DROSOPHILA

Information Service

48

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Prepared at the
DEPARTMENT OF BIOLOGY
UNIVERSITY OF OREGON
EUGENE, OREGON

Thompson

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N.W. Timofeeff-Ressovsky (Obninsk, USSR), A.V. Yablekev (Moscow) and N.W. Glotoff (Obninsk) have prepared a book on population biology to be published in 1973 by publishing house "Nauka" (Moscow).

An Outline of Evolutionary Concepts by N.W. Timofeeff-Ressovsky, N.N. Vorontsov and A.V. Yablokov was published in Moscow in 1969 by publishing house "Nauka".

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UMEÅ, SWEDEN: UNIVERSITY OF UMEÅ
Institute of Biology, Department of Genetics

Wild Stocks

1 Algeria
2 Amherst-3
3 Boa Esperance, Minas Gerais, Brazil
4 Canton-S
5 Crimea
6 Curitiba
7 Falsterbo
8 Florida
9 Formosa
10 Gruta, Argentina
11 Hikone-R (resistant to BHC DDT, parathione, nicotine)
12 Karsnäs
13 Kochi-R (resistant to parathione)
14 Oregon-R
15 Salvador, Bahia, Brazil
16 San Miguel, Buenos Aires, Argentina
17 Stäket
18 Tunnelgatan
19 Ultuna
20 Örebro

Chromosome 1

1001 B
1002 B/y:=
1003 B car bb/y f:=
1004 BB car/sc^{8}Y y f:=/sc^{8}Y
1005 car
1006 ct
1007 cv
1008 cv sn^{3}
1009 ec
1010 ec ct v f
1011 ec ct v g/y f:=
1012 f
1013 f B os^{o} car/y f:=
1014 f BB/sc^{8}Y, y f:=/sc^{8}Y
1015 f B^{i}B^{i}/y f:=
1016 f os^{o} car
1017 fa
1018 fu/y f:=
1019 g
1020 g^{2} B
1021 gt w^{a}
1022 kz
1023 kz g^{2} B/y:=
1024 lz/ClB
1025 M(1)o f/FM6, y^{31d} sc^{8} dm B
1026 m f
1027 mal/y f:=
1028 os^{o} car
1029 Pgd^{A} F
1030 Pgd^{B} S
1031 pn
1032 pn z is
1033 r^{9}/y f:=
1034 r^{39k} f B/y w f:=
1035 rb
1036 rb$^{27-4}$ cv v f^{3N}/y f:=
1037 rb cx
1038 rb wy
1039 sc z
1040 sc z^{mottled}
1041 sc z ec
1042 sc z w^{sp}
1043 sc z w^{17G2} ec
1044 sc z w^{a}/y w f:=
1045 sc z w^{ch}
1046 sc z w^{e}
1047 sc z w^{h}
1048 sc^{Sl} B InS w^{a} sc^{8}
1049 sc^{Sl} InS w^{a} sc^{8}
1050 sn^{3}
1051 su-w^{a} w^{a}
1052 su-w^{a} w^{a} w^{ch} fa
1053 svr$^{poi-dish}$
1054 t
1055 t^{3}
1056 v g
1057 w
1058 w$^{56\ 1\ 12}$
1059 w cv
1060 w cv sn^{3}
1061 w cv sn^{3} B/y f:=
1062 w sn^{3}
1063 w^{a}
1064 w^{a} su-f
1065 w^{a4}/y f:=
1066 w^{bf} f^{5}
1067 w^{bf2}
1068 w^{bl}
1069 w^{bl} ec
1070 w^{Bwx}
1071 w^{ch} fa
1072 w^{ch} spl
1073 w^{ch} rb wy/y f:=
1074 w^{ch} wy
1075 w^{co}
1076 w^{co} sn^{2}
1077 w^{e}
1078 w^{e2} e(w^{e})/y f:=
1079 w^{h}
1080 w^{m4}
1081 w^{sat}
1082 w^{sp}
1083 w^{sp2}
1084 y
1085 y ac w^{a} ec
1086 y ec ct v f
1087 y f Eb/sc^{Sl} B InS w^{a} sc^{8}
1088 y pn:=/FM6, y^{31d} sc^{8} dm B
1089 y rst^{3} car
1090 y v f:= Y^{S}.Y^{L}, In dl-49 y v f car
1091 y w:= Y^{S}.Y^{L}, y w f
1092 y w bb/X.Y^{S}, y w Y^{S}/Y^{L}. bb^{+} ac^{+} y^{+} sc^{8}
1093 y w^{a} ec
1094 y w^{a} f/y^{+} B.Y
1095 y sc z w^{a} ec
1096 y sc^{Sl} B InS w^{a} sc^{8}
1097 y sc^{4} sc^{8}
1098 y sc^{4} sc^{8}/sc^{8}Y y f:=/sc^{8} y
1099 y^{2} sc
1100 y^{2} sc w^{sp}
1101 y^{2} sc w^{sp} spl
1102 y^{2} sc z w^{-} spl
1103 y^{2} sc w^{-} spl
1104 y^{2} sc w^{-} spl B/y w f:=
1105 y^{2} sc w^{a} ec
1106 y^{2} sc w^{a} ec cv sn^{3}/y w f:=
1107 y^{2} sc w^{a} w^{sp} is/y f:=
1108 y^{2} sc w^{a} w^{ch} fa
1109 y^{2} sc w^{a} w^{ch} spl/y f:=
1110 y^{2} sc w^{bf} spl
1111 y^{2} sc w^{bf} spl sn^{3}
1112 y^{2} sc w^{i} ec/y f:=
1113 y^{2} sc w^{i} spl
1114 y^{2} sc w^{i} w^{ch}
1115 y^{2} sc^{4} InS sc^{Sl}/sc^{8}.Y, y f:=/sc^{8}.Y
1116 y^{2} su-w^{a} w^{a}
1117 y^{2} su-w^{a} w^{a} w^{ch} fa
1118 y^{2} su-w^{a} w^{a2} w^{ch} spl/y f:=
1119 y^{2} w^{a}
1120 y^{2} w^{a} spl
1121 y^{2} w^{bf} spl sn^{3}
1122 z
1123 z ec
1124 z w^{11E4}
1125 z w^{a} ec
1126 Zw^{A}
1127 Zw^{B}

Chromosome 2

2001 al b c sp
2002 al b c/al^{2} In(2L)Cy
2003 bw
2004 bw^{D}
2005 Cy/bw^{Vl}, ds^{33k}
2006 Cy cn/S
2007 ds dp
2008 ex
2009 fes Alu lt/al^{2} Cy lt^{3}
2010 ho
2011 M(2)1^{2}/Sm1, al^{2} Cy sp^{2}

2012 M(2)S7/SM5, al^2 Cy lt^v sp^2
2013 net
2014 nw^2/In(2L)Cy, IN(2R)NS
2015 pr
2016 rub
2017 S^2 Cy pr Bl cn^2 l^4 bw sp/In(2L)NS In(2R)NS px sp
2018 S Sp Bl bw^D/al^2 Cy lt^3 L^4 sp^2
2019 shr bw^{2b} abb sp/SM5, al^2 Cy lt^v sp^2
2020 shv
2021 vg
2022 vg bw

Chromosome 3

3001 c(3)G
3002 ca
3003 ca K-pn
3004 cd
3005 D^3/In(3L)P
3006 e^{11}
3007 Est-6^S Est-C^F
3008 Est-6^S Est-C^S
3009 Est-6^F Est-C^F
3010 Est-6^S Lap-A^0
3011 Est-6^F
3012 Est-6^S
3013 Est-6^S/6^F
3014 eyg
3015 Gl Sb/LVM
3016 gl
3017 In(3LR)D cx F/Sb
3018 kar^2
3019 Lap-A^0
3020 M(3)h^y/In(3L)P, Me
3021 M(3)w^{124}/In(3R)C, e l(3)e
3022 ri ss
3023 ri^2
3024 ri^2 ss
3025 ro
3026 ru h st p^p ss e^s
3027 ry
3028 ry^2
3029 ry cd
3030 se
3031 ss
3032 st
3033 st c(3)G ca/ve h th c3G Sb Ubx^{130}
3034 st c(3)G ca/TM1, Me ri sbd^1(sp^2)
3035 st p
3036 st p e
3037 st ry
3038 st ss e^{11}

Chromosome 4

4001 ci^D spa^{pol}/spa^{Cat}
4002 sv^n
4003 spa^{pol}

Multichromosomal

5001 sc z is;al b c sp
5002 sc z is;Cy/S
5003 sc z is;Cy;Ubx^{130}/Xa
5004 sc z is;D/Sb
5005 sc z is;ru h st p^p ss e^s
5006 sc^{SI}InS w^a sc^8;Cy; Ubx^{130}/Xa
5007 w^{ch};Su-w^{ch}/Cy cn
5008 w^{coi};bw
5009 w^e;cru/Cy cn
5010 w^{m4} y^{511};E(var)7/Cy
5011 y^2 sc w^- spl;Cy; Ubx^{130}/Xa
5012 y^2 sc w^a w^{ch} fa;Cy; Ubx^{130}/Xa
5013 bw;st
5014 cn bw;e^{11}
5015 Cy cn/S;D/In(3L)P
5016 L sp;th
5017 L^2/+ sp;th
5018 sp;th
5019 Pod-R

Deficiencies - X

6001 Df(1)bb, y sl^2 bb^-/FM4, y^{31d} sc^8 dm B
6002 Df(1)w^{258-11}, y/In(1) dl-49, y Hw m^2 g^4
6003 Df(1)w^{258-42}, y/FM1, y^{31d} sc^8 w^a lz^s B
6004 Df(1)w^{258-45}, sc z/FM4
6005 Df(1)w^{258-45}, y/FM4, y^{31d} sc^8 dm B
6006 Df(1)w^{258-45}, y w spl dm;Dp(1;3)w^{vco}/y w f:=
6007 Df(1)w^{258-48}, y sc^5 spl; Dp(1;3)w^{vco}/y f:=

Deficiencies - Y

6008 Df(Y)y^{bb^-}, y^2 eq
6009 Df(Y)y^{bb^-}, y^2 sc z w^- spl/y pn:=

Deficiencies - 2

6010 Df(2L)al/In(2L+2R)Cy, Cy E(S)

Duplications

6011 Dp(1;1)z^{59d15}, sc z^{59d15}/y f:=
6012 Dp(1;1), z(w^{a4}/w^a)/y f:=
6013 Dp(1;1)w^a, (w^a/w^a)/y f:=
6014 Dp(1;1), (w^{bf}/w^a)ec
6015 Dp(1;1)112, y f
6016 Dp(1;Y)y w^a/Y•w^+ Co

Translocations

7001 T(1;4)B^S/y f:=
7002 T(1;4)w^{m5}/w;ci ey^R
7003 T(2;3)bw^{VDe4}/Cy
7004 T(2;3)Sb^V, Sb^V, In(3R)Mo, In(3LR)P35/SM1, al^2 Cy sp^2;In(3LR)Ubx^{130}, Ubx^{130} e^S
7005 T(1;Y)y/y^{+Y}

Triploid

8001 y^2sc w^aec/FM4, y^{31d} sc^8 dm B

Extra Y

8002 In(1)w^{m4L} $N^{264-84R}$, y sn/ FM3, y^{31d} sc^8 dm B 1/Y; dm sn

Closed-X

8003 X^{c2} f car/y f:=

X with Y fragments attached

8004 FR-1 Y^S y cv v f/y f:=

BERLIN-DAHLEM, GERMANY: FREIEN UNIVERSITÄT BERLIN
Institut für Genetik

See DIS 47:28 (1971)
Revision: Stock No. 1 (Berlin wild B) is discarded

STOCKHOLM, SWEDEN: UNIVERSITY OF STOCKHOLM
Institute of Genetics

Wild Stocks

1 Canton S
2 Karsnäs 51
3 Oregon
4 Skaftö
5 Karsnäs 60
6 Varese
7 Berlin
8 Canton S, no ins.
9 Swedish-b, no ins.
10 Lausanne-S
11 Woodbury
12 Oslo
13 Iso-Amherst
14 Samarkand
15 Pacific-2
16 Sevelen

Isogenic, from single pair full sib matings

17-19 Oregon, 3 lines, c. F_{200}
20 Karsnäs, c. F_{200}
21 Groningen, c. F_{125}

Chromosome 1

101 B x C(1)DX, y
102 C(1)RM, y v f x Y^S $X{\cdot}Y^L$, In(1)EN + dl-49, y v f car
103 ct^6
104 cv
105 Df(1)w^{258-45}, y^2 w/FM4, y^{31d} sc^8 dm B
106 FM7a, y^{31d} sc^8 w^a v^{Off} B
107 Dp(1:1)B^S(TMG), y sc^4 m f·B^S/In(1)sc^7 + AM, sc^7 ptg^4
108 f
109 In(1)dl-49, fa^{no}
110 In(1)sc^{4L} sc^{8R}, y sc^4 sc^8/y^+ Y x C(1)DX, y f/y^+ Y
111 In(1)sc^{4L} sc^{S1R} + S, y sc^4 sc^{S1}/y^+ Y x C(1)DX, y f/y^+ Y
112 In(1)sc^8, sc^8
113 In(1)sc^{S1L} sc^{8R} + S, sc^{S1} sc^8 w^a B ("Muller 5")
114 In(1)sc^{S1L} sc^{8R} + S, sc^{S1} sc^8 w^a/y^{53i} Y
115 In(1)sc^{S1L} sc^{8R} + S, y sc^{S1} sc^8 w^a B
116 In(1)sc^{S1L} sc^{8R} + S, y sc^{S1} sc^8 w^a B/y^+ Y x C(1)DX, y f/y^+ Y
117 In(1)sc^{S1L} sc^{8R} + S, y sc^{S1} sc^8 w^a
118 In(1)y^4, y^4
119 m
120 pn
121 sc cv
122 sc cv v car
123 sc cv v f
124 Sh^5
125 sn^3
126 $su(s)^2$ v;bw
127 $su(s)^2$ v^{36f} x C(1)DX, y f
128 t
129 v
130 vs^{66k}
131 w
132 w ct^6 f
133 w ct^6 m f
134 w cv sn^3
135 w^a
136 w^a B x C(1)DX, y f
137 w^{ec2}
138 w^h
139 y
140 y^{16}/y^+ Y
141 y^{329}
142 y ac sc pn w rb cm ct sn^3 ras^4 v m g f car/FM6, y^{31d} sc^8 dm B("plex")
143a, b, c y^2 eq/Df(Y)bb
144 y f car
145 y Hw m g f Eb/FM6, y^{31d} sc^8 dm v^{Off} B
146 y^2 sc car·Dp(1;1)sc^{V1}, y^+
147 y^2 sc ec ct v f;Dp(1;1)sc^{V1}, y^+
148 y^2 sc ec ct^6 v f^5 x C(1)DX, y f
149 FM1, y sc^8 v f BxC(1)DX, y f
150 y v
151 y v^{36f}
152 y v g f
153 y w ct^6 m f
154 y w^a/w^+ Y
155 y w^a/w^+ y^+ Y
156 y w^{bf} spl sn^3 x C(1)DX, y f
157 y w sn^3
158 y w^a f/B^S Y y^+
159 y w^a f/y w^a f/B^S Y y^+ & y w^a f/B^S Y y^+

Chromosome 2

Unless otherwise specified, Cy denotes In(2L+2R)Cy, Cy

201 a px sp
202 al b c sp
203 al dp b pr c px sp/al^2 Cy lt^3 L^4 sp^2
204 al^2 Cy lt^3 L^4 sp^2/In(2LR)Pm, Pm^1
205 b Adh^{n1} T f t/In(2LR)Cy + O, Cy dp^{1VI} pr cn^2
206 ap^4/In(2LR)Rev^B, Rvd
207 b cn vg, y/y^+ Y
208 b pr vg
209 bw^D
210 cn bw
211 C(2L)RM;C(2R)RM
212 C(2L)RM, j;C(2R)RM, px
213 Cy (no ins) ed/In(2LR)Pm, ds^{33k} Pm^1
214 dp b
215 In(2L)Cy, al^2 Cy/In(2LR)Pm, dp b Pm^1
216 In(2LR)Gla, Gla/Cy pr cn sp

217 In(2R)bw^{VDel}, b bw^{VDel}/b lt l cn mi sp
218 Pin
219 px bw mr sp/In(2LR)Pm, ds^{33k} Pm^{l}
220 S^{2} Cy pr Bl cn^{2} L^{4} bw sp/In(2L+2R)NS, px sp
221 S Sp Bl bw^{D}/al^{2} Cy lt^{3} L^{4} sp^{2}
222 vg
223 vg bw

Chromosome 3

301 ca K-pn
302 e^{11}
303 e^{s} cand/In(3R)ca^{v}, e ca^{v}
304 Gl Sb/LVM
305 In(3L)D, D^{3}/In(3L+3R)P
306 In(3LR)DcxF, ru h D ca/In(3R)C(?), Sb
307 ru h st p^{p} ss e^{s}(3p1e)
308 ru se h st p^{p} ss e^{s}
309 ry^{2}
310 se
311 st
312 st c(3)G ca/TM1, Me ri sbd^{1}(sp^{2})
313 st c(3)G ca/ve h th c(3)G Sb Ubx
314 st ss e^{11}

Chromosome 4

401 C(4)RM, ci ey^{R}.gvl sv^{n}
402 ci ey^{R}
403 ci^{D} spa^{pol}/spa^{Cat}
404 sv^{n}

Multichromosomal

501 al^{2} Cy lt^{3} sp^{2}/+;In(3LR)DC x F, ru h D ca/+ & d;o
502 al^{2} Cy lt^{3} sp^{2}/T(2;3)ap^{Xa}, ap^{Xa}/TM2, Ubx^{130} e^{s}
503 bw;st
504 cn bw;e^{11}
505 In(2LR)Cy + O, Cy dp^{lvl} pr cn^{2}/T(2;3), In(3LR)C x F, Df(2R)P, S Sp P/Dp(2;3)P, Dl H e ("sifter O")
506 In(1)sc^{8L} y^{3PR} + S, y^{Sl} y^{3P} sc^{8};al^{2} Cy lt^{3} sp^{2}/In(2LR)Pm, dp b Pm^{1};In(3LR)DC x F, ru h D ca/In(3R)C(?), Sb
507 sp;th
508 T(1;2)B^{bd}/al^{2} Cy lt^{3} sp^{2} x M(e)/al^{2} Cy lt^{3} sp^{2}
509 T(2;3)bw^{VD} e^{4}/al^{2} Cy lt^{3} L^{4} sp^{2}
510 v;bw
511 vg;ss
512 y Hw w/B^{S} Y;C(4)RM, spa^{pol}/O

ANKARA, TURKEY: UNIVERSITY OF HACETTEPE
Institute of Biology

Wild Stocks	Chromosome 1	v w	Chromosome 2	Chromosome 3
Hacettepe*	Muller-5	w sn m	vg	ry^{2} ry^{2}
Oregon				

* The Hacettepe line descended from a female originally caught at Hacettepe on July, 1970. Eggs of this original organism were raised and crossed to give the F_1 generation of the new strain. At the moment (9th Feb. 1972) we have 24th inbred generation of the Hacettepe stock.

MACOMB, ILLINOIS: WESTERN ILLINOIS UNIVERSITY
Department of Biological Sciences

Wild Stocks

Oregon-R
Seto (Japan)

Chromosome 1

B
car
f

v
w
w m f
y
sc^{Sl} InS w^{a} sc^{8} ("Basc")

Chromosome 2

b
c
cn bw
dp
vg^{ni}
SD-72/Cy
SD-5/cn bw

Chromosome 3

e
st
W

Multichromosomal

v;bw
bw;e
bw;st
cn;st
y f:=;dp
X^{C2} y B & y f:=;e^{11}
c;e
y;bw;e;ci ey^{R}
sc^{Sl} InS w^{a} sc^{8};cn bw

AMHERST, MASSACHUSETTS: AMHERST COLLEGE
Department of Biology

Wild Stocks
1 Oregon-R: Inbreeding: generation 616 on 72b14
2 Oregon-R: 300, mass culture from Stock #1 at generation 300
3 Oregon-R: 600, mass culture from Stock #1 at generation 600
4 Samarkand 204: inbred for 204 generations: mass culture 53h4
5 South Amherst: collected anew each year from the natural population

Chromosome 1

6 Basc: sc^{S1} sc^{8} w^{a} B
7 cm
8 cm ct^{6}
9 cm ct^{6} sn^{2}
10 cm ct^{6} sn^{3}
11 cm ct^{6} sn^{3} oc/y f:=
12 cm ct^{6} sn^{4}
13 cm ct^{6} sn^{4} oc ptg/y f:=
14 cm ct^{6} sn^{34e}
15 cm ct^{6} sn^{36a}/y f:=
16 ct^{6} oc/y f:=
17 ct^{n} oc/y f:=
18 cx
19 ec
20 ec rb^{64f14} cv/y f:=
21 g
22 g_{3} sd
23 g^{3}
24 g^{3} sd
25 g^{50e}
26 g^{53d}
27 g^{53d} sd
28 g^{w}
29 m g f^{36a}
30 oc/y f:=
31 oc ptg/y f:=
32 ras dy
33 rb cx
34 sd
35 sn/y f:=
36 sn^{2}
37 sn^{2} oc ptg^{3}/y f:=
38 sn^{3}
39 sn^{3} g^{53d}
40 sn^{3} oc/y f:=
41 sn^{4}
42 sn^{4} oc ptg^{3}/y f:=
43 sn^{36a}/y f:=
44 w
45 w/+=
46 w sn^{5}/y f:=
47 w^{a}
48 wy^{2}
49 wy^{2} g_{2}
50 wy^{2} g^{2}
51 wy^{2} g^{3}
52 wy^{2} g^{4}
53 wy^{2} g^{53d}
54 wy^{2} g^{53d} sd
55 y ct^{6} ras^{2} f
56 y w^{sp}/FM6
57 y^{2} sn^{3} ras^{4} m/y f:=

Chromosome 2

58 al cl b c sp^{2}/SM5, al^{2} Cy lt^{v} sp^{2}
59 al cl nub sca^{65131} sp^{2}
60 al lt stw^{3} sp^{2}
61 b Bl vg bw/Cy, bw^{45a} or^{45a} sp^{2}
62 Bl L^{2}/SM5, al^{2} Cy lt^{v} sp^{2}
63 cl
64 cn bw
65 Cy, dp^{lvl} Bl L^{4} sp^{2}/bw^{Vl} ds^{33k}
66 lt stw^{3}
67 net^{38j} b^{38j} cn^{38j} bw^{38j}
68 S^{x} Coi Pin/Roi, bw^{45a} or^{45a} sp^{2}
69 S^{x} Sp/SM5, al^{2} Cy lt^{v} sp^{2}
70 Sp J L^{2} Pin/SM5, al^{2} Cy lt^{v} sp^{2}
71 Sp vg^{U} If/SM5, al^{2} Cy lt^{v} sp^{2}
72 vg^{51h25}
73 vg^{U} If/SM5, al^{2} Cy lt^{v} sp^{2}
74 vg^{U}/Roi, bw^{45a} or^{45a} sp^{2}
84 se ss
85 se ss Su^{3}-ss
86 ss^{a}
87 ss gl^{3}
88 ss^{ax}
89 ss^{ax} gl^{3}
90 ss bx Su^{3}-ss
91 TM1, Me ri sbd^{1}/D^{3}
92 TM3, ri pP Sb sep bx^{34e} e^{s} Ser/D^{3}

Chromosome 3

75 bar-3
76 cu gl^{3}
77 cu ss^{ax}
78 D Cx F, ru h ca/TM3, ru ri p^{p} Sb sep bx^{34e} e^{s} Ser ca
79 D^{3} Sb/Payne
80 h th st p^{p} cu sr e^{s}
81 ru h st cu sr e^{s} ca
82 ru st ss ca
83 se^{50k}

Chromosome 4

93 ey^{2}
94 spa^{pol}

Multichromosomal

95 bw;h
96 Cy, bw^{45a} or^{45a} sp^{2};TM3, Sb e Ser/T(2;3), bw;h
97 Cy, sp^{2}/Pm, dp b;DCxF/Sb sr
98 net or^{45a} sp^{2};ru bv
99 SM5;TM1 Me ri sbd^{1}/T(2;3)gl^{63d29}
100 vg^{51h25};se^{50k}
101 vg^{51h25} bw;se^{50k} e
102 vg^{51h25} sp^{2};se^{50k}
103 vg^{51h25};se^{50k};spa^{pol}
104 Ubx^{130} e^{s}/T(2;3)Xa

Deficiencies

105 Df(1)g^{1}, f b/In(1)AM

Inversions

* In(1)AM in stock 105
* Ins(1)Basc: sc^{S1} sc^{8} w^{a} B(Muller-5) in stock 6
* Ins(1)FM6 in stocks 56, 106, 107, 108, 109
* In(2LR)bw^{V1} in stocks 65, 97
* Ins(2L+2R)Cy in stocks 61, 65, 96, 97
* Ins(2L+2R) of SM5 in stocks 58, 62, 69, 70, 71, 73, 99
* Ins(2L)t, (2R)Cy with Roi in stocks 68, 74
* Ins(3LR)DCxF in stocks 78, 97
* In(3R)Mo, Sb sr in stock 97
* Ins(3L+3R)Payne in stock 79
* In(3LR)TM1 in stocks 91, 99
* In(3LR)TM3 in stocks 78, 92, 96
* In(3LR)Ubx^{130} in stock 104

Translocations

* T(2;3), bw;h in stock 96
* T(2;3)gl^{63d29} in stock 99
* T(2;3)Xa in stock 104

Triploids

106 cm ct^{6} sn^{3}/FM6, y^{31d} sc^{8} dm B & FM6
107 cv rb^{64c10} ec/FM6, y^{31d} sc^{8} dm B & FM6
108 g^{53a} sd/FM6, y^{31d} sc^{8} dm B & FM6
109 wy^{2} g^{H}/FM6, y^{31d} sc^{8} dm B & FM6

BRNO, CZECHOSLOVAKIA: J.E. PURKYNĚ UNIVERSITY
Department of Genetics

Wild Stocks

1 Oregon K
2 Oregon R
3 Hikone R
4 Suchumi
5 Moskva
6 Novosibirsk
7 Krnov 65
8 Ochoz 70
9 Vratislávka 70
10 Ždárec 70
11 Mangalia 71
12 Milovice 71
13 Valtice 71
14 Lednice 71
15 Šakvice 71
16 Samarkand
17 Hampton Hill
18 Teddington
19 Canton S
20 Berlin-wild

Chromosome 1

21 w
22 Muller-5
23 y v f XX/Winscy

Chromosome 2

24 dp
25 cn
26 bw
27 cn vg/Oregon K
28 cn vg/Suchumi
29 dp b cn bw
30 Cy/Bl L
31 Cy/al b pr lt ltd cn a px pd bw
* 32 cn l(2)cr c/SM5, +
* 33 al dp b bw l(2)ax/SM5, +
* 34 chl $l(2)bw^{Pb}$ mr^{2}/SM5, +
* 35 l(2)gl apx or/SM5, +
* 36 b l(2)Bl d pr c px sp/SM5, +
* 37 S Sp Bl bw^{D}/SM5, +
38 S^{2} Cy pr Bl cn^{2} L^{4} bw sp/Ins NS, px sp
39 Tft/SM1, al^{2} Cy sp^{2}
40 S Sp Tft nw Pin^{Yt}/Cy O
41 S Sp Bl bw^{D}/Cy cn^{2} lc
42 S Sp Bl Pfd bw^{D}/dp^{txI} Cy, Ins O pr cn^{2}
* 43 Tft L^{2}/SM5, +
44 Coi
45 Pin
* 46 Sp J L^{2} Pin/SM5, +
47 S Sp Bl L^{2} Px^{-}/dp^{txI} Cy, Ins O pr cn^{2}
48 S fes Alu lt/al^{2} Cy cn^{2} L^{4} sp^{2}
49 ds S G b pr/Cy, al^{2} lt^{3} L^{4} sp^{2}
50 Sp rc^{2}/Cy Bl L
* 51 L/SM5, +

Multichromosomal

52 Cy L/Pm;H/C Sb (2,3)
53 SM5, TM3/Oregon (2,3)
* 54 L/SM5, +;Me Sb e/H e (2,3)
* 55 M-5;L/SM5, +;Me Sb e/H e (1,2,3)
56 FM6;Pm;Ubx^{130}/Oregon (1,2,3)
57 sc^{S1} Ins w^{a} sc^{8};SM5/Bla;Sb/TM3 (1,2,3)
58 bw;e;pol (2,3.4)
59 M-5;SM5/Pm;Ubx^{130}/In(3R)Sb;pol (1,2,3.4)

Special Stocks

150 induced and natural lethals in the second chromosome

* Note: + means al^{2} Cy lt^{v} sp^{2}

SYDNEY, AUSTRALIA: UNIVERSITY OF SYDNEY
Department of Animal Husbandry

Wild Stocks

4 strains from N.S.W. and Victoria

Chromosome 1

In rst^3
w
wb^1
y
y w

Chromosome 2

b j
net
vg

Chromosome 3

e^{11}

Multichromosomal

In(2L+2R)Cy, Cy bw^{45a} sp^2 or^{45a};In(3LR)Ubx^{130}, Ubx^{130}/T(2:3)ap^{Xa}

PATRAS, GREECE: UNIVERSITY OF PATRAS
Department of Genetics

Wild Stocks

Oregon-K

Chromosome 1

y
pn
w

w^e
sn
f
M-5

Chromosome 2

dp
b

cn
vg
bw
Cy L^4/Pm
dp
b cn bw
dp cn
b vg

Chromosome 3

st
ss
e
st ss

Chromosome 4

ey

EASTON, PENNSYLVANIA: LAFAYETTE COLLEGE
Department of Biology

Wild Stocks

1 Oregon-R

Chromosome 1

2 B
3 w^e

4 Muller-5 (Base)
5 w
6 y
7 wmf
8 ywm

Chromosome 2

9 b vg

10 bw
11 cn
12 dp
13 ho
14 L
15 Cy
16 vg
17 vg bw

Chromosome 3

18 e
19 ry
20 se

Multichromosomal

21 Cy/Pm;H/Sb
22 Cy/Pm;D/Sb

CANTON, NEW YORK: ST. LAWRENCE UNIVERSITY
Department of Biology

Wild Stocks

Canton-S^2
Oregon-R
Swedish-b

Chromosome 1

B
f
m
v
w
wmf/ClB
y^2 w^a cv v f B

Chromosome 2

bw
dp
c
L^5
vg

Chromosome 3

e
se
st

Chromosome 4

ey^2

Multichromosomal

Cy/Pm^1

Inversions

Muller-5

CALCUTTA, INDIA: UNIVERSITY OF CALCUTTA
Department of Zoology

Wild Stocks

a^2 Oregon-R
a^3 P-Ceylon
a^5 Samarkand

Chromosome 1

B
car
cm
cm ct^6
ct
ec
f^{36a} odsy f^{+ih} & y f:=
odsy
ras^4 m/ClB
rb
sn^3
svr
v
w
w_a m f
w^{ch} wy
w^i f^3 bb^N
y
y ac sn^3 sx vb^2 sy/y sc^1 In d149 B v w^a sc^8
y w ct
y w sn^3
z w^{11E4}

Closed X (unstable)

R(1)2 w^{vc}/In(1)d149, y w lz^s /sc^8 Y (lz^s lost)
R(1)2 w^{vc} f/In(1)d149, y w lz^s/sc^8 Y

Chromosome 2

ap^4/dp^{txI} Cy, Ins O pr cn^2
b
b cn beta
b vg
bur fs(2)El/SM5, al^2 Cy Lt^v sp^2
bw
cg c/U
cl
cn bw
cn st
cn vg bw
cn^2 InCyR cg sp^2/InsNS px sp
Cy/cg c
Cy/Pm
dp
dp^T Sp cn InNSR mr/Cy
dp^T Sp cn_2 InNSR mr/S^2 ls Cy pr Bl cn^2 L^4 bw sp^2
ds S G b pr/Cy, al^2 lt^3 L^4 sp^2
fj wt/SM5, al^2 Cy lt^v sp^2
fs(2)B Alu lt/SMt, al^2 Cy lt^v sp^2
ft
Gla, InLR/S^2 Cy cn^2 bw sp
ho
In(2L)t escc sp/SM5, al^2 Cy lt^u sp^2
InNSL InNSR/ al^2 Cy, InL lt^3 L^2
M(2)z/SM5, al^2 Cy lt^v sp^2
net
pr en
vg

Chromosome 3

e^s
Gl Sb H/Payne
H^2/Xa
red
red e
ru e ca
Sb Ubx/Xa
se h
th

Chromosome 4

a^r/ey^D
ci gvl ey^R sv^4
ci^w
ey

Multichromosomal

dp^T Sp cn InNSR mr/Cy;red e vg;e^s
w^e sn/ClB;Cy/Pm
y ac sn^3;Cy/cg c
y ac sn^3;Cy/Pm
("tester-2") y^2 w^a cm wy^2 g^2 car & y f:=;sc^{19i}/Cy

Translocations

T(1;3)04/ClB
T(1;3)05, D/y f:=
T(1;3)2B7, 84A5 y/sc^{S1} d149, sc v f car/B^s Y
T(1;3)sc^{260-15}/FM6, y^{31d} sc^8 dm B
T(1;3)sta/FM3, y^{31d} sc^8 dm B 1
T(1;3)sta/y f:=
T(1;3)W^{vco}, uf/ClB^{36d}
T(2;3)S^L/In(2L+2R)Cy, Cy E(S)

Altered Y Chromosomes & Attached X·Y Chromosomes

(Maxy) 1^{J1+} Y/1^{J1} $sc^{J1(+)}$ In49 ptg oc B^{M1}/y sc^{S1} car odsy f g^2 dy v ras^2 sn^3 ct^6 cm rb ec w pn 1 sc^8
(Maxy-v) 1^{J1+}·Y/1^{J1} $sc^{J1(+)}$ In49 v ptg oc B^{M1}/y sc^{S1} car odsy f g^2 dy v ras^2 sn^3 ct^6 cm rb ec w pn 1 sc^8
Y^S·w y·Y^L·y^{55} f^{10}/O/y w:=
Y^S·X InEN v cv y·Y^L y^+ & y^2 su-w^a w^a bb := (no free Y)
Y^S X·Y^L(FR-1^L, U-$8d^R$)Y^S y w cv v f·Y^L & y^2 su-w^a w^a bb := (no free Y)

BUENOS AIRES, ARGENTINA: COMISIÓN NACIONAL DE ENERGÍA ATÓMICA
Departamento de Radiobiología, Division Genética

See DIS 41:31.

MILANO, ITALY: UNIVERSITA' DI MILANO
Istituto di Genetica

Wild Stocks

1 Canton-S
2 Chieti-v
3 Crkwenica
4 Gaiano
5 Jaslo o.c.
6 Moltrasio
7 Oregon-R
8 Sevelen
9 Urbana
10 Valdagno
11 Varese
12 Aspra
13 Ponza
14 S. Antioco
15 Serpentara

Chromosome 1

16 B
17 N^{B-S}
18 ptg^2
19 sc ec ct v g f
20 v
21 sd
22 w^a
23 w m f

Chromosome 2

24 sp a px
25 ab
26 b cn vg
27 blt^S
28 bsp
29 c wt px
30 cn c wt px
31 dp cl b
32 ft
33 ll^2
34 net
35 so
36 so^2 b cn
37 sp^2 bs^2
38 al b c sp
39 c

Chromosome 3

40 cp
41 gl^3
42 mwh
43 mwh se
44 mwh ri ss k e^s ro
45 ru
46 ve
47 obt
48 th
49 tx
50 th tx
51 h
52 se cp e

Multichromosomal

53 w;vg
54 y;al bw sp

Inversions on X

55 Cl B y/y g^4
56 1(1)7/d149 y Hw m^2 g^4
57 Muller-5
58 Muller-5/lozenge

Inversions on 2

59 Cy sp/Pm
60 Cy E(S)/S
61 Gla/spd gt-4

Inversions on 3

62 ltr/Sb sr In(3R)Me
63 Me ca/ru cu ca
64 ve h th C3 G Sb Ubx/st C3 G ca
65 Florida In(3R)Payne
66 Cy L^4 sp/Pm;H/Sb sr In(3R)Me
67 y w;Cy L^4 sp/Pm;H/Sb sr In(3R)Me
68 y sc^{S1} In49 sc^8;bw;st p^p
69 bsp/bsp;Sb Me/H

Deficiencies

70 $Df(2)Px^2$, bw sp/SM1, al^2 Cy sp^2
71 $Df(2)bw^5$ sp^2/Xa
72 M(2)B/In(2L)t, l(2)B
73 $M(2)33a/al^2$ In Mis Cy cn^2 sp^2

Translocations 1;4

74 $T(1;4)B^S(16A_1)$, y^2 cv v B^S car/y f:=

Translocations Y;2

75 $T(Y;2)C/cn^3$
76 $T(Y;2)E/ab^2$
77 T(Y;2)B/b

Translocations Y;3

78 T(Y;3)P80
79 T(Y;3)P102

Special Stocks

80 "sz e" $Y^{Lc}/X.Y^S$ & y v f.=;e
81 "sz w" $Y^{Lc}/X^w.Y^S$
82 y^2 $su(w^a)w^a$ bb/v f B, X.Y

Stocks selected for tumor manifestation

83 tu A1
84 tu A2
85 tu B1
86 tu B3
87 tu C1
88 tu C2
89 tu C4
90 tu C5
91 tu D
92 tu Aspra
93 Freckled/Curly
94 Frd/Cy L
95 y w;Cy L/Frd;Sb Me/H
96 y w;Cy L/Pm(Frd);Sb Me/H
97 q 156 melanotic
98 e 144 melanotic
99 lm

ST. CHRISTOL LES ALÈS, FRANCE: C.N.R.S. ET I.N.R.A.
Station de Recherches Cytopathologiques

CO_2 sensitive strains stabilized for sigma virus; Strains endemic for P virus.

CLEVELAND, OHIO: CLEVELAND STATE UNIVERSITY
Department of Biology and Health Science

Wild Stocks

Oregon-R (Texas)
Oregon-R (Lewis)
Oregon-R (Dickerman)
Lausaunne-S

Chromosome 1

y^{68c}
br
pn^2
w
w^{Bwx}
w^{co}
w^e
w^{sat}
Ax
Co
fa
fa^{no}
nd
ec
rb
bo
cx
rux^2
cm
sn^3
lz^K
ras
v
dy
s

f
os
Bx^3
car
sw
mal^{bz}
$y^2\ w^a\ ct^6$
y cv v f
$y^2\ w^a\ ct^6$ m f
w m f
fa fa^{no} sn
ec dx
cv f
f B
dor/ClB
N^8/y Hw In49 m^2 g^4
fa Nj^{24c} sn^3/y Hw In49 m^2
y w sn^3 B & y f:=
sc ct^6 car/y f:=
sc^{51} B InS w^a sc^8 ("Basc")

Chromosome 2

net
al
ho
dp
J^{34e}
ab
rk^4
b
Coi
el
hk

Alu
stw
ad
L
L^2
c
bw^{2b}
ll^2
Pin
Hx
al b c sp
b cn bw
b vg
Bl/esc
Cy/Pm
dp^{02} dp^{lv1} b/Cy Bl L
ds^{38k}/Cy(2L)dp^2 b pr
U/cg C
Px^2 bw sp/SM1 al^2 Cy sp^2
Bl L^2/Cy dp^2 b Go/Gla
Pu^2/SM1 al^2 Cy sp^2
M(2)S4/SM1 al^2 Cy sp^2
M(2)33a/Pm

Chromosome 3

ve
se
eyg
app
th
st
cp

W
Ki
drb
bx^{34e}
Cbx
e^{ll}
cd
bar-3
rsd
ca
bv
ca K-pn
ve h th
se ss k e^s ro
D/Gl
Gl Sb H/Payne
Bd^g/In3R C, l(3)a
Mc/ap^{Xa}

Chromosome 4

bt
ey^2
spa^{pol}
sv^{35a}
ar/ey^D

Multichromosomal

cn;st
b;e^{ll}
bw;e
Cy/Pm(dp b);st
Cy/Pm(dp b);D/Sb

BIRMINGHAM, ENGLAND: THE UNIVERSITY OF BIRMINGHAM
Department of Genetics

See DIS 46:34

LEICESTER, ENGLAND: THE UNIVERSITY OF LEICESTER
Department of Genetics

CORRECTION of DIS 46:30 list: y w (attached X) is incorrect; should be y/w

IZATNAGAR, INDIA: INDIAN VETERINARY RESEARCH INSTITUTE

1 M-5
2 vg
3 Or-K
4 dp b cn
5 w^e
6 w
7 y v f (XX)
8 O, bw st
9 Cy/Bl L_2
10 w^a
11 y
12 T
13 h 159
14 al b pr Bl e dp In cn Sp px Cy s O

SÃO PAULO, BRASIL: UNIVERSIDADE DE SÃO PAULO
Instituto de Biociências

Wild Stocks

Canton-S
Oregon-R
Oregon-RC
Swedish-C
Samarkand

Chromosome 1

B
cv
f
g
sc
sc cv
sc cv v

sc cv v f
sc z ec ct
v
v f
w
y
y cv v f car
B/C(1)DX, y f
y, T(1;2)6/B^{S}Y Breaks points 2A, 60D - male fertile
Basc, In(1)sc^{51e} sc^{8R} + S, sc^{51} sc^{8} w^{aB}

Chromosome 2

al dp b pr c px sp
bw
dp

Pu^{2}/SM1, al^{2} Cy sp^{2}
Pin Y^{t}/SM1 al^{2} Cy sp^{2}
vg

Chromosome 3

e
st
ru h th st cu sr e^{s} ca
tx

Multichromosomal

1) bw st
2) SM1 al^{2} Cy sp^{2}/In(2LR)bw^{V1} bw^{V1};Sb/In(3LR)Ubx^{130}, Ubx^{130} e^{s}
3) T(1;3)65, y/In(1)AM

KNOXVILLE, TENNESSEE: UNIVERSITY OF TENNESSEE
Department of Zoology

Note: Only chromosome 4 stocks are listed. Allelic lethals are designated by the same base number and are differentiated by superscripts. The parentheses which follow the lethal stocks indicate the number of extant alleles of the lethal and the source(s) of the mutations, viz. spontaneous (s), X rays (x), ethyl methanesulfonate (e), ICR-170 (i) and melphalan (m).

1 ar/ey^{D}
2 ar^{65f}/ci^{D}
3 ar^{65h}/ci^{D}
4 ar^{68i}/ci^{D}
5 ar^{69g}/ci^{D}
6 bt
7 bt^{D}/ci^{D}
8 Ce^{2}/spa^{Cat}
9 ci ey^{R}
10 ci gvl ey^{R} sv^{n}
11 ci^{D}/ey^{D}
12 ci^{+3}
13 ci^{+5}
14 fs(4)34/ci^{D}
15 gy
16 l(4)1/ci^{D} (11 x s e)
17 l(4)2/ci^{D} (35 x s e i)
18 l(4)4/ci^{D} (15 x s e i)
19 l(4)5/ci^{D} (11 x e)
20 l(4)6/ci^{D} (6 x s e)
21 l(4)7/ci^{D} (4 x e)
22 l(4)8/ci^{D} (2 x)
23 l(4)9/ci^{D} (3 s e)
24 l(4)10/ci^{D} (3 x s e)
25 l(4)13/ey^{D} (2 x e)
26 l(4)14/ci^{D} (7 x s e)
27 l(4)15/ci^{D} (3 s)
28 l(4)16/ci^{D} (8 s e)
29 l(4)17/ey^{D} (2 x)
30 l(4)18/ci^{D} (1 e)
31 l(4)19/ci^{D} (8 i m e)
32 l(4)20/ci^{D} (4 s e)
33 l(4)21/ci^{D} (5 s e)
34 l(4)22/ci^{D} (1 s)
35 l(4)23/ci^{D} (8 i e)
36 l(4)24/ci^{D} (9 e)
37 l(4)25/ci^{D} (5 s m e)
38 l(4)26/ci^{D} (2 i e)
39 l(4)27/ci^{D} (1 e)
40 l(4)28/ci^{D} (3 e)
41 l(4)29/ci^{D} (2 s)
42 l(4)30/ci^{D} (1 e)
43 l(4)31/ci^{D} (1 e)
44 l(4)32/ci^{D} (1 e)
45 l(4)33/ci^{D} (4 e s)
46 l(4)35/ci^{D} (1 e)
47 l(4)36/ci^{D} (4 e)
48 l(4)37/ci^{D} (4 e)
49 l(4)39/ci^{D} (1 e)
50 l(4)40/ci^{D} (2 e)
51 l(4)2^{m}24^{d}/ci^{D}
52 l(4)2^{x}36^{a}/ci^{D}
53 l(4)6^{e}23^{b}/ci^{D}
54 l(4)6^{f}36^{c}/ci^{D}
55 l(4)10^{b}37^{c}/ci^{D}
56 l(4)16^{f}24^{c}/ci^{D}
57 l(4)19^{f}24^{b}/ci^{D}
58 l(4)20^{b}40^{a}/ci^{D}
59 l(4)23^{c}24^{a}/ci^{D}
60 l(4)28^{a}37/ci^{D}
61 M(4)^{57g}/ci^{D}
62 spa
63 spa^{pol}

Attached 4

64 C(4)RM, ci ey^{R}/gvl sv^{n}

Deficiencies

65 Df(4)G/ci^{D}
66 Df(4)M/ey^{D}
67 Df(4)M^{62e}/+
68 Df(4)M^{62f}/ey^{D}
69 Df(4)M^{63a}/ci^{D}
70 Df(4)11/ci^{D}
71 Df(4)11^{a}/ci^{D} (formerly Df(4)12)
72 Df(4)11^{b}/ci^{D} (formerly Df(4)24)

Putative Deficiencies

73 lf(4)2^{c}/ci^{D}
74 lf(4)3/ci^{D}
75 lf(4)38/ci^{D}
76 lf(4)40/ci^{D}

MEXICO CITY, MEXICO: NATIONAL INSTITUTE OF NUCLEAR ENERGY
Nuclear Biomedical Program, Radiobiology Direction

Wild Stocks

a1 Mexico
a2 Florida
a4 Canton-S

Chromosome 1

b2 w f
b4 w
b5 y
b9 w f/C1B
b16 y w sn^3
b17 y^2 v
b18 y w
b19 y^2 w^a
b20 sc cv v f B

Combinations of scute

d1 M-5;sc^{S1} B In-S w^a sc^8
d2 sc^{S1} In-S w^a sc^8

Altered Y

f1 y/sc^8 Y
f4 y^2 w^a/sc^8 Y
f10 y^{S1} sc^8 B f In-49 v/sc^8 Y

Chromosome 2

g1 bw
g3 cn
g4 dp
g5 L^2
g6 b vg
g8 Cy L/Pm

Chromosome 3

h1 a e ss
h2 st
h3 e
h4 g1 bx^D
h8 st c3G en In(3LR)Ubx^{130} Ubx^{130}, e^s

Chromosome 4

i1 ey^2

Multichromosomal

j3 bw;st
j4 y;bw;e;ci ey^R
j5 "Oster" oo y sc^{S1} In-49 sc^8;bw;st p^p
j7 Cy/Pm;D/sb
j13 SM1 a^{12} Cy sp^2/Pm;In(3LR) Ubx^{130}, Ubx^{130} e^s/Sb
j15 y^2 w^a/sc^8 Y;e
j18 "Sterilizer" Y^{Lc}/X Y^S; bw;st p^p

Attached Chromosomes

m1 Y^S.X.Y^L In(1)EN.Y^S B y.Y^L/ y^2 su-w^a bb/O_2
m2 "Oster" oo X^{c2} y b/sc^8 Y (oo) sc^8 Y/y f: (oo)

VALENCIA, SPAIN: THE HIGH TECHNICAL SCHOOL OF AGRICULTURE
Department of Genetics

Wild Stocks

Oregon K
Pac 7 inbred line
Geb 4 inbred line
Geb 10 inbred line

Chromosome 1

y
w
w^e
w^a
lz
m
g
f
B
v^{36} f
Muller-5
w m f
y v f

Chromosome 2

dp
b
cn
L
bw
vg 1
pr px
b cn vg
dp b cn bw

Cy L^4/Pm

Chromosome 3

eyg
st
ry
ss
g1
e
Ly Sb/LVM

Chromosome 4

ey

Multichromosomal

Cy/Pm;H/C Sb
y;se
bw;st

NORWICH, ENGLAND: JOHN INNES INSTITUTE

Wild Stocks

1 Bayfordbury
2 Hampton Hill
3 Oregon-K
4 Samarkand
5 Teddington

Inbred Lines

6 Bayfordbury (A)
7 Bayfordbury (B)
8 Oregon (v marker)
9 b pr

Chromosome 1

10 B
11 car
12 sc w ec cv ct
13 v
14 w
15 y w

Chromosome 2

16 al b c sp^2
17 b pr
18 b pr vg
19 bw
20 cn
21 dp b cn bw
22 vg

Chromosome 3

23 st

Multichromosomal

24 Cy L^4/Pm;H/Sb
25 bw;e

Inversions

26 Muller-5

HEVERLEE, BELGIUM: UNIVERSITÉ CATHOLIQUE DE LOUVAIN
Faculté des Sciences Agronomiques, Laboratoire de Génétique

Inbred Temperature Lines

1 line raised at 25°C for 266 generations (Abeele, Belgium)
1 line raised at 25°C for 233 generations (Gabarros, Spain)

Wild Stocks

Abeele (Belgium)
Canton-S
Chicago
Gabarros (Spain)
Oregon
Swedish-B
Urbana-S
Watou (Belgium)

Chromosome 1

B
w
w^a
w m f
w m f/Cl B

Chromosome 2

b
b;vg
bw
vg

Chromosome 3

e
Ly/D^3
ro
se
st
ve

Multichromosomal

b;ro
e;vg
vg;se

KALYANI, WEST BENGAL, INDIA: UNIVERSITY OF KALYANI
Department of Zoology

x
v
c^s
sn^3
y
b
vg
ec
r
e
ct

TEHRAN, IRAN: TEACHERS TRAINING COLLEGE
Department of Natural Sciences

Wild Stocks

Gayaneh
Java
Oregon-R
Tehran

Chromosome 1

B

w
w^a
w^{vr}
y sc

Chromosome 2

b
bw
vg

Chromosome 3

e
se
se e

Chromosome 4

ey

Multichromosomal & Balanced Stocks

Bl L^2/al^2 Cy lt^V sp
Cy cn C/cn Df
fs(3)/LVM
Gl Sb/LVM
vg/vg;e/e
vg/vg;se/se
Cy/Pm;D/Sb

NUGEGODA, CEYLON: VIDYODAYA UNIVERSITY OF CEYLON
Department of Biological Sciences

Wild Stocks

Oregon K

Chromosome 1

w
y
y w

w sn B
M-5
O-1

Chromosome 2

vg
dp b cn bw
Cy/Bl L^2

Multiple

dp;e
bw;st

Attached-X

yB/yf

VARANASI, INDIA: BANARAS HINDU UNIVERSITY
Department of Zoology

Wild Stocks

a) Canton-S
b) Oregon-R
c) Kerala

Chromosome 1

ClB
X^{c-2}
w^{i}
w^{a}
w^{bl}
w^{e}
w^{co}
w^{h}
82 - y sc^{S1} B In^{49} ct^{ns} sc^{8}

Chromosome 2

vg
g49 - dp^{txl} Sp ab^{2}/S^{2} ls Cy In Cy L
B - fes ms(b) cn sp/dp^{txl} Cy^{l} cn^{2}
135 - S fes Sp ms ta cn mr crs/dp^{txl} Cy^{l} cn^{2}
g67 - ls dp^{T} Sp ms ta cn crs/S^{2} Cy Bl cn^{2} L^{4} sp^{2}
g45 - dp^{T} Sp cn bw sp/S^{2}(lst)Cy, In L cn bw sp Cy D

Chromosome 3

se cu
seh
ss^{a}
Ly/D^{3}

Chromosome 4

ey^{2}
ci^{w}

Multichromosomal

fs 13 - y^{+} ac^{+} sc^{8} Y/y B;bw^{D};st^{+} O & y f:=; bw^{D} ♀
j 102 - Y^{S} X In EN In^{49} y Y^{L};st (no free Y)

BOGOTÁ, COLOMBIA: UNIVERSIDAD DE LOS ANDES
Instituto de Genética

Fusa XXI
Caracolicito X
Orito (Putumayo)
Fusa XX V B.
Vermellón
Ebony
Sepia
White
Vestigial
Dumpy
Cy L/Pm

BALTIMORE, MARYLAND: JOHNS HOPKINS UNIVERSITY
Department of Biology

Chromosome 3

Gl/TM1, Me ri sbd^{1}
Gl Sb Ser/TM2, Ubx^{130} e^{s}
Gl Sb Ser/TM3, y^{+} ri p^{p} sep bx^{34e} e^{s}
mwh cp in ri p^{p} red e
mwh e
mwh red e
mwh red e Pr^{L}
mwh red e Ser/TM1, Me ri sbd^{1}
red

TÜBINGEN, GERMANY: INSTITUT FÜR BIOLOGIE
Lehrstuhl für Genetik

Wild Stocks

Oregon
Wien 1965
Wien 1966
Ponza III

Chromosome 1

Muller 5
ClB/v ptg oc sn
y v f
B sn w
w
cv

Chromosome 2

vg bw
dp b
b cn vg
L Cy/Pm
L/Cy

Chromosome 3

Ly/D^{3}

Multichromosomal

bw;st
bw;e

SEOUL, KOREA: SEOUL NATIONAL UNIVERSITY
Department of Zoology

Note: Stocks are as listed in DIS 46:37 with the following addition:
Chromosome 2 210. Srf/bw^{V1}

LYON, FRANCE: FACULTE DES SCIENCES
Biologie Générale et Appliquée

Wild Stocks	Chromosome 1	Chromosome 2	Chromosome 3	Multichromosomal
Lyon	y	cn	e	st;bw
Algérie	w	b cn vg bw		v;bw
	v			cn;bw

LUDHIANA, INDIA: PUNJAB AGRICULTURAL UNIVERSITY
Department of Genetics

Wild Stocks

Oregon-K

Chromosome 1

1 y

2 sc^{S1} B, In-S, w^{a} sc^{8}(M-5)
3 y cv v f car

Chromosome 2

4 cn
5 vg

6 dp b cn bw
7 Cy/B1 L^{2}

Multichromosomal

8 ec, bw, st(1;2;3)

MELANOGASTER - NEW MUTANTS

Report of J.R.S. Whittle

Cos: Costal 2-unmapped. A recessive lethal mutation having a morphological effect in heterozygotes, recovered from the F_1 between TM3/Sb females and st sr e^{s} ro ca males following EMS mutagenesis of the latter. Outgrowths of wing tissue appear in the costal cells proximal and distal to the humeral cross-vein. Penetrance and expressivity are very sensitive to genetic background and culture conditions. In many flies the outgrowth approaches 30% of the area of the normal wing, and in extreme examples there is mirror image duplication of the wing including veination and marginal bristles, with an axis of symmetry along the anterior border of the normal wing. No duplication of the alula is seen. Halteres are often bifurcated at the capitellum, there are eruptions in the mesonotum near the supra- and post-alars, and femurs of the 3rd legs may show projections. Cos is not an allelic lethal to 1(2)gd and this heterozygote does not have good penetrance for Cos. Fertility good.

Report of S. Gossi, D. Kreisman and R. Moree

ca^{G}: claret of Gossi 3-100.7. The mutant originally reported in DIS 46:40 as bwn^{G} has been found to be allelic to ca. Both thin layer and paper chromatography indicate the pteridine content of ca^{2} and ca^{G} to be the same or at least very similar; no qualitative or quantitative differences between ca^{2} and ca^{G} have been detected. However, the body and wing effects of ca and ca^{2} are not found in ca^{G} flies. Other aspects of the original description still hold.

Report of P.T. Ives

sca^{65131}: Additional information to that in DIS 42:38. This allele appears not to reduce any bristle frequency substantially. Over the years I have come across several sca mutants in analysing chromosomes from various natural populations, all of them with a marked bristle-removing effect, similar to that of the original sca. This particular allele seems to be different in this respect.

Report of S.J. O'Brien

α-GPDH-1^{P}: α-glycerophosphate dehydrogenase-1^{P} S. O'Brien, 1968. EMS induced electrophoretic variant from α-GPDH-1^{S}. Allelic to α-GPDH-1 (DIS 43:61). More electropositive protein than α-GPDH-1^{S}.

α-GPDH-1^{N-0}: α-glycerophosphate dehydrogenase negative-0 S. O'Brien, 1968. Hemizygous viable (with Df(2L)GdhA, Science 158:1319). EMS induced from α-GPDH-1^{S}. This mutant lacks α-GPDH completely. (< 0.1%) Dosage dependent, adults are visibly normal but cannot sustain flight.

α-GPDH-1^{N1-4}: α-glycerophosphate dehydrogenase negative-1-4 S. O'Brien, 1968. EMS induced from α-GPDH-1^{S}. Hemizygous viable, dosage dependent, lacks α-GPDH (< 0.1%). Visibly normal, but cannot fly.

α-GPDH-1^{N-5-4}: α-glycerophosphate dehydrogenase negative-5-4 S. O'Brien, 1968. EMS induced from α-GPDH-1^{S}. Hemizygous viable dosage dependent lacks α-GPDH (< 0.1%). Visibly normal but lack ability to sustain flight.

α-GPDH-1^{N-1-5}: α-glycerophosphate dehydrogenase negative-1-5 S. O'Brien, 1968. EMS induced from α-GPDH-1^{S}. Hemizygous viable, α-GPDH levels of 1-5%. Dosage independent, flight normal. Electrophoretic mobility altered to α-GPDH-1^{P} position.

Report of A.-M. Pierre

Km: killer of male EMS induced in wild ♂ Oregon, on second chromosome - recessive. All homozygous ♂♂ for this mutation are killed at an early state of embryogenesis.

km(2)A: localization about 45
km(2)B: localization about 20

Report of J.N. Thompson, Jr. and D.J. Purnell

vg^{72a}: vestigial 72a 2-67.0. Spontaneous in selection line. Like vg.

f^{71i}: forked 71i 1-56.7. Spontaneous in selection line. Bristles short, thick and bent or gnarled, often with split ends. Viability and fertility good. RK1.

y^{72a}: yellow 72a 1-0.0. Spontaneous in a selection line. Like y.

lz^{tear}: lozenge tear Spontaneous. Eye size reduced, tear shaped, surface smooth, without facets, pigment reddish-brown and confined mostly to the perimeter of the eye. Tarsal claws vestigial. Female and male fertility fair, but homozygote appears to be inviable. The stock is maintained over the Muller-5 balancer. Recombination tests placed this allele at 1-18.0, though in the mutant stock, a small inversion between forked and the centromere (described by P. Doyle), and the indication of a semilethal factor near vermilion have thrown doubt on the precision of this location. lz^{tear}/lz^{37h} has reddish-brown eyes with large, irregular facets.

Report of B. Hochman

The following chromosome 4 mutants were detected and/or analyzed after the publication of Hochman (1971) Genetics 67:235-252. They have not been reported or adequately described previously but they are included in my stock list elsewhere in this issue of DIS. Four new vital loci on chromosome 4 (designated 18, 24, 31 and 34) were uncovered by the last four mutants described below.

ar^{68i}: abdomen rotatum Hochman 68i. 4-(within Df(4)M). EMS-induced allele of ar. Abdomen twisted about 45° in clockwise direction as viewed from behind. Homozygotes for this allele have higher viability and fertility than those for other ar alleles. Male and female homozygotes capable of mating with each other and with flies having normal (untwisted) abdomens.

ar^{69g}: abdomen rotatum Hochman 69g. 4-(within Df(4)M). EMS-induced allele of ar. Phenotype similar to ar^{68i} but viability lower and fertility much reduced.

fs(4)34: female sterile (4) at locus 34 Hochman 64d. 4-unlocalized. Derived from normal male collected December, 1963 in Lake County, Florida. Viability of homozygotes is normal and males are fertile but females are completely sterile. Inspection and dissection reveal no morphological abnormalities in females. They can be inseminated, and oviposit but eggs fail to develop. This is the first female sterile found on chromosome 4.

1(4)18: lethal (4) at locus 18 Hochman 69f. 4-(within Df(4)M). EMS-induced. Homozygotes are completely lethal. No interaction between 1(4)18 and the other lethals and visibles mapped within Df(4)M.

1(4)24: lethal (4) at locus 24 Hochman 69f. 4-(within Df(4)M). EMS-induced. Homozygotes die as larvae or pupae with rare (<.01) escapers. This lethal is one of ten EMS-induced lethals or extreme semilethals of locus 24 detected in my laboratory during 1965-9. Four of the chromosomes containing mutations of 24 also carry a nonallelic lethal (2^m, 16^f, 19^f and 23^c, respectively) induced simultaneously with the 24 alteration. The viability of heterozygotes for 24 alleles is, with three exceptions ($24/24^e$, $24/24^h$ and $24^e/24^h$), significantly below normal but it always exceeds that of the two respective homozygotes. The partial complementation observed here suggests that locus 24 may be second complex locus uncovered on chromosome 4.

1(4)31: lethal (4) at locus 31 Hochman 69e. 4-unlocalized. EMS-induced. Homozygous lethal with death occurring during larval period. No interaction with other known factors on 4.

Report of P. Gay

ref: réfractaire We call "réfractaires" the genes of Drosophila melanogaster which slow down or inhibit Sigma virus multiplication. Previously we knew the only gene called ref (Genetic Variation of Drosophila melanogaster, Lindsley and Grell). But now we have discovered, in natural populations or in laboratory strains, several refractories genes we have to distinguish. So we keep the symbol Ref or ref followed by the number of chromosome and by origin. Each ref gene has its own susceptible viral strains range.

Ref(1)H: 1-14 ± found in Hikone-R strain. Reduces the possibility of infection and prevents hereditary transmission of some viral strains.

Ref(2)P: 2-54 ± (between $M(2)m^{S6}$ and pr). Previously known as ref(2-52.8). Found in Paris strain. Reduces the possibility of infection and prevents hereditary transmission.

Ref(2)Me: Study in progress. Location about 40, found in su(Hw)/Me Delayed apparition of CO_2 sensitivity symptom caused by Sigma virus, perhaps in slowing down its multiplication.

ref(3)O: 3-70 ± Found in Oregon. Seems to affect maturation of sigma.

Report of G.L. Lee

All of the following mutants were found in stocks containing su-(Hw)^2 and either homozygous for or segregating for yellow, scute and white alleles.

ap^{67E}: wings reduced to stumps although occasionally one wing showing a Xasta effect was noticed. Both sexes sterile. Enhancer of Xasta. Viability unaffected. Lost.

ct^{68E}: an allele of cut resembling ct^1 but not ct^6. Suppressable by su-(Hw)^2 while ct^1 is not. Fully penetrant but expressivity is variable.

Black syndrome: elongated body and extremely dark body colour in males containing the deficiency sc$^{260-1}$ covered by Y^{sc}. All such males were sterile.

Hw^{59g}: found by Dr. M.M. Green and originally described as a partial reversion of sc^1. Insertion of su-(Hw)^2 however demonstrates that sc^1 is still present and still suppressable allowing Hw^{59g} to express. Main phenotype consists of extra vertical and dorso-central bristles with some extra scutellars. Previously reported (Green 1961, Genetics 46:1385) as containing no structural alterations.

k^{66L}: roughly located at 63.9 on chromosome III. Proved to be allelic to kidney. Less than 1% of homozygous flies have normal eyes although expressivity varies from a 90% reduction in size of the eye to a typical kidney-like indentation of the margin. Bristle growth on the eye may be profuse. RK1.

sn^{67R}: a female sterile allele of singed. Fully penetrant and not suppressed by su-(Hw)^2.

supact: a suppressor activated effect. Located on the left end on the X chromosome between scute and su-w^a. Appears to be covered by Def(1)260-1. Only expressed in flies homozygous for su-(Hw)^2. The phenotype consists of missing bristles in one or more of the following systems: scutellars, dorso-centrals, ventricals, post-ventricals and ocellars. The bristle effect is recessive but the eye effect (rough eye, reduced in size) is semi-dominant. Penetrance is high at 90-100% but expressivity, particularly with respect to number of bristles removed is highly variable. Flies raised at 30^{o}C show no supact effect while flies raised at 18^{o}C show an enhanced eye effect plus a wing effect consisting of deformed and/or fluid filled wings. The effect of supact is restricted to females. XO males do not show the supact effect nor do males with two doses of the left end of the X. Females heterozygous for supact and a deficiency of the region still show the effect.

std: serratoid Located on the third chromosome in the vicinity of Serrate, this recessive mutant was found to be allelic to Serrate. The Ser/std combination shows considerable enhancement of Serrate - the notch in the wing is much deeper and more irregular while the margins of the wing have many gaps and the marginal wing vein is occasionally completely missing. RK1.

su-w^h: 3-? suppressor of white honey This recessive acts as a partial suppressor of white honey. The suppressed phenotype is a bright cherry colour. Of the other white alleles tested W^{a4} showed slight suppression as did w^a while W^{a2}, w^{bl}, w^{arm}, w^{col}, w^i, w, w^c, w^{tint}, w^{cf}, w^e, and w^{sat} were unaffected. In stocks homozygous for w^h and segregating for su-w^h the frequency of the suppressor increased, indicating a selective advantage. RK1.

"short wing": located on the X segregating independently of yellow. Expression varies from the wings having curled edges to a 50% reduction in size. The affected wing is broad at the tip and veins are generally broken. Female sterile. Presumed to be an allele of short wing. Lost.

bobbed^{68F}: a good bobbed allele with an extremely strong abnormal abdomen effect in females and a lesser one in XO males. There was no bristle effect and males carrying bb^{68F} over a Y-chromosome partially deficient for the bobbed region showed no effect. Body colour of bb^{68F} female is whitish while viability and fertility are excellent.

"short wing, black body": a recessive third chromosome gene not separated from $su(Hw)^2$ nor further tested. Phenotype closely resembles that of Delta.

"occeliless": found as a single sterile male.

"antennaless": found as a single sterile female.

"lozenge-mosaic": found as a single female having one lozenge-like eye and dissarranged bristles on the same side of the head. Not transmitted.

"Singed mosaic": two males and one female with singed bristles were found in independent experiments. This condition was not transmitted although all flies proved fertile.

Report of J. Bell and R.J. MacIntyre

Acph-1^n: acid phosphatase-1 negative mutants EMS induced. These mutations were screened for by a combination of starch gel electrophoresis and a spot test assay. The mutations were verified by the absence of the band typical for either the Acph-1^A or Acph-1^B allele in stained gels. Flies made homozygous for three of these mutations (indicated below) are viable and fertile. Such homozygous flies contain approximately 10% of normal wild type activity as measured by test tube assays (MacIntyre, 1971). There is evidence that indicates this residual activity is due to phosphatases other than Acph-1. Complementation tests were performed by preparing crude extracts of every possible mating between these mutants and subjecting them to polyacrylamide gel electrophoresis. The gels were overstained to bring out even minute amounts of activity. Several of the mutants proved to be slightly leaky while some of the others showed evidence of complementation. The results from one complementation experiment are summarized in the following table. We plan to repeat this experiment to verify the results.

References: MacIntyre, R.J. 1971 Biochemical Genetics 5:45-56.

Allele	Derived from Acph-1^A or Acph-1^B	Complementation + or -	Electrophoretic mobility if new mutant is leaky
n- 1	B	** leaky	B ⟶ A
n- 2	A	leaky	A
n- 3	B	leaky	B
*n- 4	A	+?	
*n- 5	A	+?	
n- 6	B	leaky	B ⟶ A
n- 7	B	*** +	
n- 8	A	-	
n- 9	B	leaky	B ⟶ New (activity remains close to origin and gives streaky band).
n-10	A	+	
*n-11	B	+?	
n-12	B	+	
n-13	B	-	
n-14	A	leaky	A ⟶ B
n-15	A	-	

* Indicates that this stock has been made homozygous.

** Mutants which displayed bands of activity with all of the other fourteen in overstained polyacrylamide gels are designated as leakies. However in 4 of the 6 cases the electrophoretic mobility seems to be altered.

*** A plus indicates that this mutant shows evidence of complementation with one or more of the other fourteen mutants but not all of them.

Report of G. Korge

The following chromosomal mutations were X-ray (7000 R) induced in males of the wild stock Berlin-normal. All mutants are viable in heterozygous condition; homozygous lethal.

Df(3R)e^{671}: Deficiency (3R) ebony Cytology: Df(3R) 93B5-7; 93D3.

Df(3L)th^{70i}: Deficiency (3L) thread Cytology: Df(3L) 72A2; 72D9.

Df(3L)th^{70kI}: Deficiency (3L) thread Cytology: Df(3L) 71C3-4; 72C1-2.

Df(3L)th^{70kII}: Deficiency (3L) thread Cytology: Df(3L) 71F3-4; 73A4-5.

Df(3L)th^{701}: Deficiency (3L) thread Cytology: Df(3L) 72A2; 72D. This places ebony in 93B7-D3 and thread in 72A2-C1-2.

Report of D.J. Fox

Idh-NADP^{SS}: NADP-dependent isocitrate dehydrogenase, slower than slow. This new allele is co-dominant with both of the previously described (DIS 45:35) Idh-NADP alleles forming, in addition to the two parental bands, a hybrid band on Agarose gel electrophoresis in citrate-borate-tris buffer, pH 8.6 (see Biochem. Genet. 5:69-80 for recipe). The variant enzyme migrates more slowly toward the anode than do the other variants.

MELANOGASTER - LINKAGE DATA

Report of J.J. Colaianne and A.E. Bell

Linkage relationship between the rudimentary and sonless loci The complex mutational locus rudimentary (r, 1-54.5) and the recently reported sonless mutant (snl, 1-56.1; Colaianne and Bell, 1970) give very similar distorted sex-ratio patterns and have been localized in close proximity. However, recent experimentation has demonstrated that the two loci are non-allelic (Colaianne and Bell, 1972). Consequently, a three point linkage test was conducted (utilizing forked, 1-56.7) to determine the linkage relationship between the two mutants since it appears plausible that snl may be, in some sense, an extention of the multiple site r-locus.

Although r and f can be detected phenotypically, it was necessary to progeny-test for the presence of snl since this gene has no phenotypic expression other than the distorted progeny sex ratios of snl/snl females. All male offspring of the cross r^{39k} + f/+ snl + x B/Y were classified with respect to r and f. Then single-recombinant type sons (r,+: +,f) were test-mated for the presence of snl by crossing them to + B/snl + females and progeny-testing the resultant non-Bar eyed daughters for the sonless phenotype. This procedure of analyzing only single-recombinant type males failed to detect double-recombinants. However, it did enable maximization of efficiency in the progeny-testing and considering the close proximity of the three loci, double-recombinants were probably so rare (approximately 1/10,000) that the introduced bias is minimal.

Experimental results: (N = 5164)

	single-crossovers	
non-crossovers	region 1	region 2
r,f: 2601	r,snl,+: 15	r,+,+: 12
+,+: 2501	+,+,f: 23	+,snl, f: 8

recombination frequency between:
r and snl = .74; snl and f = .39; r and f = 1.12

Three points of interest are evident: 1) The sonless gene is located approximately .7 map units from rudimentary and to its right. If snl had been to the left of r the recombinant products r, snl, + and +, +, f would have resulted from double-crossover events. However,

their observed high frequencies of occurrence invalidates this possibility.

2) Sonless is somewhat closer to f than previously reported. We now place snl approximately .4 units to the left of f at 56.3, using f as a reference point.

3) The observed total crossover frequency for the region between r and f was only 1.12 which tends to support Nørby's finding (1970) that r and f are somewhat closer than the expected 2.2 units based on their reported map locations.

Literature cited: 1. Colaianne, J.J. and A.E. Bell 1970 Genetics 65:619-625; 2. ____ 1972 Genetics (submitted); 3. Nørby, S. 1970 DIS 45:41.

Report of A. Robertson and M. Riviera

fap In DIS 41:154, evidence was presented for a locus affecting abdominal pigmentation pattern in females located towards the tip of 3L. We now have evidence that this locus is polymorphic in many wild populations with at least six alternative alleles. Using the two described in the earlier note (Figs. I and III) in the background of a specific fourth chromosome, it has been possible to locate the locus more precisely using the markers mwh, ru and ve. mwh is known (DIS 44:52) to be close to or to the left of ru which is to the left of ve. Using the symbol fap (female abdomen pattern) for the new locus, the evidence from experiments involving various combinations of the four loci may be summarized as follows:

i) The order of the loci is fap mwh ru ve.

ii) In experiments involving mwh and ve only, there were 25 crossovers, confirmed by subsequent crossing, in 3741 chromosomes.

iii) In experiments involving all 4 loci, there were 14 confirmed crossovers between fap and ve in 2445 chromosomes examined.

iv) Of 26 crossovers analysed between fap and ve, 6 were between fap and mwh.

v) Of 30 crossovers analysed between mwh and ve, 17 were between mwh and ru.

With the location of ru as an arbitrary zero, the other three loci therefore map approximately at fap: -0.5, mwh: -0.3, ve: +0.2.

MATERIALS REQUESTED OR AVAILABLE

L. Ehrman, Division of Natural Sciences, S.U.N.Y. College at Purchase, Purchase, N.Y. 10577, is now keeping and maintaining all strains, mutant and wild type, of D. paulistorum that were formerly kept at the Rockefeller University, New York. There are at present about 150 strains.

Amparo Espinós (Department of Genetics, High Technical School of Agriculture, Valencia, Spain) would appreciate receiving reprints on current work on Drosophila to supplement the library of this Department.

R.C. King, Dept. of Biological Sciences, Northwestern University, Evanston, Ill. 60201, would like anyone who has a chromosomal aberration with breakage points in the region between 22E and 23B in the left arm of II to send a stock to him. The mutation fes (fes(2)B) is in this region, and he is interested in studying its effects when hemizygous.

P.T. Ives of Amherst College (Sta. 2, Box 320, Amherst, Mass. 01002) has available a Tortuga Island strain of the Phorid fly, Megaselia scalaris, which breeds well on Drosophila medium, particularly on banana-agar, without proprionic acid.

A new department of genetics was created at the University of Louvain (Belgium). Dr. F.A. Lints, head of the department, Laboratoire de Génétique, Faculté des Sciences Agronomiques, 92, kardinaal Mercierlaan, B - 3030 Heverlee, Belgium, would appreciate receiving reprints (old or new) on the genetics of Drosophila in order to establish a library of reprints.

Any Drosophila simulans strain from Japan would be highly appreciated for a comparison of quantitative characters with European strains by Prof. J. David, Laboratoire d'Entomologie expérimentale et de Génétique, 16, quai Claude Bernard, (69) Lyon 7 (Villeurbanne), France.

(Continued on next page)

I.H. Herskowitz, Dept. of Biological Sciences, Hunter College, New York, N.Y. 10021, is preparing Bibliography on the Genetics of Drosophila, Part VI. Please send him titles (hopefully with reprints) you wish included.

Fruit fly culture bottles (new round or spuare one-half pint glass bottles) are available from Winscot, Inc., Box #1, Clarion, Penna. 16214 (Telephone 814-226-9208). They will be happy to quote price and delivery to interested persons.

S.C. Lakhotia, now in charge of Cytogenetics Laboratory, Department of Zoology, University of Burdwan, Burdwan, West Benga., India, desires an exchange of information and reprints on polytene chromosomes, gene regulation, etc.

ANNOUNCEMENTS II

J.G. Mendel and Genetics Today The 150th anniversary of Mendel's birth will be commemorated at a scientific meeting of geneticists and research workers in agriculture and forestry in Brno, Czechoslovakia from 19th to 21th of September, 1972. Comtemporary scientific problems will be discussed in the following sections: 1) The Genetic Information; 2) Genetics of Cells; 3) Genetics of Organisms; 4) Population Genetics; 5) Genetics and Breeding Methods. Further information can be obtained from the Scientific Secretary of the Organizing Committee, Dr. V. Orel, Brno, Mendelianum, C.S.S.R.

I.H. Herskowitz, of Hunter College, New York, N.Y., has recently completed the book Principles of Genetics that will be published by Macmillan Co. in 1973.

R.C. King's Dictionary of Genetics (2nd Edition) was published this year by Oxford University Press. It adds seven hundred new entries to the 1st Edition and updates Appendices A, B and D

The Egyptian Society of Genetics is publishing a new Journal of Genetics entitled The Egyptian Journal of Genetics and Cytology. Its advisory board consists of 24 internationally well known scientists from all over the world. It is published twice a year. The first issue is already in circulation and contains 13 original articles. The second will be out in June 1972 and will contain 16 articles. Subscription price to individuals is $5.00 and to Institutions is $10.00 per year; $2.00 are added for postage. Dept. of Genetics, Faculty of Agriculture, Alexandria University, Shatby, Alexandria, Egypt.

Behavioural and Ecological Genetics; A Study in Drosophila is the title of a book by Peter A. Parsons, La Trobe University, Victoria, Australia, to be published in January 1973 by Oxford University Press. The book is concerned with the various behavioural and ecological factors known to be of importance in leading to adaptation to the environment, regarding environment in the broadest possible sense as consisting of both living and non-living components. Although there are behavioural and ecological parts in the book, the division is artificial, since many of the factors isolating populations and determining their distribution, are a combination of ecological and behavioural components. The overall aim is to provide some insight into the evolutionary biology of Drosophila as a whole, with the hope that some of the principles discussed may be applicable to other genera.

The Isozyme Bulletin contributions, orders and information requests should be directed to Dr. John G. Scandalios, Editor, The Isozyme Bulletin, AEC-Plant Research Laboratory, Michigan State University, East Lansing, Mich. 48823. Size of the bulletin must be limited, so material will be accepted on a first come, first served basis. Copy should be clean, accurate and single spaced, as it does directly to the printer without re-typing. Orders should be paid in advance ($3.00 USA, $3.50 Foreign).

A. Singh, Department of Zoology, Panjab University, Chandigarh, India, received the Ph.D. degree on his work entitled "Taxonomical and Cytological Studies on the Indian Drosophilidae" in October, 1971.

DAVIS, CALIFORNIA: UNIVERSITY OF CALIFORNIA
Department of Genetics, Laboratory of Population Genetics and Evolution

Wild strains from different geographic origins:

			miranda
willistoni	paulistorum	nebulosa	azteca
tropicalis	insularis	pseudoobscura	serrata
equinoxialis	pavlovskiana	persimilis	birchii

Mutant or selected stocks. Balanced stocks for second and third chromosomes of willistoni. Various autosomal and sex-linked markers of paulistorum.
pseudoobscura: stocks selected for positive and negative phototaxis or geotaxis.

KALYANI, WEST BENGAL, INDIA: UNIVERSITY OF KALYANI
Department of Zoology

ananassae

SÃO PAULO, BRASIL: UNIVERSIDADE DE SÃO PAULO
Instituto de Biociências

Other species stocks are no longer maintained in the laboratory.

BOGOTÁ, COLOMBIA: UNIVERSIDAD DE LOS ANDES
Instituto de Genética

D. Paulistorum

Yaguaracaca A2
Yaguaracaca A1
Yaguaracaca B1
Yaguaracaca B2
Mitú 1A
Mitú 1B
Mitú 2B
Valparaiso 1
Valparaiso 2
Caripe 8 (Ven)
British Guiana
Gigante (Huila)
Raposo 95 - a. b. c. d.
Fusa
Angra 24 (Brasil)
Chocó
Belem 11 (Brasil)

D. Willistoni

Marco 2
Yaguaracaca A (Bajo)
Yaguaracaca B (Alto)
San Pablo (Brasil) Bosque
Recuerdo
Condoto
Valparaiso (Caquetá)
Mitú 2
Macarena
Sasaima
Manizalez
Mitú 1
Piojó

Equinoxialis

Mitú 2A

San Pablo (Bosque)
Mitú 2A
Mitú 1
Marco 1 (Brasil)
Mesas
Valparaiso
Turbo B2
Yaguaracaca A (Bajo)
Yaguaracaca B1
Macarena
Umaripunta bosque (Vaupes)

Tropicalis

Mitú 2
Valparaiso (Caquetá)
San Pablo (Bosque)
Macarena
Umaripunta Est. 2 (Vaupes)

PURCHASE, NEW YORK: STATE UNIVERSITY OF NEW YORK
Division of Natural Sciences

D. paulistorum

We keep all those strains, including mutants, of paulistorum formerly kept in the laboratory of Professor Th. Dobzhansky at The Rockefeller University, New York City.

CALCUTTA, INDIA: UNIVERSITY OF CALCUTTA
Department of Zoology

ananassae

Wild Stocks

a^{66} Calcutta (a^{6})
a^{77} Behala
a^{99} College Street
a^{222} Port Blair, Andamans

hydei

Chromosome 1

to
w
w^{a}
w^{m1}
w^{m2}

Translocation

703/12 T(X:A)/wlt.Y

bipectinata

kikkawai Brazil

simulans

tropicalis (from Austin)

1975.1 (Brazil)
2374.5 (Peru)
H 65.2 (Salvador)
H 340.13 (Honduras)

BARCELONA, SPAIN: UNIVERSITY OF BARCELONA
Department of Genetics, Faculty of Science

D. ambigua - Spanish stocks
D. bifasciata - Pavia (Italy)
D. busckii - Spanish stocks
D. buzzati - Spanish stocks
D. emarginata
D. funebris - Spanish stocks
D. hydei - Spanish stocks
D. immigrans - Spanish stocks
D. lebanonensis - Peramola (Spain)
D. mercatorum - Spanish Stocks
D. obscura - Spanish stocks
D. phalerata - Spanish stocks
D. persimilis
D. pseudoobscura - Texas (USA)
D. repleta - Spanish stocks
D. simulans - Spanish stocks
D. subobscura - Spanish stocks
mutant stocks
D. testacea - Spanish stocks
D. transversa - Spanish stocks
D. victoria - Prescott (USA)
Dettopsomya nigrovittata - Tenerife, Canary Islands
Megaselia scalaris - Spanish stock

CHANDIGARH, INDIA: PANJAB UNIVERSITY
Department of Zoology

melanogaster
takahashii
nepalensis
suzukii
malerkotliana
jambulina
punjabiensis
immigrans

SYDNEY, AUSTRALIA: UNIVERSITY OF SYDNEY
Department of Animal Husbandry

simulans

net
jv se
H^{h} pe
st se
$y_{2}w$
f^{2}
v

b
bw
dh b pm
net b py sd pm
py^{2} up
stw
st Dl^{2} pe/st pe
rd
st Ubx pe/st pe

ananassae

+ (Hawaii)
+ (Rockhampton)
w^{65} y^{49}

immigrans + (Sydney)
repleta " "
lativittata " "

TÜBINGEN, GERMANY: INSTITUT FÜR BIOLOGIE
Lehrstuhl für Genetik

subobscura

Wild Stocks

Belgrad
Lipari
Ponza 2/3
Norwegen
Tunis Mischstamm

Homozygous for gene arrangements

Küsnacht

Tunis 1
Tunis 2
Zürich U_{1+2}

Selected for light independence

Dunkelstamm

Chromosome A

pm ct sn

y
Bx
Oc

Chromosome O

cu
ch cu
$Ba/1^{8}$
Va/+
Va/Ba^{210}

Chromosome E

dp^{1}

Chromosome I

int ey wt

Chromosome U

nt fd^{Mi}
Itr

pseudoobscura (wild)

ambigua (wild)

IZATNAGAR, INDIA: INDIAN VETERINARY RESEARCH INSTITUTE
Division of Animal Genetics

D. ananassae

CLEVELAND, OHIO: CLEVELAND STATE UNIVERSITY
Department of Biology and Health Sciences

D. virilis

Wild Stocks

Argentina

Brazil
Chile
Texmelucan

Multichromosomal

b;tb gp;cd;pe

MILANO, ITALY: UNIVERSITA' DE MILANO
Istituto di Genetica

simulans

Wild Stocks

1 Aspra
2 Giannutri

Chromosome 3

3 st

Stocks selected for tumor manifestation

4 tu Bl
5 tu Aspra

MEXICO CITY, MEXICO: NATIONAL INSTITUTE OF NUCLEAR ENERGY
Nuclear Biomedical Program, Radiobiology Direction

III	virilis	IX	pseudoobscura (Mexico City)
IV	hydei	X	immigrans " "
V	ananassae	XIII	virilis " "
VII	neohydei	XII	busckii " "
VIII	simulans	XIV	funebris " "

AMHERST, MASSACHUSETTS: AMHERST COLLEGE
Department of Biology

(Collected from the Amherst area; may not flourish on medium containing propionic acid; generally, but not always, available.)

affinis	funebris	immigrans	quinaria	simulans
algonquin	hydei	melanica	robusta	virilis
busckii				

ST. CHRISTOL LES ALÈS, FRANCE: C.N.R.S. ET I.N.R.A.
Station de Recherches Cytopathologiques

immigrans strains endemic for iota virus

SEOUL, KOREA: SEOUL NATIONAL UNIVERSITY
Department of Zoology

virilis

NORWICH, ENGLAND: JOHN INNES INSTITUTE

D. simulans

HELSINKI, FINLAND: UNIVERSITY OF HELSINKI
Department of Genetics

D. ambigua - Finnish strains
D. bifasciata - N. European strains
D. littoralis - Finnish strains
D. obscura - N. European strains
D. simulans - Finnish strain
D. subobscura - Finnish strains
Chymomyza costata - N. European strain

VARANASI, INDIA: BANARAS HINDU UNIVERSITY
Department of Zoology

Wild Stocks

a) ananassae - 7 strains
b) bipectinata (Calcutta)
c) malerkotliana
d) nasuta
e) kikkawai
f) raychaudhurii
g) latifshahi
h) seguyi

ananassae

Chromosome 1

y
w^a
vs

Chromosome 2

cu b se
cu se
b se
cu b
b
cu
se
ic
cu bw
ss^a

Chromosome 3

px pc
stw pc
stw px
stw
px
pc

Unlocated mutants

dct
sp
ci
arch

STOCKHOLM, SWEDEN: UNIVERSITY OF STOCKHOLM
Institute of Genetics

701 simulans (wild type) 702 simulans: v 703 funebris (wild type)

EASTON, PENNSYLVANIA: LAFAYETTE COLLEGE
Department of Biology

D. mojavensis D. mulleri D. pseudoobscura D. virilis

DROSOPHILA SPECIES - NEW MUTANTS

ananassae

Report of D. Moriwaki (4) (1-43:79; 2-45:58; 3-46:49)

(X-chromosome)

od^{u}: uplift C. Kato 70j7. Spontaneous in +F8 wild stock. Wings uplifting at right angles to body. Allelic to od.

ct: cut Moriwaki 71gl2. Recovered as a single ♂ in a cross referring to Pt and rd-a. Wings cut, incised at tips.

w^{m}: white-mottled C. Kato 71c8. Spontaneous as a single ♂ in the culture of a Pt pair. Eyes show one or a few red spots on white background. Penetrance incomplete, especially in ♂♂

w^{m}: white-mottled C. Kato 71c8. Spontaneous as a single ♂ in the culture of a Pt pair. Eyes show one or a few red spots on white background. Penetrance incomplete, especially in males. Allelic to w.

scar: scarred C. Kato 71cl7. Derived from a cross M-d Pt x ri. Eye surface scarred and wrinkled. Postscutellars mostly erect. Often wings spread, especially in males.

amb: amber C. Kato 71cl7. Spontaneous as a single ♂ in a cross ri x M-d Pt. Pale yellow body. Bristles thin and slightly shortened.

(2-chromosome)

Pt: Plexate Moriwaki 71a22. A single female originated from the culture of a cross referring to od and od^{u}. The end of L2 vein fused with costa like in Delta; extra veins often seen in submarginal cells. Dominant. Homozygote not necessarily lethal.

ext^{k}: kidney Moriwaki 70d30. Appeared in the culture of ext. Eye size reduced by indentation of front margin. Penetrance low; expressed when combined with Dl gene.

Ir-a: Interrupted-autosomal Moriwaki 69hl. Spontaneous as a single female in +F5 wild stock. Posterior crossveins missing or broken. Expression variable, overlapping the wild type even when homozygous. Semidominant.

bw^{71}: brown 71 Moriwaki 71d9. Single female appeared in the culture of a cross referring to w^{m} Pt. Allelic to bw.

bw^{71e}: $brown^{71e}$ Moriwaki 71e25. Derived from the culture of a cross scar x + F3. Allelic to bw.

bs: blistered Moriwaki 71g28. Spontaneous in +B219 wild stock. Wings blistered.

(3-chromosome)

Ms: Missing Moriwaki 69112. Spontaneous in bw ru stock. Bristles missing, in extreme cases nearly all off. Semidominant (penetrance about 40%). Heterozygote when expressed, anterior scutellars missing.

ri^{71}: radius interruptus^{71} Moriwaki 71e9. Spontaneously appeared in the culture of a cross w^{m} Pt x $+_2$. Allelic to ri. Expression often incomplete in females.

subobscura

Report of M. L. Rivera

antenas cortas (Provisional name). Segments of antennae thicker. Arista shorter with smaller branches. Expression variable. Good classification. Fair viability. Chromosome E (linkage group 4). Found by Prevosti in F_2 obtained by inbreeding the offspring of wild ♀♀.

blistered-curly Wings blistered with the surface sometimes dusky and slightly curled. The wings of freshly hatched adults are inflated with lymph. Sometimes lymph later dries, leaving the wing vesiculated and slightly curled upward. Good classification. Poor viability. Chromosome O (linkage group 5). Found first by Prevosti in F_2 of wild females and later by crossing two mutant stocks.

hairy-scutellum Extra hairs on scutellum. Good classification. Good viability. Chromosome J (linkage group 2, determined by Rosa Miró).

macrohaltere Halteres very large, with hairs along its outer margin. Variable size to about three times its normal volume. If it is very large the individual has low viability and difficulty mating. Good classification. If was found in F_2 obtained by inbreeding the offspring of wild females.

quetas chamuscadas (Provisional name). Macrochaetae on head and thorax singed and forked. Hairs wild type. Good classification. Fair viability. Chromosome U (linkage group 3). It was found in the F_2 obtained by inbreeding the offspring of wild females.

roof-bent Dorsocentral and scutellar bristles smaller, rigid and bent. Wings drooped at sides like a roof and slightly shortened. Bad viability. Good classification. Late hatching Chromosome O (linkage group 5). It was found in F_2 obtained by inbreeding the offspring of wild females.

PERSONAL AND LABORATORY NEWS

M.P. Kambysellis is now Assistant Professor of the Department of Biology, New York University University Heights, Bronx, New York (from Harvard University, Cambridge, Massachusetts).

Claës Ramel and some of his co-workers at the Institute of Genetics, University of Stockholm, have formed a sub-group for environmental toxicogenetics, formally adjoined to the Institute but now located in the newly erected Wallenberg Laboratory, Lilla Frescati, S-104 05 Stockholm, Sweden.

N.S. Sidhu, Professor of Animal Genetics, Division of Animal Genetics, Indian Veterinary Research Institute, Izatnagar, U.P., India, and associates Shri M.C. Saxena and Shri A.K. Batbyal are working on haploid genetic effect on egg volune in the y v f(XX) strain. Inbred lines through full sib-mating are being developed based on early laid and late laid eggs which have differences in the amount of yolk in them.

Tsuchiyama, S. and B. Sakaguchi. Kyushu University, Fukuoka, Japan. Disc electrophoresis of soluble proteins in sex-ratio female of D. melanogaster.

It has been demonstrated by Poulson and Sakaguchi (1961) that one class of the maternal sex-ratio (SR) condition in Drosophila is caused by an infection with SR spirochete. Male zygotes of the SR line are selectively killed by the SR spirochete but female zygotes are not, and the spirochete behaves as a symbiont in the body of the female.

The object of the present work was to elicit information on biochemical aspects of these differences between the two sexes for the selective killing.

Female and male flies of normal line, Oregon strain, and SR line of the same strain with nebulosa SR spirochete were used as a source for extraction of soluble proteins. Two young flies, two days after eclosion, were comminuted in 0.1 ml of Drosophila Ringer's solution containing 10% sucrose in a small glass homogenizer. To analyze for soluble proteins in the homogenates, 7.5% acrylamide gels for disc electrophoresis were prepared. The procedure of electrophoresis was carried out according to the method of Loening (1967). Gels were stained in 0.5% amido black in 7% acetic acid. Relative ratios of each band for quantitative amount of protein separated by electrophoresis were calculated from the results of electropherograms obtained by densitometer.

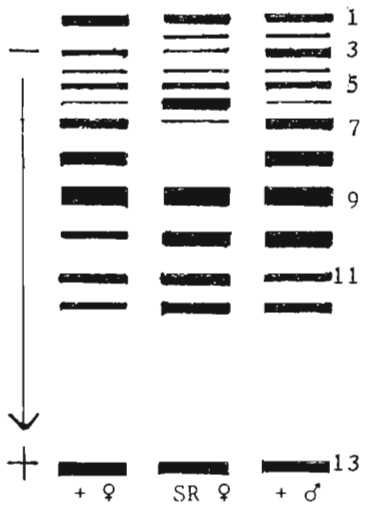


Fig. 1. Schematical electropherograms obtained from soluble proteins of normal and SR flies.

Table 1. Relative amount of each fraction of soluble proteins separated by disc electrophoresis

Fraction No.	Normal female	SR female	Normal male
1	12.5%	11.5%	8.3%
2	0	1.9	1.4
3	3.1	1.9	6.8
4	1.5	1.9	1.4
5	7.8	5.8	6.8
6	1.5	13.5	1.4
7	15.6	1.9	15.3
8	14.0	0	11.1
9	15.6	15.4	16.7
10	7.8	15.4	11.1
11	9.3	11.5	8.3
12	4.7	9.6	6.8
13	6.2	5.8	4.2

The electrophoretic patterns of the soluble proteins from the tested flies are schematically shown in Fig. 1. Normal female and male had very similar patterns except that the minor fraction 2 was entirely missing in the former. Relative ratios of the quantitative amounts, among each fraction, shown in Table 1, were also similar with some variation between normal female and male. However, the protein patterns obtained from SR females revealed very significant differences between normal female and male. Fraction 8, a major fraction found in both normal female and male, was completely absent in SR female as shown in Figure 1. It is interesting that minor fraction 2 found only in the normal male was also present in the SR female. Fraction 6 and 7 show considerable quantitative variations between normal and SR female: the ratios in the SR were elevated or degraded for fractions 6 and 7, respectively (Table 1). Furthermore, the ratios of fraction 10, 11 and 12 of SR female were raised in comparison with the corresponding fraction of normal female and male (Table 1). Further analyses on these differences of the protein patterns between normal and SR flies are now underway.

References: Poulson, D.F. and B. Sakaguchi 1961 Science 133:1489; Loening, U.E. 1967 Biochem. J. 102:251.

We wish to thank the Ministry of Education, Japan, for their support of the Scientific Research Grant.

Cummings, M.R. and B. Ganetzky. University of Illinois at Chicago Circle, Chicago, Illinois. Carbohydrate content of adp^{fs} females of D. melanogaster.

In both alleles of the second chromosomal mutant, adipose (2-83.4) of D. melanogaster, the female corpus allatum is hypertrophied and histological observations on the fat body indicate that lipid is accumulated at the expense of glycogen. Carbohydrate analysis indicates that at eclosion, females homozygous for the adp^{60} allele have total body carbohydrate levels only slightly below those of wild type, while eight days later, such females have carbohydrate levels far below wild type (Doane, 1963 DIS 37:73). In addition to excess fat body lipid accumulation, females homozygous for adp^{fs} lay defective eggs, indicating that carbohydrate metabolism might also be affected in this mutant.

To investigate this possibility, total body carbohydrate levels for +/+ (Oregon R) and $+/adp^{fs}$ and adp^{fs}/adp^{fs} isogenic for the Oregon R residual genome were carried out on flies raised on axenic killed yeast medium (David, 1962 DIS 36:128) in a 12:12 hour light-dark cycle. Females from each genotype, ranging in age from eclosion to 7 days were assayed. To eliminate variability caused by food in the gut, flies were starved for 18 hours prior to testing. For each series, groups of four females of each genotype were weighed and homogenized in 10% cold PCA, and the total carbohydrate of the supernatant of the homogenate determined at 625 mu using the anthrone reaction of Scott and Melvin (Analyt. Chem. 25:1656-1661, 1953) with glucose as a standard. Results for day 1 and day 7 are presented in the table as ug/fly.

		Carbohydrate content (ug/fly)		
Genotype		+/+	$+/adp^{fs}$	adp^{fs}/adp^{fs}
	Series 1	17.5±3.53	29.0±1.41	16.5±3.53
Age: 1 day	Series 2	15.0±1.41	21.0±9.89	18.0±2.82
	Mean	16.2±2.63	25.0±7.39	17.2±2.75
	Series 1	32.2±1.06	10.8±0.30	9.8±1.06
Age: 7 day	Series 1	35.2±1.06	11.0±0.00	11.2±5.30
	Mean	33.8±1.93	10.8±0.25	10.5±3.24

From the data presented in the table, it is apparent that adp^{fs}/adp^{fs} and probably $adp^{fs}/+$ females begin adult life with the same total carbohydrate levels as +/+ flies. At 7 days after eclosion, the carbohydrate levels in the +/+ flies has increased significantly, while in the $adp^{fs}/+$ and adp^{fs}/adp^{fs} females, the levels are far below those of +/+ flies. In addition, the $adp^{fs}/+$ and adp^{fs}/adp^{fs} values are lower on day 7 than on day 1. Data not included in the table show that on day 3, the carbohydrate levels in +/+ flies begins to increase, while those of $+/adp^{fs}$ and adp^{fs}/adp^{fs} flies begin to decrease.

The abdomens of newly emerged female Drosophila contain two different types of adipose tissue: larval fat body which is present during larval and pupal stages and the first 2 days of adult life, and the adult fat body, which arises during metamorphosis. After eclosion, the adult fat body increases in volume through the accumulation of large deposits of glycogen, while the larval fat body degenerates and usually disappears by the third day of adult life (Butterworth and King, 1964 DIS 39:82). Since the differences between +/+ and adp^{fs} flies become apparent at the same time as the switchover from larval to adult fat body, one of the defects associated with the adp^{fs} mutant might be the inability of the adult fat body to synthesize and/or store carbohydrates, causing instead, the accumulation of lipids characteristically seen in these mutants.

In adp^{60}, a semifertile allele of adp^{fs}, Doane (1963 DIS 37:73) found that at 8 days after eclosion, adp^{60}/adp^{60} females contained significantly lower amounts of carbohydrate than +/+ flies. However, several differences between adp^{60} and adp^{fs} should be noted:

1) carbohydrate values for 7 day adp^{fs}/adp^{fs} females are much lower than those of 8 day adp^{60}/adp^{60} flies;

2) in 7 day $adp^{fs}/+$ flies, the carbohydrate values are in the same range as adp^{fs}/adp^{fs}, while 8 day $adp^{60}/+$ values are essentially the same as +/+;

3) 8 day adp^{60}/adp^{60} females contain approximately the same amount of carbohydrate as newly emerged +/+ flies, while 7 day adp^{fs}/adp^{fs} values are much lower than newly emerged +/+ flies. Perhaps the causes of some of these differences can be explained by analysis of the amounts of specific carbohydrates in whole flies and selected organs such as ovaries.

Sobels, F.H. University of Leiden, The Netherlands. A study on the possible effect of the gene segregation distorter, SD 72, on the radio-sensitivity of sperm and spermatids in Drosophila melanogaster.

Late Drosophila spermatids are characterized by considerably lower radiosensitivity, with regard to the induction of recessive lethals or translocations, than mature spermatozoa. Earlier studies with X-irradiation in air, O_2 or N_2 (Sobels, Mutation Res. 8:111, 1969) showed that the lower radiosensitivity of late spermatids in comparison to that of spermatozoa originates from a lower degree of oxygenation, and this conclusion was further strengthened by results obtained with fast neutron irradiation (Sobels and Broerse, Mutation Res. 9:395, 1970). It was considered of interest to determine whether genotypic differences in intracellular oxygen tension would be reflected in changes of radiosensitivity. A strain carrying the gene segregation distorter was chosen to study this problem. Recent observations with the electron microscope by both Takahashi and Peacock (unpubl.) and Nicoletti (Atti. Ass. Genet. Ital. 13:1, 1968) have shown that in strains carrying the gene segregation distorter, SD, about half the cells (i.e. those carrying the SD^+ allele) contained within a cyst of late spermatids become pycnotic and decay away. It did not seem altogether improbable that the processes involved in the breakdown of the SD^+ cells require oxygen, and that consequently the intracellular oxygen tension within the remaining spermatids carrying the SD allele is possibly reduced with a concommitant effect on their radiosensitivity.

The SD 72 strain was selected for this study because of its high K value. As control, a Tokyo wild type strain was used. Every generation, both the SD and Tokyo strains were outbred to the same cn bw strain. Because this procedure had been continued for a great number of generations the two strains were, except for the SD gene, otherwise considered to be isogenic. One-day-old males of both strains were exposed to 2000 R X-rays. Mature spermatozoa were sampled by leaving the irradiated males individually with 1 female during one night, following the day of irradiation (brood A). To sample spermatids, the males were mated to 3 females per male for 1 (brood B), 2 (brood C) and 2 (brood D) days, respectively. Since the morphological manifestation of the SD gene is restricted to a late stage of spermatid development, it was thought that this sampling procedure would bring out the effect, if any.

Table 1. The frequencies of sex-linked recessive lethals, as induced by an exposure of 2000 R X-rays in sperm and spermatids of a segregation distorter (SD 72) and an isogenic wild (Tokyo) strain; pooled data of 3 replica experiments.

	Broods* - Days after treatment							
	A 0 - 1		B 1 - 2		C 2 - 4		D 4 - 6	
	N chr.	% l	N chr.	% l	N chr.	% l	N chr.	% l
SD 72/cn bw	1691	6.03	2236	4.96	1998	5.06	1418	8.25
Tokyo/cn bw	1622	6.04	2231	4.84	1818	4.40	967	7.65

* For brood A the males were mated individually to one female during one night only. For brood B, C and D the males were mated to 3 females per male, during 1, 2 and 2 days, respectively.

In two experiments tests for recessive sex-linked lethals were carried out by means of the Basc method. No differences in mutation frequencies in the successive broods were observed between the two strains. A third experiment was then carried out in which the irradiated males were mated to Inscy;bw;st p^p females; F_1 females heterozygous for the SD, or Tokyo chromosome could then be recognized and used for further testing. The induced mutation frequencies in the two different strains were not, however, different. Since there was not significant heterogeneity between experiments, the data were pooled, as they are shown in Table 1. It can be seen that the effect of the SD gene on spermatids carrying the homologous chromosome is not parallelled by a change in sensitivity to the mutagenic action of X-irradiation.

The two strains used were kindly placed at my disposal by Dr. J. Peacock. The investigation was carried out within the framework of the Association between Euratom and the University of Leiden, contract 052-64 I BIAN. It also received support from the J.A. Cohen Institute for Radiopathology and Radiation Protection and the Health Organization TNO.

Willis, D.E. and C.P. Wright, Western Carolina University, Cullowhee, North Carolina. A histological study of glufultyrless-1, 1(1)EN7, a lethal mutant of Drosophila melanogaster.

Glufultyrless-1, 1(1)EN7, is a sex-linked, lethal mutant of Drosophila melanogaster which was X-ray induced by Novitski (1963). Death in this mutant usually occurs in the pupal stage. A histological study of 1(1)EN7 larvae was made in an attempt to determine the developmental breakdowns which lead to death.

Larvae for the study were fixed in Bouin's fluid and imbedded in paraffin. All larvae were cut into 12μ serial sections. The sections were stained with Harris' Hematoxylin and counterstained with 5% eosin. Both transverse and longitudinal sections were made. Sections of control larvae were made at 48, 72, and 96 hours after oviposition. Sections of 1(1)EN7 larvae were made at 48, 72, 96, 144, 168, and 192 hours after oviposition. The sections of older 1(1)EN7 larvae were made because puparium formation in the mutant occurred much later than in the control. The average age at puparium formation in 1(1)EN7 was 195 hours after oviposition whereas in the control it was 110 hours.

Prior to the time at which puparium formation would normally occur the only observable histological abnormality in 1(1)EN7 larvae related to the structure of the pharyngeal muscles. In the control (Fig. 1) the pharyngeal muscles were oriented more or less longitudinally

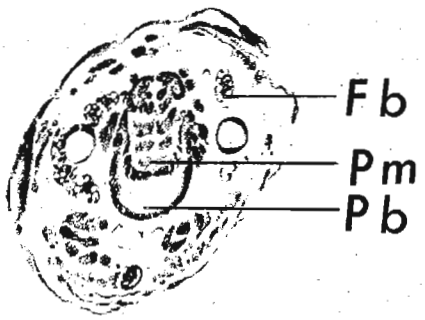


Fig. 1. Cross section through pharyngeal region of a 96 hour control larva. Fb, fat body; Pb, pharyngeal bars; Pm, pharyngeal muscles.

Fig. 2. Cross section through pharyngeal region of a 96 hour 1(1)EN7 larva. Fb, fat body; Pc, pharyngeal cavity; Pm, pharyngeal muscles.

within the larval body. In 1(1)EN7 larvae (Fig. 2) the pharyngeal muscles appeared to be oriented dorso-ventrally. After the age at which puparium formation would normally occur the pharyngeal muscle abnormalities were still evident in the 1(1)EN7 larvae. Other abnormalities also became evident. As the mutant larvae aged, their fat bodies became more and more broken apart and diffuse. These old 1(1)EN7 larvae appeared to be extremely fragile as evidenced by the fact that sections of the larvae tended to break up badly during preparation.

Perhaps the observed histological abnormalities relate to the developmental breakdowns which cause death in this mutant. It is known that in normal larvae the pharyngeal muscles aid in the ingestion of food materials by contracting and exerting a suction force in the pharynx which pulls food into the digestive tract (Snodgrass, 1935). In 1(1)EN7 perhaps the abnormal pharyngeal muscles cause breakdowns in the digestive process. The observed fat body abnormalities might cause changes in the process of metamorphosis which eventually lead to death.

References: Novitski, E. 1963, List of biochemical mutants. DIS 37:51-53. Snodgrass, R.E. 1935, Principles of Insect Morphology. McGraw-Hill, New York.

Kuroda, Y. National Institute of Genetics Misima, Japan. Differentiation of pupal testis of D. melanogaster in culture.

Testes were obtained from 48-hour pupae of the Oregon-R strain of D. melanogaster and cultured by the procedure described previously (1,2).

Testes aseptically obtained from pupae which were grown under sterile conditions were cut into several fragments in Drosophila saline solution. They were filled with germ cells in various stages of maturation. The anterior apical fragments of testis contained spermatogonia (Fig. 1), about 5 u in diameter. The middle fragments contained germ cells at more advanced

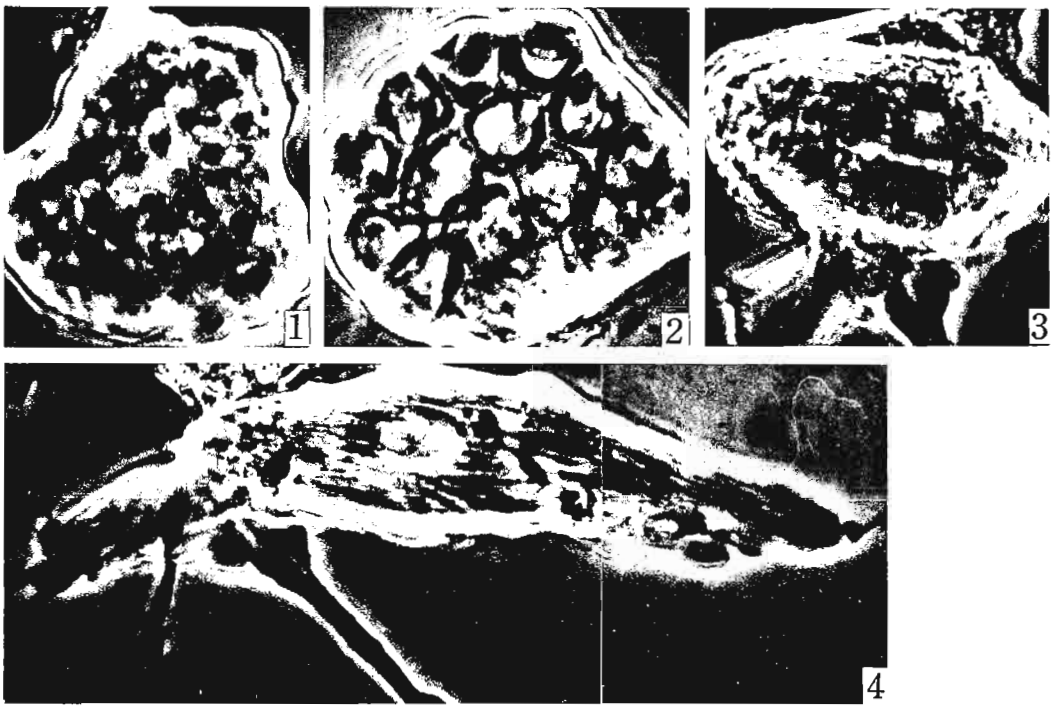


Fig. 1. An anterior fragment of pupal testis, which contained spermatogonia. Phase. x 600. Fig. 2. A middle fragment of pupal testis, which contained spermatocytes or spermatids. Phase. x 600. Fig. 3. A posterior fragment of pupal testis, which contained sperm bundles. Phase. x 600. Fig. 4. The same fragment as Fig. 3 after 24 hours of cultivation. Phase. x 600.

stages of spermatogenesis: spermatocytes and spermatids, about 15 - 20 u in diameter (Fig. 2). In the posterior fragments the sperm at early stages of spermiogenesis were found (Fig. 3).

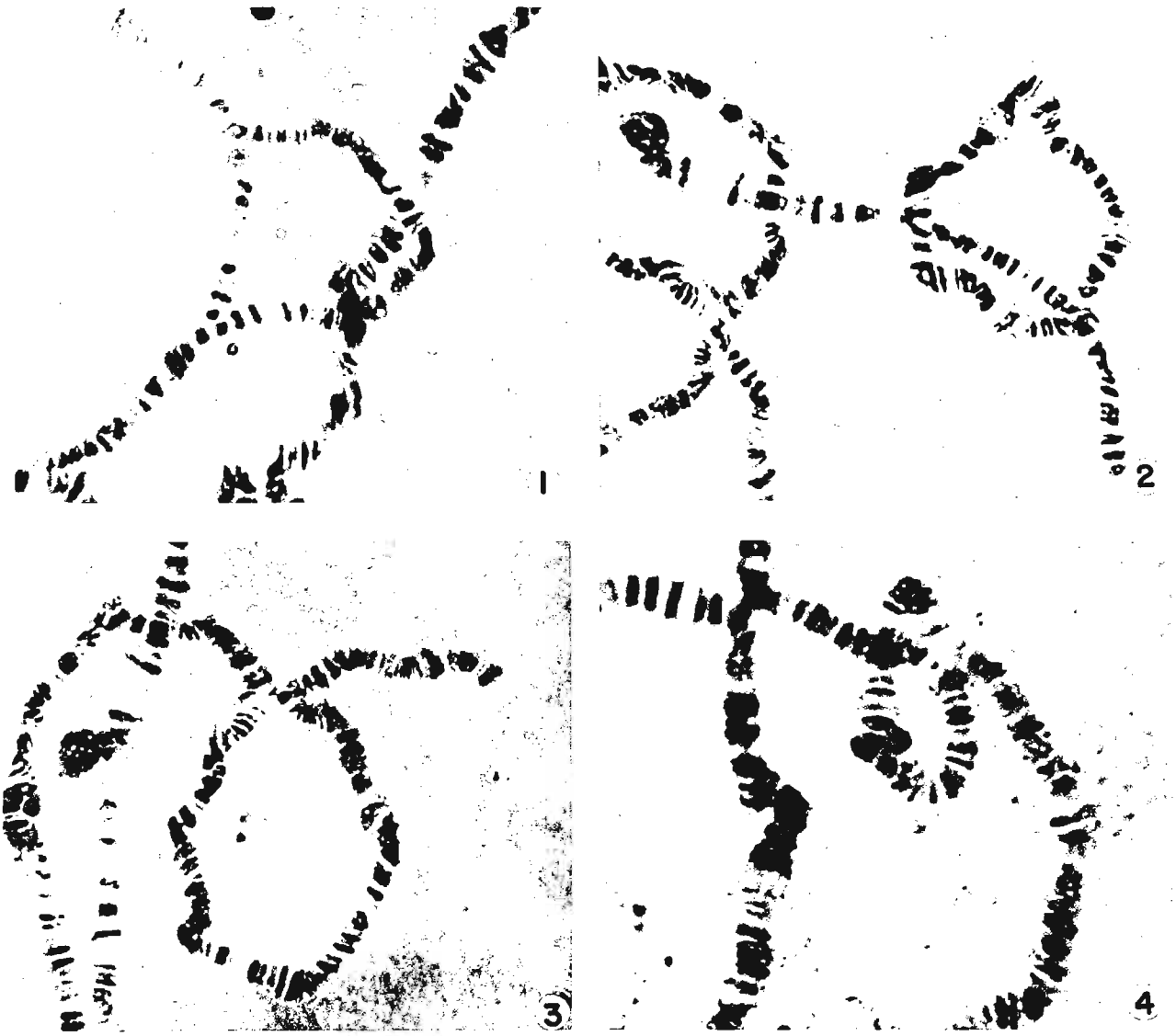
These fragments of testes were cultured at 28°C in T-5 flasks with 0.8 ml of Medium K-17, which was slightly modified from Medium K-6' (1,3) and supplemented with 0.1 mg/ml fetuin, 5 mg/ml peptone and 15% fetal bovine serum.

After 24 hours of cultivation, no or slight detectable changes were found in the anterior or middle fragments which contained spermatogonia, spermatocytes or spermatids, although these cells increased slightly in size and testicular sheath cells grew and extended on the glass surface of the culture flasks. On the other hand, the sperms in the posterior fragments expanded markedly towards both ends along the long axis of the sperm bundles (Fig. 4), indicating that they attained to more advanced stage of spermiogenesis. This result indicates that under culture conditions employed, the process of spermiogenesis would be traced under a phase microscope, whereas it is relatively difficult to examine the early process of spermatogenesis.

References: 1. Kuroda, Y. 1969 Japan. J. Genetics 44 Suppl. 1:42; 2. Kuroda, Y., Proc. III Internat. Colloq. Invertebrate Tissue Culture (in press); 3. Kuroda, Y. 1970 Exp. Cell Res. 59:429.

Nirmala Sajjan, S. and N.B. Krishnamurthy
University of Mysore, Manasagangotri, India. Chromosomal polymorphism in Drosophila neonasuta.

Drosophila neonasuta which exists sympatrically with D. nasuta, is less polymorphic than the latter with regard to gene arrangements. The population studies of D. neonasuta from five different places (Mysore, Channapatna, Chitradurga, Krishnarajasagar and Chikmagalur) have revealed one duplication (Fig. 1), 3 inversions (Figs. 2, 3 and 4) and one translocation (Fig. 5). The distribution and the frequencies of these gene arrangements are shown in the



Chromosome polymorphism in Drosophila neonasuta: Fig. 1. Duplication in Chromosome 3; Fig. 2. Inversion 2LA; Fig. 3. Inversion 2RA; Fig. 4. Inversion 3A.

Tables 1 and 2. The heterozygous duplication of the order of about 18 bands in the third chromosome is found in Bababudangiri population. As it is found only once, it is difficult to attribute any evolutionary significance. The three inversions, 2LA, 2RA and 3A are of paracentric type. 2LA and 2RA are found in all populations studied and thus widespread in their occurrence, while the inversion 3A is found only in Channapatna and Mysore and thus limited in its distribution. Further the fact that 2LA and 2RA coexist more frequently than independently, suggests that the adaptive feature or the influence of this complex supercedes the in-

fluence of either inversions on carriers. Translocations are reported sporadically for a few species of Drosophila. A translocation for the first time in D. neonasuta is reported here. It is reciprocal heterozygous translocation involving the third chromosome and the right arm of the second chromosome and named as (2R-3)A. As it occurs in very low frequency of 1%, it is quite safe to say that it may not have any evolutionary significance.

Acknowledgements: The authors are highly indebted to Dr. M.R. Rajesekarasetty, Professor and Head of the Department of Zoology, University of Mysore, Manasagangotri, for his constant encouragement. The authors are also thankful to Sri Ramakrishna Raju for his help in the preparation of microphotographs. This work is financially supported by the Department of Atomic Energy, Government of India.

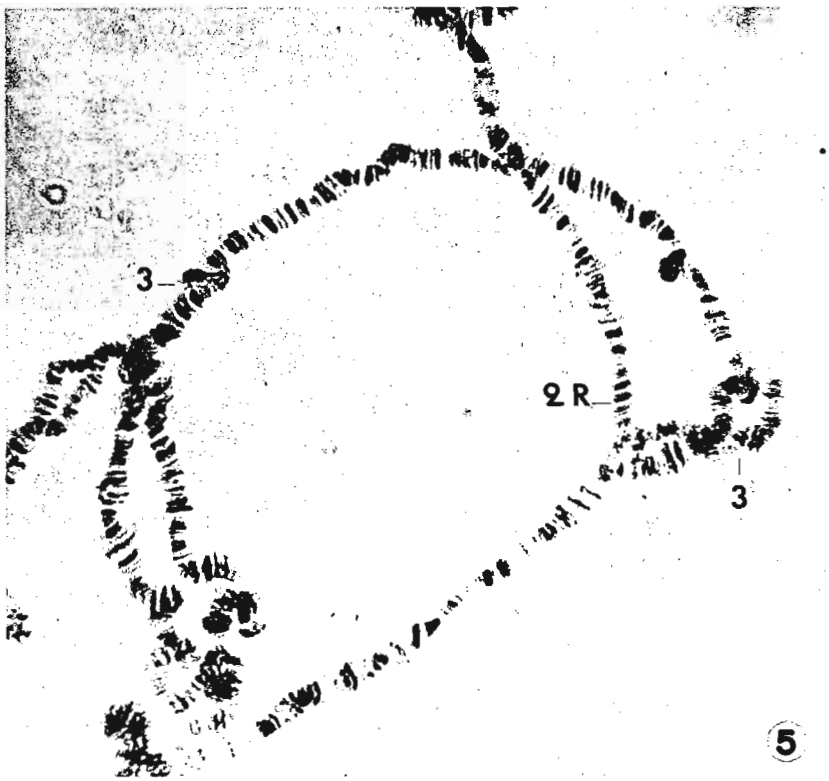


Fig. 5. Translocation (2R-3)A in D. neonasuta

Table 1. Percents of gene arrangements of D. neonasuta from five different populations of Mysore State

Population	Second chromosome		Third chromosome	Translocation	Duplication
	2LA	2RA	3A		
Chitradurga	67	67	-	-	-
Channapatna	23	23	24	-	-
Bababudangiri Hills	38	40	-	1 (2R-3)A	1
Krishnaraja sagar	20	21	-	-	-
Mysore	14	15	26	-	-

Table 2. Percents of single, double and multiple heterozygotes for gene arrangements in D. neonasuta

Population	2LA	2RA	3A	2LA & 2RA	2LA,2RA & 3A	Translocation	Duplication
Chitradurga	8	8	-	59	-	-	-
Channapatna	-	-	22	21	2	-	-
Bababudangiri Hills	1	3	-	37	-	1	1
Krishnaraja sagar	-	2	-	40	-	-	-
Mysore	-	1	15	3	11	-	-

Ehrman, L.*, S. Koref-Santibañez** and C.T. Falk*** Rockefeller University and New York Blood Center, New York. Frequency dependent mating in two species of the mesophragmatica species groups of Drosophila.

In order to extend our information on frequency-dependent mating to additional species of Drosophila, three strains from two species of the mesophragmatica group (Brncic and Koref-Santibañez 1957) were studied: D. pavani, a wild type strain, and D. gaucha, a wild type and a yellow-bodied strain (bearing a sex-linked recessive mutant derived from the wild type strain).

In Elens-Wattiaux (1964) direct observation chambers we tested for frequency-dependent mating success in this heretofore uninspected material. The technique has been described fully (Ehrman 1965, 1968), and all the results are presented below. In Table 1, "Early matings" refers to the first half of the observed matings, and "I" is an isolation index which ranges from -1 (strong preferences for heterogamic matings), through zero (random mating), to +1 (strong preferences for homogamic matings, sexual isolation).

When the two wild types are considered, D. pavani ♂♂ have a mating advantage when they are rare, and D. gaucha ♀♀ mate before D. pavani ♀♀ do. Note that D. gaucha ♂♂ do ostensibly better as competitors when they are rare than when there is no rare type.

When D. pavani ♂♂ compete with the yellow mutant of D. gaucha, they outperform the mutant in all situations.

When the two D. gaucha types are compared, the wild type of both sexes is more successful. The only time yellow ♂♂ are capable of engaging in essentially random mating, occurs when yellow is rare. When wild type D. gaucha is rare, it possesses an even greater mating advantage than it does when all flies are present in equal numbers.

These data can also be analyzed according to the recommendations of Ayala (1971); this involves the calculation of the regression of the logarithm of the ratios of the mated individuals on the logarithm of the ratios in which the individuals are present. For all male matings, the values are the following:

Comparison	Equation	s.e. of slope	t (1d.f.)
D. pavani x D. gaucha (wild)	Y = 0.11 + 0.67X	0.013	25.84
D. pavani x D. gaucha (yellow)	Y = 0.69 + 0.82X	0.092	1.93
D. gaucha (wild) x D. gaucha (yellow)	Y = 0.40 + 0.40X	0.217	2.77

The only significant t value occurs in the comparison of the two wild type males. As Ayala points out, when only three frequencies are tested, a demonstration of statistical significance is difficult. For example, Table 1 also shows evidence of a rare male advantage when the two D. gaucha ♂♂ are compared, whereas Ayala's method gives a nonsignificant t of 2.77.

The Levene isolation indices indicate the total absence of sexual isolation between these two sibling species (and between the two D. gaucha forms). Although there is a total hybrid sterility, previous studies have not shown any sexual isolation between these two species either (Koref-Santibañez and del Solar 1961).

References: Ayala, F., 1971 Behavior Genetics 2:in press; Brncic, D. and S. Koref-Santibañez, 1957 Evolution 11:300-310; Ehrman, L., 1965 Evolution 19:459-464; Ehrman, L., 1968 In Animal Behavior in Laboratory and Field, A.W. Stokes, Ed., Wm. Freeman Co., San Francisco 85-87; Elens, A.A. and J.M. Wattiaux, 1964 DIS 39:118-119; Koref-Santibañez, S. and E. del Solar, 1961 Evolution 15:401-406.

Lee Ehrman is the recipient of U.S.P.H.S. Research Career Award 2KO3 HD 09033-07; Susi Koref-Santibañez acknowledges a J.S. Guggenheim Fellowship and the hospitality of Professor Th. Dobzhansky and the Rockefeller University; Catherine T. Falk is supported by NIH Grant HE 09011.

* Present address for Dr. Ehrman is Division of Natural Sciences, State University of New York at Purchase, Purchase, N.Y. 10577.

** Present address for Dr. Koref-Santibañez is Departmento de Genetica, Facultad de Medicina, Universidad de Chile, Zañartu 1042, Santiago, Chile.

*** Present address for Dr. Falk is New York Blood Center, 310 E. 67th St., New York, N.Y. 10021.

(Table 1 on next page)

Table 1

Matings observed between different proportions of D. pavani (wild type) and D. gaucha (wild type or yellow) flies per observation chamber. 1 = significant at the 1% level. 5 = significant at the 5% level.

			(All Matings)						(Early Matings)					
			Males			Females			Males			Females		
	Runs													
D. pavani + : D. gaucha +			p	g	X^2_1	p	g	X^2_1	p	g	X^2_1	p	g	X^2_1
1.	12 : 12*	6	66	50	2.21	53	63	0.86	35	24	2.05	12	47	20.76^1
2.	20 : 5	5	84	26	0.91_1	93	17	1.42_5	45	12	0.04	48	9	0.63_1
3.	5 : 20	5	36	71	12.45^1	11	96	6.32^5	14	41	1.02	2	53	9.21^1
D. pavani + : D. gaucha y			p	y	X^2_1	p	y	X^2_1	p	y	X^2_1	p	y	X^2_1
4.	12 : 12**	8	94	22	44.69^1_1	55	61	0.31	55	5	41.66^1_1	32	28	0.27_1
5.	20 : 5	6	100	6	13.62^1_1	78	28	2.73	52	3	7.27^1_1	34	21	11.36^1
6.	5 : 20	7	63	37	115.56^1	21	79	0.06	30	21	48.04^1	11	40	0.08
D. gaucha + : D. gaucha y			g	y	X^2_1	g	y	X^2_1	g	y	X^2_1	g	y	X^2_1
7.	12 : 12***	8	67	38	8.01^1	58	47	1.15	34	19	4.25^5	33	20	3.19
8.	20 : 5	5	93	18	0.99_1	91	20	0.27	46	11	0.02_1	51	6	3.20_5
9.	5 : 20	7	63	37	115.56^1	26	74	2.25	35	18	70.21^1	18	35	6.46^5

* = I = +0.15 ± 0.09 ** = I = -0.02 ± 0.09 *** = I = +0.06 ± 0.10

Siddaveere Gowda, L. and N.B. Krishnamurthy
University of Mysore, Manasagangotri, India.

Report on Drosophila species in Charmadi Ghats (Mysore State, India).

Charmadi ghats, a part of the Western ghats, are situated at a distance of 125 miles northwest of Mysore. This hilly terrain is drenched with rain during the months of July through October. The whole area is packed with thick vegetation and human inhabitation is sparse and confined to a few areas. Collections were made in September 1971 when the average rainfall calculated was 18.25 inches. The flies were trapped in the midst of rain using icecream cups as protective felts fastened over the 1/4 pint milk bottles to prevent the entry of rain water. Nine different altitudes ranging from 300 to 1025 meters were chosen as collection spots. A Minimum of ten bottles containing fermented banana as bait, were tied in each collection spot. Net sweeping was also employed.

The number and species of Drosophila collected in the above expedition are all listed in the Table 1. A total of 1478 flies were trapped. Of these, D. nasuta and D. neonasuta of the

Table 1. A list of Drosophila species of Charmadi ghats.

		Altitude in Meters								
	Species	1025	1000	900	900	800	700	600	500	400	300
	nasuta	68	24	-	58	74	34	90	-	50	30
	neonasuta	218	14	22	54	70	36	118	20	64	20
	mysorensis	10	8	-	40	30	6	6	10	-	-
**	neotruncata	26	4	-	22	14	-	2	-	-	-
	varietas	2	-	-	-	-	-	-	-	-	-
	nigra	-	2	-	-	-	-	-	7	-	2
	jambulina	-	-	-	-	12	-	-	-	-	-
	brindavani	-	-	-	-	-	-	2	-	-	-
	immigrans	44	8	1	-	-	-	-	-	-	-
	takahashii	-	-	-	-	-	-	-	-	4	-
	melarkotliana	-	-	-	-	-	-	-	-	-	20
	gracilis	8	-	3	2	-	-	3	-	-	-
	pseudoananassae	2	-	-	-	6	-	-	-	-	-
*	mundagensis	2	-	-	-	-	-	-	5	-	-
	charmadensis	-	-	-	4	-	-	1	-	8	6

* A new species (Nirmala Sajjan, S. and N.B. Krishnamurthy, unpublished)
** A new species (Sreerama Reddy, G. and N.B. Krishnamurthy, unpublished)

nasuta subgroup represent the dominant species as shown by their abundance and contribute nearly to 50% of the total flies scored at each spot. At 1025 meters the members of nasuta subgroup are more abundant than at other altitudes. Further in terms of both number of species and density, this altitude is superior. D. pseudoananassae, a member of the bipectinata complex (Bock 1970), is for the first time reported here from India. One more interesting feature in this report is the finding of a new species of Drosophila. This new species is bright yellow in colour with black margin along the posterior part of each tergite. Males have tarsal ornamentation in that there are two sets - one the proximal set with 22 teeth and the distal one with 14 to 15 teeth. Acrostichals are regular in 6 rows. In several respects it is similar to D. montium except for the difference in number of teeth in sex combs and shape of the male novasternum. Based on these features (Okada personal communication, 1971) the above species has been given the status of a new species and named after the collection locality as Drosophila charmadensis. Detailed description of this species will appear elsewhere.

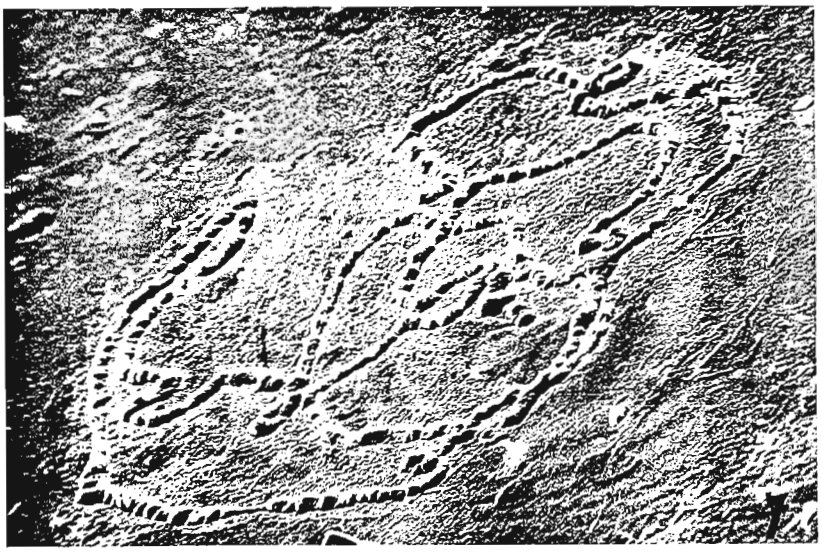
Acknowledgements: The authors are highly thankful to Dr. M.R. Rajasekarasetty, Professor and Head of the Department of Zoology, University of Mysore, for his help and encouragement. One of us (L. Siddaveere Gowda) is thankful to the University of Mysore for the financial assistance.

References: Bock, I.R. 1971 Univ. Tex. Publ. 7103:273-280.

Scheid, W., H. Traut and M. Pfautsch.
University of Münster, Institute for Radiation Biology and Institute for Medical Physics, Münster, Germany. Visualization by scanning electron microscopy of giant chromosomes of D. melanogaster.

With the technique of scanning electron microscopy pictures of three-dimensional appearance of biological and other specimens can be obtained. In the following study the scanning electron microscope "Stereoscan" of the Cambridge Instrument Co. Ltd. was used. Recently the application of this technique has given some insight into the nature of achromatic lesions ("gaps") induced by X-rays in chromosomes of Vicia faba[1].

The methods used in our scanning electron microscopical studies on giant chromosomes of D. melanogaster seem to be open to improvement. Nevertheless two of the microphotographs so far obtained are demonstrated in this preliminary communication (Figs. 1 and 2).



The salivary glands (Berlin wild) were dissected in a solution consisting of 0.09 M KCl, 0.06 M NaCl and 0.005 M phosphate buffer (pH 7.0)[2] and were then torn to several pieces with the aid of two forceps. After adding immediately a drop of 48% acetic acid and applying a cover slip, the preparation was pressed with the thumb. The next steps: removal of the cover slip by the dry ice technique, 2 x 10 min alcohol absolute, drying in vacuum, mounting in orcein, selection of suitable chromosomes by light microscope, removal of the cover slip by alcohol, hydration to water, keeping the slides for 3 h in distilled water. We then tried to remove residual cytoplasm covering the chromosomes by enzymatic digestion (trypsin) as described elsewhere[3]. Further steps: 5 min 0.1 N acetic acid, 1 h water-methanol (1:1), 10 min distilled water, dehydration by alcohol, drying in vacuum. Areas of about 10 mm x 10 mm containing the selected chromosomes were cut out of the slide with a diamond and then overlaid with thin conducting layers of evaporated carbon, gold and again carbon. When making the scanning electron microscopical photographs the chromosomes were tilted to an angle of 66° from the normal plane to the direction of observation.

References: (1) Scheid, W. and H. Traut 1971 Mutation Res. 11:253-255; (2) D'Angelo, E.G. 1946 Biol. Bull. 90: 71-87; (3) Pawlowitzki, I.H., R. Blaschke and R. Christenhuss 1968 Naturwissenschaften 55:63-64.

Mather, W.B. and P. Thongmeearkom.
University of Queensland, Brisbane, Australia. Inversion polymorphism in D. sulfurigaster albostrigata.

In January, 1971, fifty-six iso-lines were established from a collection from Cebu, Philippines. The salivary chromosomes of approximately ten larvae from each line were examined and 11 simple and 5 complex inversions detected. (Table I and Fig. 1 - 2)

It will be noted that inversion heterozygosity is very marked. Only four flies were free of heterozygous inversions. It will also be noted that the heterozygosity is concentrated in chromosome III, particularly at the proximal end, and that some inversions are much more frequently heterozygous than others.

(The material was collected and maintained and the larvae reared for dissection by W.B.M. The chromosomes were prepared, analysed and photographed by P.T.)

Inversion	Type	Position	Heterozygosity frequency %
A	Sim.	III P	3.6
B	Sim.	III P	17.9
C	Sim.	III D	35.7
D	Sim.	III D	7.1
E	Sim.	IIL C	41.1
F	Com.	III P	3.6
G	Sim.	I P	23.2
H	Com.	III P	5.4
I	Sim.	III P	12.5
J	Com.	III C	1.8
K	Sim.	III D	1.8
L	Sim.	III P	10.7
M	Com.	III P	3.6
N	Sim.	III P	5.4
O	Com.	III P	1.8
P	Sim.	III P	3.6

Note: Sim.=simple; Com.=complex; D=distal; C=central & P=proximal to centromere.

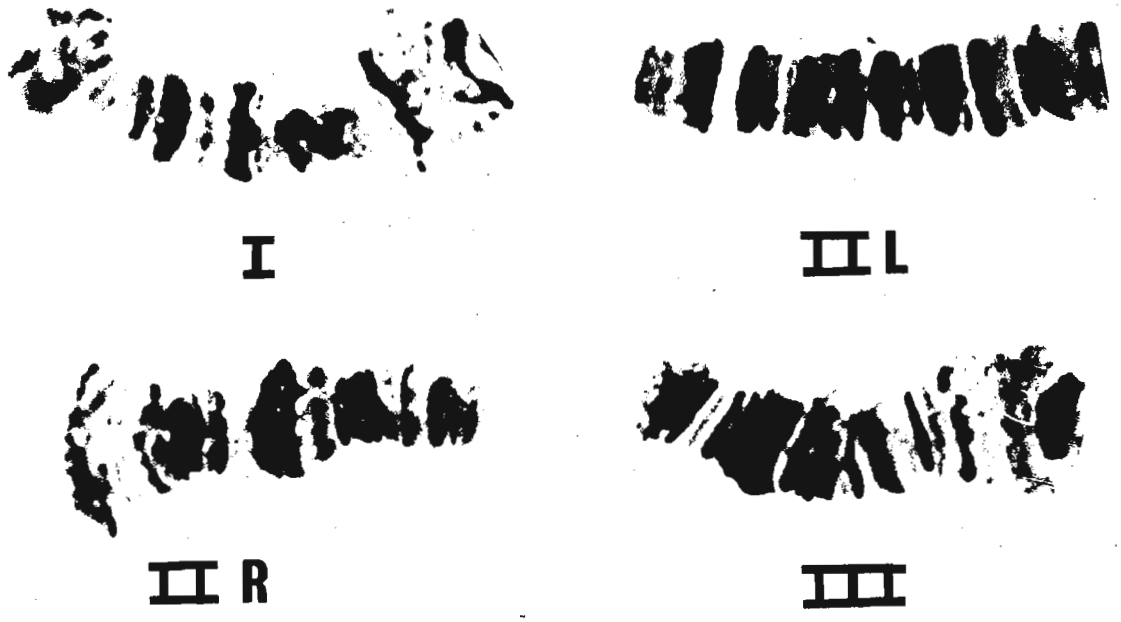


Figure 1. Chromosome ends. The free ends are to the left.

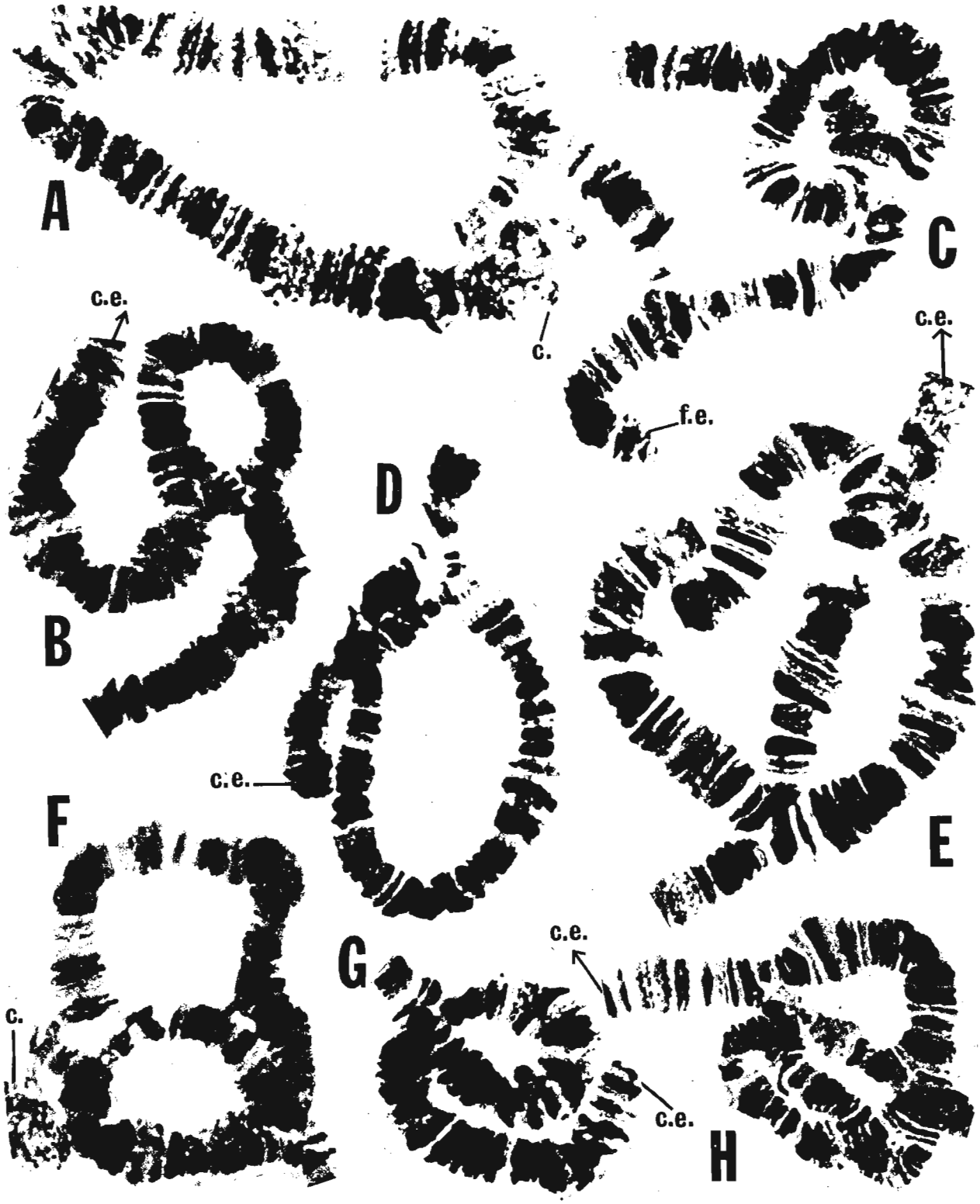


Figure 2. See legend next page.

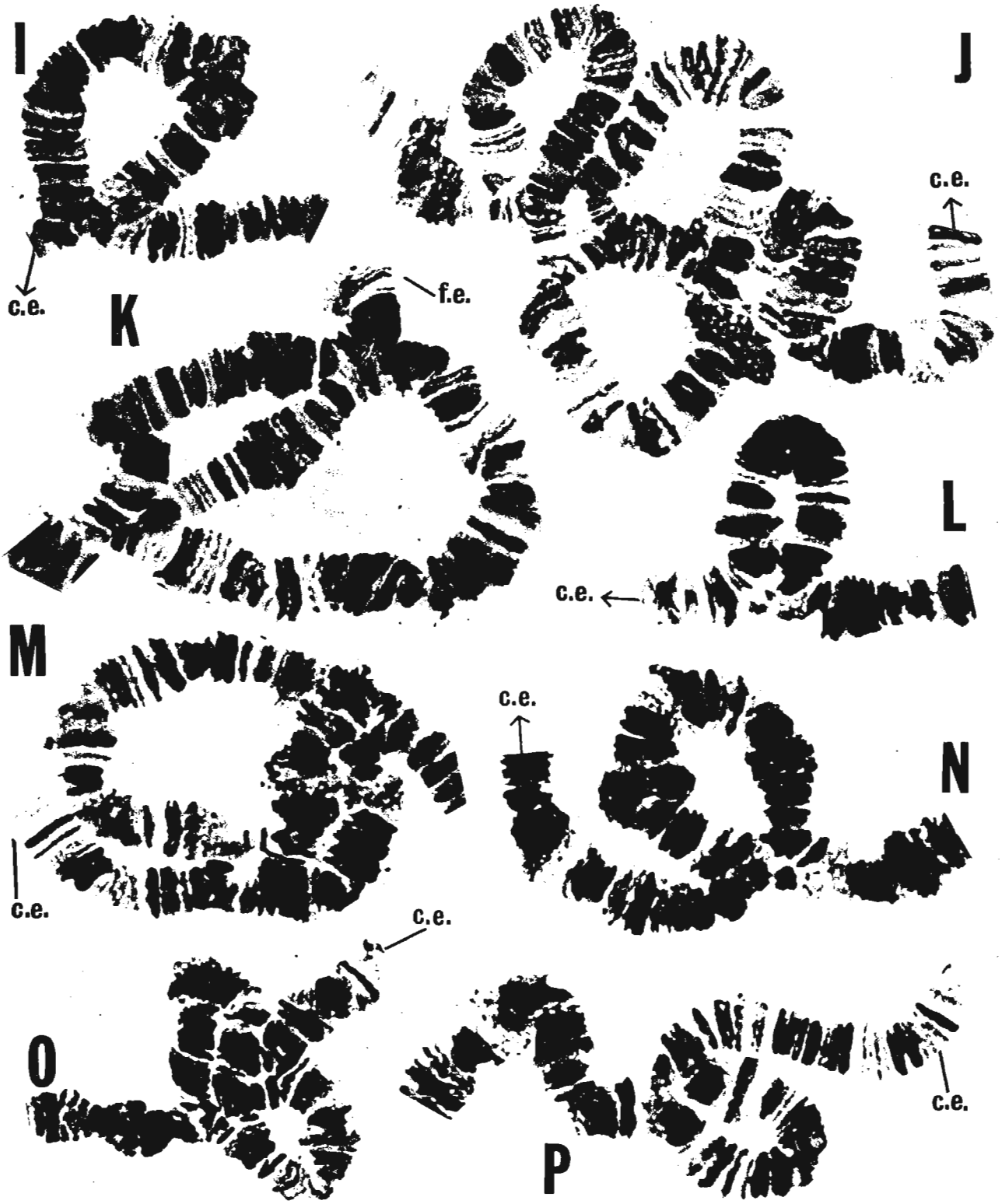


Figure 2. (Cont.) Inversions. c, chromocentre; c.e., centromere end; f.e., free end. Arrows point toward centromere ends.

Mukai, T. and O. Yamaguchi North Carolina State University, Raleigh, North Carolina.

Effects of inversions on viabilities in a local population of D. melanogaster.

It has been reported that the frequency of inversion-carrying chromosomes in natural populations, which are presumably near equilibrium, is fairly high (e.g. Oshima, Watanabe and Watanabe 1964; Watanabe 1967). The effects of these inversions on viabilities of individuals were examined, using experimental materials obtained from a Raleigh, North Carolina, population.

Six hundred ninety-one second chromosomes were extracted in the summer of 1970 and their salivary gland chromosomes were examined. One hundred and thirty chromosomes were shown to carry inversions, among which there were two polymorphic inversions (40 In(2L)Cy and 66 In (2R)NS). The homozygous viabilities of these chromosome lines and the viabilities of heterozygotes constructed by random combinations of these chromosome lines were estimated by the Cy method (cf. Wallace 1956). The experiment was conducted at 9 different times. The viabilities were standardized by the average heterozygote viabilities of their respective replications. The main conclusions were as follows:

1. The frequency of lethal-carrying chromosomes (Q) is much higher in the inversion-carrying chromosomes than in the inversion-free chromosomes ($\hat{Q}$= 0.54 vs. 0.37, $\chi^2_{df.=1}$ = 13.19 $P < 0.0005$).

2. Among the lethal-free chromosomes, the average homozygous viability of inversion-carrying chromosomes does not differ significantly from that of inversion-free chromosomes [Inversion-carrying chromosomes: 0.7253 ± 0.0296 (N=60); Inversion-free chromosomes: 0.7159 ± 0.0117 (N=356) where N is the number of chromosome lines].

3. The average viabilities and genotypic variance among random heterozygotes are shown in the following table:

	N	Average viability	Genotypic variance
All heterozygotes	688	1.0000 ± 0.0038	0.005691 ± 0.000546
Inversion-free heterozygotes	458	0.9957 ± 0.0047	0.005847 ± 0.000674
Inversion heterozygotes	230	1.0083 ± 0.0064	0.005294 ± 0.000921

The average viability of inversion heterozygotes is slightly higher than that of inversion-free heterozygotes but not significantly so ($t = 1.59$, $P > 0.05$). No significant difference was found in genotyic variance between inversion-carrying and inversion-free heterozygotes.

4. The average viability of lethal heterozygotes was estimated as follows:

	N	Inversion-carrying	N	Inversion-free
Normal/Normal′	68	1.0118 ± 0.0115 (1.0000 ± 0.0114)*	173	1.0124 ± 0.0076 (1.0000 ± 0.0075)
Normal/Lethal	118	1.0059 ± 0.0090 (0.9941 ± 0.0089)	232	0.9865 ± 0.0065 (0.9744 ± 0.0065)
Lethal/Lethal′	44	1.0098 ± 0.0151 (0.9980 ± 0.0149)	53	0.9821 ± 0.0116 (0.9701 ± 0.0115)

* The figures in parentheses are the standardized values.

The average degrees of dominance on a locus basis are 0.003 in the inversion-carrying individuals and 0.018 in the inversion-free individuals. The latter is significantly larger than 0. (Supported by PHS grants GM-11546 and FR-00011).

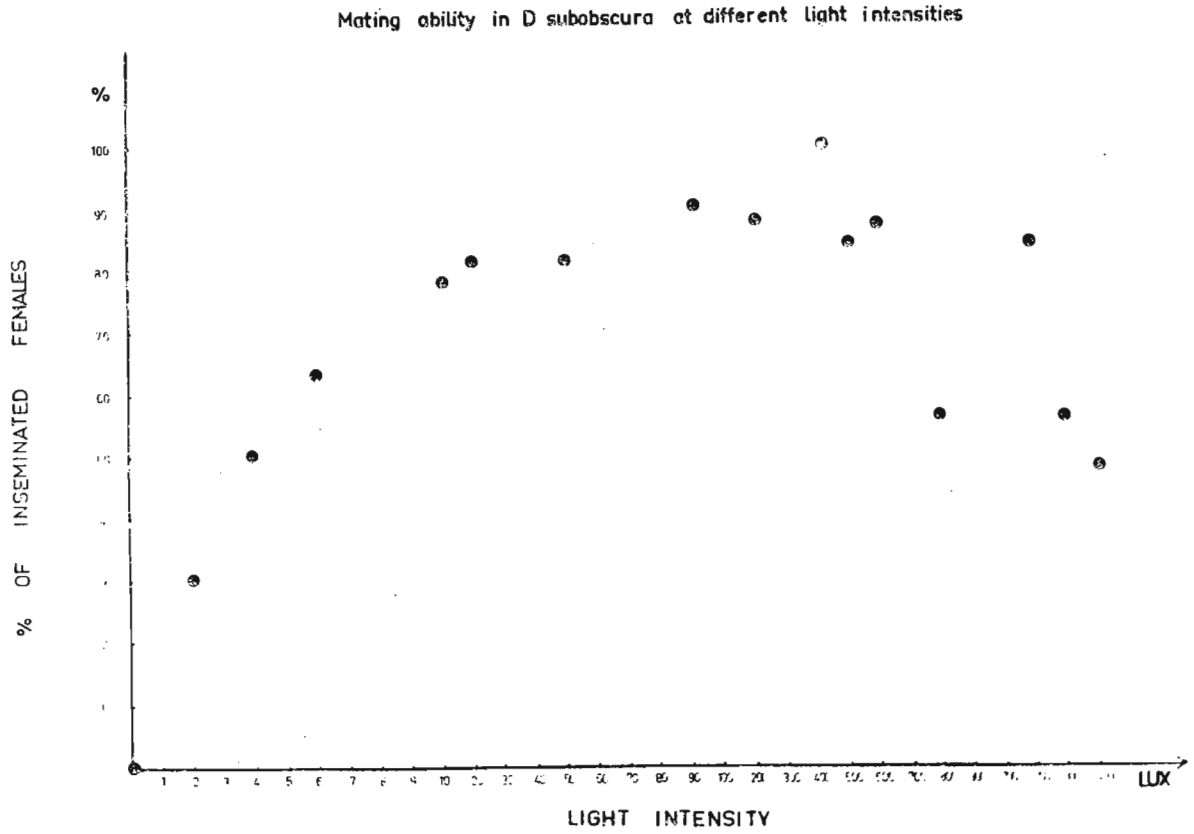
Merriam, J.R. and C. Duffy University of California, Los Angeles, California.

First Multiple seven: now contains sn^{x2} for better balancing.

The construction of FM7 containing lz^{sp} has been previously described (DIS 44:101). Because males bearing this chromosome have poor viability, it is not useful for balancing sex linked lethals. We have subsequently replaced lz^{sp} with sn^{x2} as the female sterilizing mutant and males bearing the new FM7 chromosome are normally viable. The FM7 chromosome now contains the markers y^{31d}, sc^8, w^a, sn^{x2}, v, and B. We maintain it in two ways, over the y f attached-X and in females against un Bx^2, and will be glad to send cultures on request.

Marinković, D. and M. Andjelković Institute for Biological Research, Belgrade, Yugoslavia. Reproductive ability of D. subobscura at different light intensities.

The males and females from F_1 progeny of wild flies collected at Fruska Gora (about 60 km. north of Belgrade) were separated using aspirators and kept for six days in the dark, in bottles with culture medium. On the seventh day groups of 5 males and 20 females were placed in new 150cc glass bottles with culture medium, and these bottles were exposed during 48 hours to one of different light intensities in the range of 0 - 4000 lux, at 20°C. After etherization of the flies, the females were dissected (a total of about 2000), and the proportion of those inseminated was determined. In this way, the reproductive ability of D. subobscura was measured simultaneously six times, at fifteen different light intensities.



The distribution of the frequencies obtained corresponds to a normal distribution, with a maximum proportion of inseminated females (ca. 90%) when the flies were exposed to a light intensity of 100 - 600 lux. At weaker light intensities, mating success was sharply lowered. At greater than 1000 lux the proportion of inseminated females decreased quite gradually, reaching a value of only 30% at 4000 lux.

When initiating this experiment, the help of Dr. O. Kitagawa was very valuable.

Literature: Elens, A.A. and J.M. Wattiaux 1970 DIS 45:110; Rendel, J.M. 1945 Jour. Genet. 46:287; Springer, R. 1964 DIS 39:118; Wallace, B. and Th. Dobzhansky 1946 P.N.A.S. 32:4.

Denell, R.E.* and R. Jackson. University of California, La Jolla, California. A genetic analysis of transformer-Dominant.

Gowen isolated a third-chromosomal dominant gene which causes genetic females to develop into intersexes, and denoted it Hermaphrodite (Hr). He was, of course, unable to map this mutant by recombination. However, Gowen and Fung (Heredity 11:397) found that genetic females who were heterozygous for Hr and the recessive third-

chromosomal sex-transforming gene transformer (tra) were more male-like than Hr/+. They concluded that Hr and tra are alleles, and Hr is listed in Lindsley and Grell (1968) as transformer-Dominant (tra^D). Hildreth (Genetics 51:659) has described a third-chromosomal gene, double-sex (dsx), which transforms both genetic females and males into intersexes. It now appears that Hr is an allele of dsx rather than of tra, on the basis of the following evidence: 1) X/X;dsx/Hr individuals are indistinguishable from normal males except for an increase in body size and abnormal testes. However, Hr completely complements the effect of dsx on males, and X/Y;dsx/Hr individuals are normal and fertile. 2) Hr-bearing genetic females with an interstitial duplication of 84D to 85E on the salivary gland chromosome map (which includes the locus of dsx) are phenotypically normal females, although they are sterile and lay no eggs. 3) Three revertants of Hr were induced by X-irradiation. When first isolated, they all failed to complement dsx. When they were examined sometime later, two stocks had been contaminated, and the reversion-bearing chromosomes lost. The remaining reversion-bearing chromosome still failed to complement dsx, and was normal in salivary gland chromosome preparations.

These data are all consistent with the conclusion that Hr is an allele of dsx. We, therefore, propose that it be renamed double-sex-Dominant (dsx^D).

* Present address: Institute of Animal Genetics, West Mains Rd., Edinburgh EH9 3JN, Scotland.

Denell, R.E.* University of California, La Jolla, California. Reversion studies of Nasobemia.

Nasobemia (Ns) is a homozygous viable, dominant gene in Drosophila melanogaster. Flies bearing Ns show, with varying degrees of expressivity, a homoeotic transformation of the antennal region into a mesothoracic leg (Gehring, Arch. Julius Klaus-Steft. XLI:44). Males homozygous for Ns were given 4000 r of X-rays, and five putative reversions of Ns were recovered from cells treated at post-meiotic stages. These were designated by the symbol Ns^{+R} followed by an identifying number. They were tested for homozygous viability, and subjected to salivary gland chromosome analysis, with the following results:

Line	Homozygous viable	Cytological characteristics
Ns^{+R11}	-	Normal
Ns^{+R25}	-	At least a 3 break rearrangement of the 3rd chromosome, with breaks in the proximal heterochromatin and at 84B12 and 85AC
Ns^{+R70}	+	Normal
Ns^{+R72}	-	Df(3R)84A;84D
Ns^{+R96}	-	A complex T(Y;3) inferred from genetic evidence, with breaks in the Y and at 84B1-2 and 94C

In addition, Ns^{+R70} is viable heterozygous with all other chromosomes. Any heterozygous combination of the other chromosomes is lethal.

Since Ns^{+R11}, Ns^{+R25}, Ns^{+R72}, and Ns^{+R96} share noncomplementary recessive lethals, it is strongly suggested that they represent events at the same locus, that is at Ns. Further, since all three revertants with rearrangements are associated with an event at 84B12, it is concluded that this region represents the position of Ns.

Ns and the various alleles of Antennapedia (Antp) have similar phenotypes, and are similarly placed on the recombinational map. Gehring found that flies heterozygous for Ns and $Antp^B$ were viable, with an enhanced transformation phenotype. However, since all Antp alleles are associated with rearrangements and share a common recessive lethal, he tentatively designated Ns as a separate gene. I crossed In(3R)$Antp^B$, $Antp^B$/In(3LR)TM1, Me ri sbd^1 ♀♀ x Ns^{+R11}/In(3LR)TM6, $Ubx^{6/e}$ e ♂♂, and recovered no $Antp^B/Ns^{+R11}$ flies among 281 progeny. Thus, the revertant of Ns fails to complement the recessive lethality of $Antp^B$, suggesting that Ns is another allele of Antp. It is, therefore, suggested that it be renamed Antennapedia-Nasobemia ($Antp^{Ns}$).

* Present address: Institute of Animal Genetics, West Mains Rd., Edinburgh EH9 3JN, Scotland.

Shannon, M.P. University of Texas, Austin Texas. Characterization and developmental analysis of the female-sterile mutant almondex of Drosophila melanogaster.

A combined genetic and embryological investigation (Shannon, 1972a, 1972b) indicates that the mutant almondex (amx) (1-27.7±) belongs to a small class of sex-linked recessive D. melanogaster mutants characterized by a peculiar type of female-sterility. Mutant females of this type produce eggs bearing a cytoplasmic defect that causes the death, usually during embryogenesis, of all offspring that do not inherit a wild-type allele from the father. Generally, in matings of mutant females to mutant males, all progeny die; in matings of mutant females to non-mutant males, all regular (XY) male progeny die, but all or most female (heterozygous) progeny and occasional non-disjunctional non-mutant (XO) male progeny survive. An hypothesis to explain these results (Lynch, 1919) is that the wild-type allele can function in the zygote to repair the cytoplasmic defect, thus making possible survival of females and exceptional males. Heretofore, only three mutants exhibiting this partial sterility pattern - deep orange, fused, and rudimentary - have been carefully studied (Carlson, 1971; Counce, 1956a,b,c; Fausto-Sterling, 1971a,b; Hildreth and Lucchesi, 1967; Lucchesi, 1968; Lynch, 1919; Merrell, 1947; Nørby, 1970).

Fig. 1. Heterozygous (amx/+) female offspring from the mating amx ♀ x + ♂ showing non-lethal maternal effect. Note thoracic defects and absence of left hindleg.

The cytoplasmic defect in the eggs produced by amx females is so severe that most offspring die regardless of the presence of a wild-type allele in the genotype. Matings of amx females to amx males are lethal to all embryos, as would be expected from Lynch's hypothesis. Matings of amx females to non-amx males are lethal to all ordinary (amx/Y) male embryos and to most female (amx/+) embryos as well. Offspring that escape death during embryogenesis often die after puparium formation, and most of those that survive to the adult stage have thoracic defects, including crippled or missing legs, and defects of the abdominal sternites (Fig. 1).

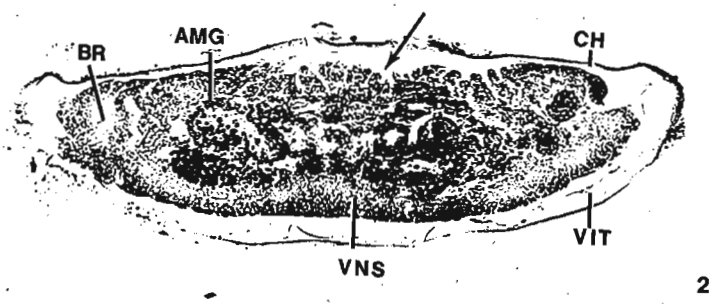


Fig. 2. Sagittal section of an 18-hour-old embryo from the mating amx ♀ x amx ♂, showing characteristic pattern of damage. Anterior end at left. Arrow indicates abnormal segmentation. AMG - anterior midgut; BR - brain; CH - chorion; VIT - vitelline membrane; VNS - ventral nervous system.

Almondex females have apparently normal genitalia, and egg yield is good. Fertility is enhanced by a temperature of 27°C (the amx female is essentially sterile at lower temperatures), by moderate crowding of the culture bottles, and apparently by increasing age of the mutant female.

Embryos produced by matings of amx females to amx males undergo advanced but abnormal development. Morphological abnormalities are first noticeable shortly after the time of maximal germ band extension. The principal anomalies involve derivatives of the ectoderm and somatic mesoderm. The main features of the pattern of damage (Fig. 2) include incomplete differentiation of the hypoderm, abnormal segmentation, exposure and often hypertrophy of the nervous system (which does not condense), tracheal defects, breakdown of the foregut, and lack of somatic musculature. Endodermal abnormalities are relatively minor. Both dorsal closure and head involution are impaired.

Matings of amx females to non-amx males produce a similar pattern of damage in male embryos, but in female embryos there is an amelioration of development.

I suggest that either an inherent structural defect in the presumptive ectoderm or some

metabolic defect to which the ectoderm is particularly susceptible may underlie the morphological defects found in the progeny from amx females.

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Samuel, B.C. and M. Sanjeeva Rao.
Osmania University, Hyderabad, India.

Induction of mutations in D. melanogaster with O-Sulphobenzoic imide (saccharin).

Artificial sweeteners are of two types, namely cyclamates and saccharins. The cyclamates used in food stuffs and drinks belong to sodium and calcium salts of cyclamic acid. The cyclamates have been banned in various countries because of their genetic effects. The work on genetic effects of saccharin are scanty. Sram and Weidenhofferova (1969) have carried out experiments on D. melanogaster and found the chemical sodium saccharin to be not mutagenic while Sax and Sax (1968) have found sodium saccharin to cause chromosome breakage in onion root tip cells. The present work is undertaken with a view to find out whether or not saccharin (Madhurin marketed by M/s. Merck Sarabhai) is mutagenic in Drosophila melanogaster. 8.33% of solution of Madhurin (in 0.4% NaCl) was used so as to give a survival above 85% and 12.5% solution of Madhurin was used as to give a survival of 70%. 0.2 micro c.c. of the above solution was injected in the vicinity of the last two abdominal segments with the aid of a Agla micro-meter syringe. The flies were cultured on the usual standard Drosophila corn meal medium.

Sex linked recessive lethals and translocations were screened to study for any induced genetic damage. Six broods of three days interval were used.

Treated males were crossed individually with 3 virgin females of Y sc^{S1} In-49 sc^{8};bw;st stock. The F_1 females were mated individually with Y sc^{S1} In-49 sc^{8} males while the males were mated with bw;st females to score for sex linked recessive lethals and translocations respectively in F_2 generation. The results are presented in Table 1:

Brood	Sex linked recessive lethals									Translocations								
	Control			8.33% madhurin			12.5% madhurin			Control			8.33% madhurin			12.5% madhurin		
	T	l	%	T	l	%	T	l	%	T	t	%	T	t	%	T	t	%
A Brood	1366	3	0.219	227	-	-	269	-	-	1516	-	-	334	-	-	265	-	-
B Brood	1716	8	0.466	208	1	0.48	256	-	-	1496	-	-	217	-	-	249	-	-
C Brood	1894	3	0.26	209	-	-	233	-	-	1668	-	-	235	-	-	213	-	-
D Brood	1599	7	0.43	234	1	0.42	253	1	0.23	1539	-	-	212	-	-	235	-	-
E Brood	1015	0	-	215	-	-	251	-	-	1321	-	-	240	-	-	236	-	-
F Brood	1073	3	0.27	218	-	-	167	-	-	1367	-	-	154	-	-	256	-	-

T = Total number of X chromosomes or F_1 sons scored
l = lethals recorded
t = translocations recorded

The chi-square test has been done to compare the following groups: (1) control versus 12.5% madhurin; (2) control versus 8.33% madhurin. The results of statistical analysis are presented in Table 2:

Chi-square values for the differences in sex linked recessive lethals for the groups compared.

Group	Brood A	Brood B	Brood C	Brood D	Brood E	Brood F
Control vs 8.33%	-	0.0032	-	0.000064	-	-
Control vs 12.5%	-	-	-	0.1233	-	-

Batabyal, A.K. and N.S. Sidhu. Indian Veterinary Research Institute, Izatnagar, India. Fertility study on different mutant strains of Drosophila melanogaster.

Fertility study on Drosophila melanogaster with reference to mutations and variation of egg number among the strains has not been carried out so far. Studies on the egg production in inbred lines and selected stocks have been carried by various authors. The present note reports variation in egg production and the fertility differences among the mutant strains of D. melanogaster.

Table 1. Mean daily egg production of different stocks of Drosophila melanogaster

Sl. No.	A O_1 bw st	B Izat-4*	C Random bred	D Or-K	E dp b cn	F sc cv v f B y f
1.	21.85	24.28	27.28	20.85	-	24.14
2.	13.28	30.85	20.71	31.71	19.48	-
3.	17.71	13.26	21.71	29.85	20.00	25.14
4.	17.42	33.28	26.00	19.00	-	24.71
5.	22.42	12.71	26.28	31.14	22.82	-
6.	20.71	18.00	28.85	24.00	-	28.28
7.	18.14	-	23.28	27.14	19.00	26.28
8.	19.00	29.14	16.85	28.71	18,25	26.14
9.	15.28	29.85	23.85	28.57	-	31.57
10.	24.00	25.71	14.28	30.00	14.85	24.85
Av.	18.92	24.12	22.90	27.09	19.06	26.38

* al b pr Bl c dp In cn sp px Cy s O

Ten strains in all, including Or-K (a control) stock of D. melanogaster were studied. Ten females were utilized per stock and egg productions from the 3rd to the 8th day, the peak period, were recorded. Means were obtained for various strains and the analysis of variance carried out. The experiment was broken up into two parts keeping two strains common in both for comparison. In the second part of the experiment live yeast was added to the food while it was not used in the first part of the experiment.

Results: The results obtained are presented in tables 1 to 5. In the first part of the experiment, egg production for 7 days (3rd to 9th) for 6 stocks is presented in case of food medium devoid of yeast. The maximum egg production (27 eggs/day) are obtained in the case of Or-K, the control stock. All the mutant strains have lower egg production. Analysis of variance indicates a significant difference between strains studied. The critical differences test (Table 3) shows significant differences in all except in a few cases as given in the table.

Table 2. Analysis of variance for egg number in D. melanogaster.

Source of variation	df	S.S.	M.S.S.	F
Between stocks	5	496.47	99.29	2.92*
Within stocks	47	1619.03	34.44	

In the second part of the experiment egg production has been recorded on Burdick's medium as in the first case but with the addition of live yeast. The data obtained are presented in table 4 which show obvious differences between strains. The control stock again has maximum average egg production (65 eggs/day).

The egg production in the presence of live yeast is nearly double compared to that on food medium devoid of live yeast.

Analysis of variance (Table 5) shows highly significant differences between strains. Again, the mutant stocks have lower egg number compared to the Or-K stock. Mutations seem to lower fertility and thus fitness of the stocks. These results indicate that the mutations in case of various Mendelian factors are lowering fertility in case of the laboratory Drosophila. As far as the authors are aware no literature is available on the fertility studies on the mutant strains of D. melanogaster for comparison. Further studies on this problem are in progress.

(Tables 3, 4 and 5 on next page)

Table 3. Critical differences between the means of egg in different stocks of D. melanogaster

Differences	Critical differences at 0.05 level
A~B - 5.20	1.83
A~C - 3.90	1.76
A~D - 8.17	1.76
A~E - 0.14	2.03
A~F - 7.46	1.89
B~C - 1.22 N.S.	1.83
B~D - 2.97	1.83
B~E - 5.06	2.06
B~F - 2.26	1.95
C~D - 4.19	1.76
C~E - 3.84	2.03
C~F - 3.48	1.89
D~E - 3.03	2.03
D~F - 0.71 N.S.	1.89
E~F - 7.32	2.11

Table 4. Mean daily egg production of different stocks of D. melanogaster

Sl. No.	Or-K	O_1 bw st	r	y v f	Cy/Bl L^2	ru h th st cu sr e^s ca
1.	59.63	37.50	55.33	60.50	44.83	46.00
2.	61.66	36.83	33.50	50.50	48.50	65.50
3.	60.83	-	33.83	65.00	35.83	50.00
4.	66.66	39.82	54.16	60.83	42.16	60.00
5.	71.50	19.50	61.33	53.16	42.33	-
6.	64.66	27.50	51.16	56.00	42.16	-
7.	38.83	46.00	24.83	57.83	52.33	42.00
8.	76.16	36.16	51.50	47.33	49.66	48.50
9.	71.16	41.00	-	52.33	43.00	30.33
10.	74.83	41.33	58.00	47.83	37.00	-
Av.	64.59	36.18	47.07	55.13	43.78	48.90

Table 5. Analysis of variance for egg number in D. melanogaster strains

Sources of variation	df	S.S.	M.S.S.	F
Between stocks	5	4573.48	914.69	10.53*
Within stocks	49	4254.99	86.83	

Bürki, K. and F.E. Würgler. Swiss Federal Institute of Technology, Zürich, Switzerland. A quick method for the determination of the oocyte stages in the ovaries of young D. melanogaster females.

Class-B oocytes of Drosophila, which correspond to the stages 7 to 13 of oogenesis, are interesting for mutation work. For the definition of the different classes and stages see R.C. King, Ovarian Development in Drosophila melanogaster, Academic Press 1970, p. 145. If class-B oocytes from different stocks are to be used in a set of experiments, a quick and simple method for counting the different oocyte stages should be available in order to exclude possible differences in oogenesis with different types of females. A method initially developed for the analysis of living embryos of the gall midge Heteropeza pygmaea by F. Bärlocher (Experientia 27:985, 1971) can be applied in the following way:

Ovaries of newly hatched females are prepared in a small dish containing insect Ringer solution (0.65g NaCl, 0.025g KCL, 0.03g $CaCl_2$, 0.025g $NaHCO_3$ in 100 ml H_2O). A single ovary is placed on a slide, a drop of Ringer solution is added and the individual ovarioles are separated from one another. The ovarioles are now covered by a cover glass. Under a phase contrast microscope (using a 25x objective and 8x oculars) the Ringer solution below the cover glass is gently sucked away with a piece of filter paper. Gradually, as the solution is removed, the oocytes become more and more flattened. At a certain moment the different nuclei (oocyte and nurse cell nuclei) and the delimination between oocyte and nurse cells become clearly visible. If too much of the solution is sucked away the oocytes will burst. In such preparations the oocyte stages 4 to 11 can easily be classified.

An advantage of this method is that in addition to fresh material, ovaries of females stored in the refrigerator for several weeks can also be analysed.

Work supported by Schweizerischer Nationalfonds zur Förderung der wissenschaftlichen Forschung.

Sun, D.C., I.I. Oster and R.E. Crang. Bowling Green State University, Bowling Green, Ohio. Pigment granules in the compound eyes of the wild type and two mutants of D. melanogaster.

Eye pigment granules in D. melanogaster are known to belong to the biochemical groups of pterins (yellow and reds) and ommochromes (browns). Nolte[1] has explored ultrastructural differences in the pigment granules of D. melanogaster wild type and several mutants, and was concerned primarily with the distribution of

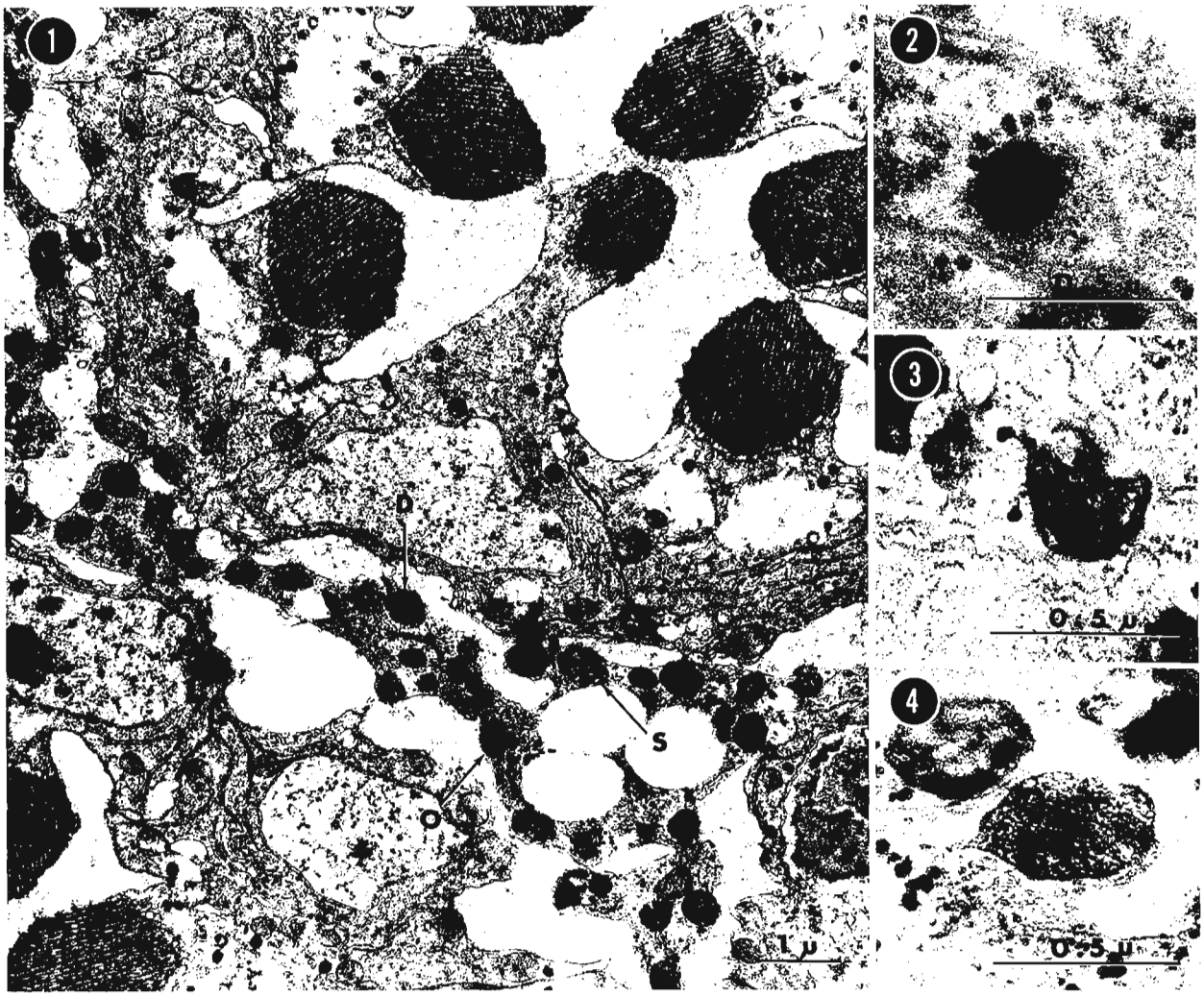

Fig. 1. Clot. 90-hour-old pupa. Ommochrome (O), drosopterin (D) and sepiapterin (S) are present in this transverse section at the level of seventh retinular nucleus. At this stage, sepiapterin is morphologically similar to drosopterin but its size is consistently larger than drosopterin.

Fig. 2. Sepia. 54-hour-old pupa. This micrograph is a higher magnification of an ommochrome pigment granule. Some of the ommochrome pigment granules are completely electron opaque while others have an internal granular substructure indicating that they are still in the process of development. At this stage, no limiting membrane surrounding the pigment granule is present.

Fig. 3. Wild type. 72-hour-old pupa. Drosopterin pigment granules are made up of a fibrillar substructure, distributed in a whorled or parallel fashion with some of the fibers tending to clump together to produce fibrils of a coarser diameter. In most cases, membrane-enclosed drosopterin pigment granules are present.

Fig. 4. Sepia. 72-hour-old pupa. The internal substructure of a sepiapterin pigment granule appears to be an aggregation of minute round or amorphous particles which are uniformly distributed throughout the pigment body. The body is usually limited by a membrane.

pigment granules in adult eyes. In the only other previous ultrastructural report on the development of pigment granules, Shoup[2] has distinguished the early-forming pigment granules of brown, vermilion, white and varigated-eye mutants. We wish to report on fine structural differences between yellow, red and brown pigment granules as noted at 54, 72 and 90 hours post-pupation in wild type, sepia and clot. At 54 hours, the only pigment body present in all flies checked was ommochrome and it increased in size throughout the time periods tested. Ommochrome-containing granules were small (average diameter 0.22-0.24 μ), electron dense, globular masses, and possessed no definite enveloping membrane. At the 72-hour stage, the same type of pigment granules were larger in size (ave. 0.53 μ), and of uniform medium electron density. At this stage, pteridine pigment granules were present in both the wild type and the mutants studied.

Among the pterin-containing granules, sepiapterin pigment granules in sepia were larger and morphologically distinguishable from drosopterin pigment granules in wild type. Both drosopterin and sepiapterin were present at 72 and 90 hours--but morphologically became more difficult to distinguish in the older pupae. However, sepiapterin pigment granules remained larger in average size at both 72 and 90-hour time periods. The pigment granules found in wild type were ommochrome and drosopterin; in sepia ommochrome and sepiapterin were present; and in clot ommochrome, drosopterin and sepiapterin were present.

The distribution of the pigment granules may be characterized in clot, since all three basic types of bodies are found there. Fig. 1 (clot, 90-hour post-pupation) represents a transverse section at the level of the seventh retinular cell (distal from the cornea) with the rhabdome at the top of the figure, and the secondary pigment cells at the bottom. All three basic types of pigment bodies may be identified in the secondary pigment cells, and only small ommochrome-containing bodies are present in the retinular cells. Detail of the fine structure of an ommochrome pigment granule is shown in Fig. 2, drosopterin in Fig. 3, and sepiapterin in Fig. 4.

These observations account for the differences in morphology between sepiapterin and drosopterin not previously reported, and indicate an increase in the size of pteridine pigment granules from 72 hours to 90 hours post-pupation--a finding in opposition to that reported by Shoup in the other mutants. A more comprehensive investigation by means of electron microscopy of the pigment granules in these and other mutants has been initiated.

References: [1]Nolte, D.J. 1961, Heredity. 16:25-38. [2]Shoup, J.R. 1966, J. Cell Biol. 29:223-249.

This research was supported in part by NSF Institutional Grant Number 230539 from the Graduate School of Bowling Green State University to D.C. Sun, and with funds provided by the National Science Foundation (GB 29140) and the National Aeronautics and Space Administration (NAS2-6067) for the work of I.I. Oster and associates.

Doschek, E. Institut für Allgemeine Biologie, Vienna, Austria. Competition between the three types of sex-determination of Megaselia scalaris in artificial populations.

The male sex of the Phoride M.sc. is determined by an epistatically-operating sex-realizer which is exchanged between the three non-homologous chromosomes by a regular translocation process (1). Experiments of competition in artificial populations have shown that by using different strains a certain balance can be achieved between the three different chromosomes that are the carriers of the sex realizer (2). In this case, the problem has been examined against the genetic background of one particular wild-type strain. A female caught in nature was used to produce a strain "Las Palmas 6/7". Females of this strain were mated with single males carrying the sex-realizer on chromosomes I, II or III respectively. For the following 10 generations the males were mated with females of the wild-type strain "Las Palmas 6/7". As a check proved that the desired chromosome was still the sex-determinating, well-aired cages were populated 50:50 each with combinations of sex-determining chromosomes as follows: I:III, I:II and II:III. After a period of 2 years the sex-determinating type of 100 males from each cage was examined, using suitable genetic markers. The first cage showed 98% of the males being sex-determined by chromosome III, the second 100% by chromosome I, and the third 96% by chromosome III. In accordance with earlier experiments chromosome II had been entirely or almost entirely eliminated. By contrast chromosome III held its own successfully against chromosome I with this genetic background.

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Kekić, V. and D. Marinković Institute for Biological Research, Belgrade, Yugoslavia. The dispersion of D. subobscura after exposure to different light intensities.

Using a modified apparatus for the measurement of phototactic behaviour (Kekić et al. 1971), dispersion to five different light intensities (from 30 to 6500 lux) was measured separately in males and females of D. subobscura. A total of 614 progeny, 6-7 days old, of wild flies captured near Belgrade in the fall of 1970, were used, after being raised in an incubator at 20°C and ca. 60% humidity. The newly hatched males and females were separated by an aspirator and kept for five days in glass bottles with culture medium. Before the experiment, flies were transfered to new bottles, and kept for 12 hours in the absence of light. The results obtained are presented in the following Table.

Light intensity (in lux)		30	300	1300	3200	6500	N	$\bar{X}$
Percent of distribution	Males	4.8	7.5	14.3	19.8	53.6%	293	4327 lux
	Females	1.9	2.5	9.6	21.2	64.8%	321	5023 lux
	Total	3.3	4.9	11.9	20.5	59.4%	614	4687 lux

On the average, females are found to be more positively phototactic than males (χ^2 = 17.9; $p < 0.005$), which was repeated in a number of other experiments with the same species (Kekić, Marinković 1971).

References: Kekić, V., D. Marinković, N. Tucić and M. Andjelković 1971 DIS 46:148; Kekić, V. and D. Marinković 1971 Genetica 3:181-188, Beograd.

Johnson, T.K. and G. Lefevre, Jr. San Fernando Valley State College, Northridge California. Comparative mutability of cm, ct, and sn.

Deficiencies which involve both cm (18.9; 6E6) and ct (20.0;7B3-4) and include as many as 30 bands have been reported in Lindsley and Grell (1968); by contrast, no deficiency that includes both ct and sn (21.0; 7D1-2), which are separated by only 14 bands, has been reported. This discrepancy, combined with the large number of cytologically rearranged ct mutations but small number of such sn mutations reported in Lindsley and Grell, prompted an investigation of the mutational response of the cm-ct-sn interval. Approximately 21,500 F_1 female progeny of 7 day old In(1)dl-49, f males given 2000r X-ray exposures and mated to multiply marked females were examined for newly induced mutations at the N, cm, ct, and sn loci. The results (see Table) indicate that the frequency of recovered ct mutants is much greater than that of either cm or sn, higher even than Notches. This may be due to the high frequency of rearrangement breakpoints that affect the ct locus, as compared with the other loci.

Mutant	♂ viable	♂ lethal	sterile
N	0	10	10
cm	0	0	2
cm ct	0	2	0
ct	2	15*	6
ct sn	0	0	0
sn	0	0	1

* of 12 cytologically analyzed, 9 are associated with rearrangement; 3 are cytologically normal.

Among the F_1 female progeny were two deficiency mutants that expressed both cm and ct simultaneously and were fertile, but no mutants expressing both ct and sn were found, not even sterile ones. Of the cytologically analyzed ct mutants, two are deficiencies, the longer including 30 bands; but neither extends farther to the right than 7C1. No ct deficiencies reported in Lindsley and Grell extend farther to the right than 7C4. This fact, together with the scarcity of sn deficiencies, suggests the presence of a haplo-insufficient locus between ct and sn that prevents the survival of ct-sn deficiencies. The postulated locus, which should lie just to the left of sn, must prevent the development of females heterozygous for its deficiency. As a result, recoverable ct deficiencies ought to be skewed to the left, sn deficiencies to the right. The situation is somewhat analogous to that seen at vermilion (33.0; 10A1) where a locus just to the right of v eliminates many v deficiencies, but through F_1 female sterility, not inviability (Lefevre, 1969).

Zwolinski, R. and F. DeMarinis. Cleveland State University, Cleveland, Ohio. A preliminary study of the metabolic pathway of 2-C^{14}-uracil in Bar and wild type larvae of 70-73 hours old.

It has been shown that amides, as glutaramide and cyclic amides, as uracil increase the number of facets in the Bar (B) eye mutant. (S. Kaji 1954, 1955, 1956; F. DeMarinis and F. Sheibley 1960, 1963, 1965). In the recent work of Hirose and Kaji (1968) it has been shown that ^{3}H-acetamide and ^{3}H-thymidine fed to larvae of Bar concentrate in the nuclei of the optic disk cells as well as in the nuclei of the salivary glands cells and fat bodies cells. It was further shown that inhibitors of facet-forming in Bar, as mitomycin-C and nitromine, when added along with ^{3}H-acetamide prevent the incorporation of the latter in the nuclei. This indicates that acetamide may be tied in with the possible synthesis of DNA.

In the present experiments, we fed 2-C^{14}-uracil to 69-70 larvae of Bar and wild type (wild type derived from Bar as reverted Bar) for a period of one hour. Larvae of this age were chosen because it has been demonstrated that Bar is most active in its expression during this time (DeMarinis and Sheibley 1965). The larvae were tested for radioactivity immediately after feeding and three hours later. The activity was determined with a scintillation counting apparatus, Unilux-II Scintillation System (Nuclear Chicago Corporation). Each test sample consisted of six larvae. It appears from Table 1 below that there is a distinctive

Table 1. Average C.P.M. values of larvae of Bar and wild type immediately after treatment with 2-C^{14}-uracil and three hours later, in larvae 70-73 hours.

	Total No. of Larvae Tested	Ave. C.P.M. immediately after treat. 2-C^{14}-uracil	Total No. of Larvae Tested	Ave. C.P.M. 3 hrs. after treatment 2-C^{14}-uracil	Total No. of Larvae Tested	Average C.P.M. Control
Bar	24	1156	24	482	24	22
wild (revert B)	24	1454	24	454	24	22

difference between Bar and wild in the uptake of 2-C^{14}-uracil. But more outstanding is the loss of activity in both Bar and wild type that occurs three hours later. In other words, about two-thirds of the original uracil intake has been metabolized and excreted in three hours time. Further tests were made to find where the loss occurred. This was done by placing strips of paper soaked in 50% KOH in vials containing treated and untreated larvae during the three hours of respiration. The strips plus the residue in the vials were counted. Table 2 below gives the results of the count. It is evident from these data that part of the

Table 2. Average C.P.M. values of the metabolized products excreted by larvae Bar and wild type during the period starting from age 70 to 73 hours.

	Experimental 2-C^{14} treated		Control		
	No. of Larvae Tested	KOH-paper Plus Vial Residue	No. of Larvae Tested	KOH-paper Plus Vial Residue	H_2O-paper Plus Vial Residue
Bar	24	306	24	93	67
wild (revert B)	24	384	24	86	69

loss comes from the metabolic products of uracil which are excreted. These preliminary tests further indicate that about two-thirds of the 2-C^{14}-uracil intake, at least in part, may be metabolized to $C^{14}O_2$ as shown by the positive higher count of KOH-paper. This provides some evidence in Drosophila that uracil may follow the major pathway as first found in mammals by Canellakis (1956).

Poels, C.L.M., C. Alonso and S.B. de Boer.
University of Nijmegen, The Netherlands.

Functional capacities of isolated salivary glands in a chemically defined medium.

Mid third instar salivary glands of Drosophila hydei were incubated for various periods up to three days in a chemically defined medium, the composition of which is given in Table 1. At various moments after the onset of incubation, the genome response to extracellular stimuli, the capacity for uridine and thymidine incorporation and the submicroscopic structure of the gland cells were studied and compared with that of glands under in vivo conditions.

Upon addition of 0.01 ug/ml ecdysterone after 12 hours of preincubation of the glands, a complete pattern of response, identical to

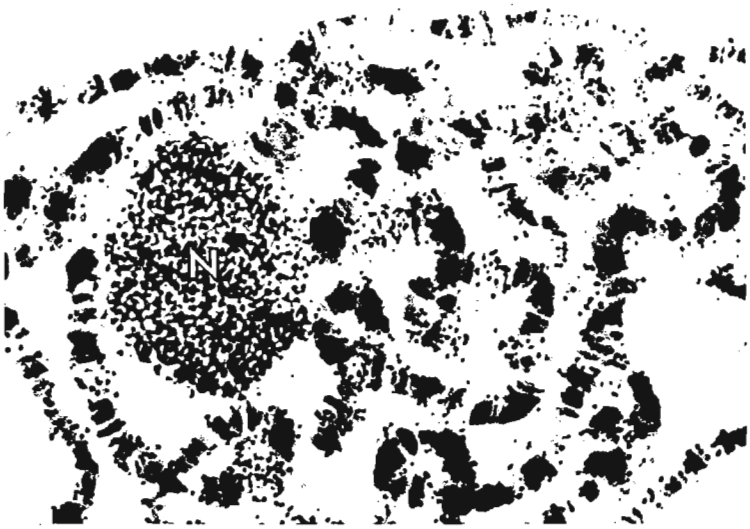


Fig. 1. Salivary glands were incubated in medium for 72 hours and subsequently transferred to medium containing 0.5 uCi ^{3}H-uridine/ul for 5 minutes. N, nucleolus.

that observed during normal development prior to puparium formation or after injection of the steroid into intact larvae, is observed. Within 15 min after the addition of the steroid, the first series of ecdysone specific changes in the puffing pattern are evident. At 4-6 hours after addition of the steroid to the medium the cells start secretion of the stored mucopolysaccharide product. The submicroscopic features of this process and the consequences for the structural organization of the cytoplasm of the gland cells are essentially equivalent to those observed to occur during normal development or after injection of the steroid into mid third in-

Fig. 2. Salivary glands were incubated in medium for 18 hours and subsequently transferred to medium containing 0.05 uCi ^{3}H-thymidine/ul for 15 min.

star larvae. The effect of ecdysterone has not been tested on gland kept in the medium for longer than 12 hours.

Autoradiographical and biochemical analysis of the incorporation of ^{3}H-uridine (spec.act.24 Ci/mM) following a 15 min pulse after 12 hours preincubation not only revealed a normal pattern of incorporation of the precursor into nuclear components, heavy labeling of puffs and nucleolus, but also a normal processing of the ribosomal precursor and an apparently normal spectrum of newly synthesized RNA species in sucrose gradients (Poels, in press). Autoradiographs of pulse labeled salivary glands after 72 hours of preincubation revealed heavy labeling of chromosomes and nucleoli (Fig. 1).

Incorporation of ^{3}H-thymidine (spec.act. 6.7 Ci/mM) was studied autoradiographically by

Table 1. Composition of the modified Shields and Sang medium (in mg/100 ml)

$MgSO_4 . 7H_2O$	513	monosodium malate. $2H_2O$	95
$CaCl_2 . 2H_2O$	116	monosodium α-ketoglutarate	42
KCL	313	disodium fumarate	8
NaCl	86	disodium succinate. $6H_2O$	14
$NaH_2PO_4 . 2H_2O$	88	monosodium pyruvate	2
$KHCO_3$	18		
monosodium L-glutamate	76	L-isoleucine	5
L-aspartic acid	9	L-leucine	9
L-threonine	15	L-tryosine	3
L-serine	17.5	L-phenylaline	3
L-asparagine	15	L-β-alanine	12
L-glutamine	30	L-histidine	19
L-proline	40	L-trytophan	10
L-glycine	17.5	L-arginine	21
L-α-alanine	75	L-lysine	7
L-valine	9	L-cystine	1
L-methionine	15	L-cystine	6
glucose	30	TC yeastolate (Difco)	200
trehalose	80		

Double distilled water ad 85 ml. 10 ml foetal bovine serum (Flow Laboratories) was added and the pH brought to 6.9 with 1 N NaOH. The volume was made 100 ml with A.bidest and aliquots were frozen on dry-ice-acetone and stored at -20°C.

incubating glands after various periods of preincubation, for 15 min in medium containing 0.05 uCi/ul of the precursor. All glands tested after 10 min, 6 hours and 18 hours preincubation displayed thymidine incorporation in 10-15% of the nuclei (Fig. 2) among which the various labeling patterns from only a few regions per chromosome labeled, to massive continuous labeling of the entire complement, are represented.

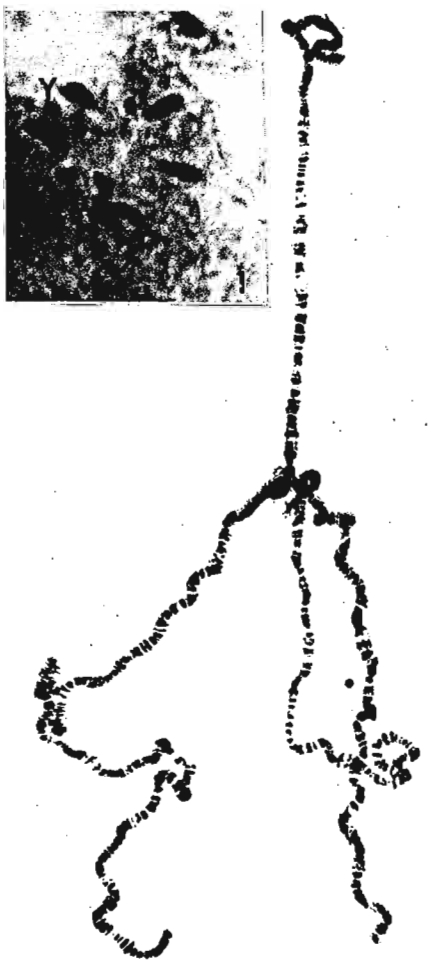
Shellenbarger, D.L. University of Iowa, Iowa City, Iowa. Evidence that EMS induces point mutations at high frequency. There is no convincing evidence that EMS induces base substitutions at substantial frequency in Drosophila, even though it appears to do so in T_4 (Krieg, 1963 Genetics 48:561), whereas there is evidence that it produces chromosome breaks (Fristrom, 1970 Ann. Rev. Gen. 4:325). Although temperature-sensitive mutations are produced in high frequency by EMS in Drosophila (Suzuki et al., 1967 Proc. Nat. Acad. Sci. 57:907), temperature-sensitivity per se is not sufficient to conclude a base substitution that renders a polypeptide inactive at restrictive conditions in Drosophila.

A simple genetic test has been used which identifies deficiencies in part or all of the white locus (Green, 1959 Zeitschrift für Vererbungslehre 90:375). w^{sp} homozygotes have mottled yellowish-brown eyes; w deficiency/w^{sp} trans heterozygotes are similar to w^{sp}/w^{sp}; but w point mutation/w^{sp} heterozygotes exhibit complementation to give a uniform reddish-brown color (Lindsley and Grell, 1967 Gen. Var. of D. mel.). Thus w deficiencies are clearly distinguishable from w point mutations.

4,340 EMS treated chromosomes (0.025 M EMS fed to males) which survived over w^+y^+Y were tested heterozygous to $Df(1)N^8$ for mutations in the w - N region. 26 mutants were recovered as follows: 19 recessive lethals at the Notch locus, none of which included white; one rst semi-lethal; and six white recessive visibles, including three w, two w^a, and one w^e. All six whites when tested with w^{sp} were complementing, producing the uniform reddish-brown eye color. This test identifies all six white mutations induced by EMS as point mutations. Critical to this argument are 1) that the collection of mutants is not biased against large deficiencies of one or more bands, and 2) the technique can resolve true base substitutions as opposed to small deletions of part of the white gene. The extent to which the second holds is unknown to this author.

Nirmala Sajjan, S. and N.B. Krishnamurthy
University of Mysore, India. Report on two new species of Drosophila from Mysore.

The genus Drosophila is a large diverse group with world wide distribution. The total size of the genus must be at least 2000 species (Stone et al. 1960). Two new species reported here for the first time belong to the immigrans group of species, as evidenced by the presence of a row of cuneiform bristles on the first femur, horn about one half the length of puparium, ventral receptacle short with about twenty-five loosely arranged coils and a sperm pump with two twisted posterior diverticula. These flies were collected from coconut and arecanut grooves of Mysore. Sympatric with these two species, are found D. melar-



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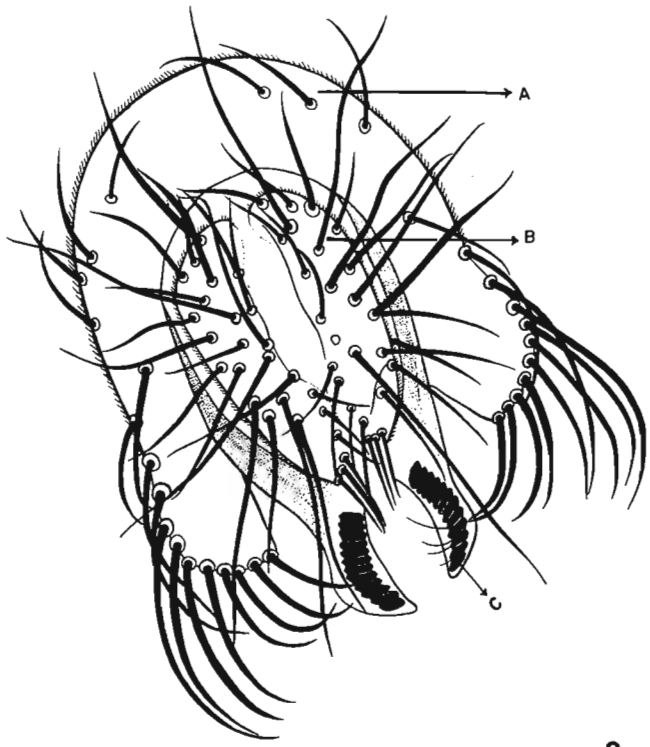

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Fig. 1. Metaphase plate of D. neonasuta ♂
Fig. 2. Salivary gland chromosomes of D. neonasuta

Fig. 3. Periphallic organs of D. chamundiensis ♂
A - Genital arch; B - Anal plate;
C - Primary clasper

kotliana, D. bipectinata, D. nasuta (Lamb), D. jambulina, D. mysorensis, D. rajasekari and D. brindavani.

Of the two new species, one is named here as Drosophila neonasuta. This species belongs to the nasuta subgroup of the immigrans group of species. The males of D. neonasuta lack tarsal ornamentation and have silver-whitish frons characteristic feature of the nasuta subgroup. Morphologically it resembles D. sulfurigaster, D. pulaua and D. nixifrons in having whitish silvery bands along the frontal orbits. In other characters, it is similar to that of D. nasuta (Lamb) redescribed by Okada (1964). However this species differs cytologically from all other members (with whitish silvery orbits) of the nasuta subgroup described by Wilson et al. (1969). The karyotype of this species (Fig. 1) consists of a pair of V's, a pair of double length rods, a pair of dots and a pair of rods in the females, while one of the rods is replaced by a J-shaped Y chromosome in the males. A small amount of heterochromatin is

added to the dot chromosomes making them slightly thicker and longer than the basic dots. The salivary gland chromosomes (Fig. 2) exhibit 4 long arms and one short arm as in the other members of the nasuta subgroup. Wilson et al. (1969) have pointed out that nasuta subgroup is characterized by marked divergent evolution. Further a large range of water and distance isolates the population understudy from the populations studied by Wilson et al. (1969). The additional parameter of cytological differences noted for this species is in support of our qualifying the present species as a new species - Drosophila neonasuta.

The other species collected at the base of Chamundi Hills of Mysore for the first time, is a new species as identified by Okada (1971, personal communication) and named by the authors as Drosophila chamundiensis after its locality of collection. The flies are fairly large in size and somewhat dark brownish in colour. Sex comb is absent in males. Acrostichal hairs are slightly irregular in 8 rows. Periphallic organs (Fig. 3) differ from all other members of immigrans group. The egg has four long and tapering egg filaments. The metaphase karyotype revealed the presence of a pair of V's, a pair of dots and two pairs of rods in females while one of the rods of one pair is replaced by a J-shaped Y chromosome in males. There are four long arms and a short arm in the salivary gland nuclei. Based on these observations, this has been given the status of a new species - Drosophila chamundiensis.

Acknowledgements: We are highly indebted to Dr. M.R. Rajasekarasetty, Professor and Head of the Department of Zoology, University of Mysore, Manasagangotri, Mysore for his valuable suggestions. We are especially grateful to Dr. T. Okada, Tokyo Metropolitan University, Setagaya-ku, Tokyo, Japan for kindly confirming the identification of flies. We are thankful to Mr. Ramakrishnaraju for helping us in preparing photomicrographs.

References: Okada, T. 1964 in Nature and Life in Southeast Asia, Vol. III, Ed. T. Kira and T. Umesao; Stone, W.S., W.C. Guest and F.D. Wilson 1960 Proc. Nat. Acad. Sci. USA 46: 350-361; Wilson, F.D., M.R. Wheeler, M. Harget and M. Kambysellis 1969 Univ. Tex. Publ. No. 6918:207-254.

Lucas, K.U. and G.F. Sprague, Jr. Yale University, New Haven, Connecticut. Glycogen synthetase activity in adipose males.

Histological observations (Doane, 1960) coupled with total carbohydrate determinations (Doane, 1963) have suggested that the adipose mutant of D. melanogaster may metabolize carbohydrate abnormally. Furthermore, we have found that when extracted with either water or hot 30% KOH, adipose flies yield about 1/3 the wild-type level of glycogen. In an attempt to locate the biochemical lesion more precisely, we are investigating the enzymology of glycogen metabolism in these flies. This note reports preliminary measurements of glycogen synthetase activity.

For use in these experiments, wild-type (Oregon-R) and homozygous adp^{60} flies (in an Oregon-R background) were reared axenically on standard corn meal-molasses medium, containing 30 mg/ml brewer's yeast. Newly emerged adult males were aged 7 days in the presence of excess brewer's yeast before being assayed. Glycogen synthetase activity was measured in whole-fly homogenates and low speed (1000g, 15 min) supernatant fractions by the method of Villar-Palasi et al. 1966. The data below show a 30-40 fold difference in the ability of males of the two strains to incorporate radioactive glucose (supplied in the form of ^{14}C-UDPG) into ethanol-precipitable material.

Genotype		μmoles glucose incorporated/mg protein-min (x 10^4)
+/+	Homogenate	6.4 ± 1.6
	Supernatant fraction	11.3 ± 2.4
adp^{60}/adp^{60}	Homogenate	.14 ± .02
	Supernatant fraction	.46 ± .27

Since measurements made on crude preparations such as ours reflect net, rather than absolute, rates of glycogen synthesis, we are currently investigating the effect which polysaccharide degradative enzymes may have in this system, as well as continuing our analysis of glycogen synthetase.

References: Doane, W.W. 1960 J. Exp. Zool. 145:1; _____ 1963 DIS 37:73; Villar-Palasi, C, M. Rosell-Perez, S. Hazukuri and J. Larner 1966 in S.P. Colowick and N.O. Kaplan, Methods in Enzymology, Col. VIII, Academic Press, N.Y. p. 374.

Williamson, D.L. and R.P. Kernaghan.
State University of New York at Stony Brook, New York. Virus-like particles in Schneider's Drosophila cell lines.

Virus-like particles have been reported to be present in several adult tissues of D. melanogaster, see, e.g., Filshie, et al. (1967), Kernaghan et al. (1964), Philpott et al. (1969), and Rae and Green (1967). In addition, Akai et al. (1967), observed virus-like particles in cell lines derived from in vivo cultures and Wehman and Brager (1971) report similar particles to be present in in vitro cultures of wing imaginal discs. We are reporting the presence of similar virus-like particles in sublines of Schneider's Drosophila cell lines 1, 2, and 3.

Cells from each line were fixed in 2% glutaraldehyde in M/15 phosphate buffer (pH 7.2) and centrifuged at 1,000 XG. The pellets were washed in phosphate buffer, post-fixed in 2% aqueous osmium tetroxide containing 1% sucrose, en bloc stained in 2% aqueous uranyl acetate, dehydrated in acetone and embedded in epon. Sections were stained with lead citrate for 15 seconds. Figure 1 is a cell belonging to line 2 in which the virus-like particles are clearly

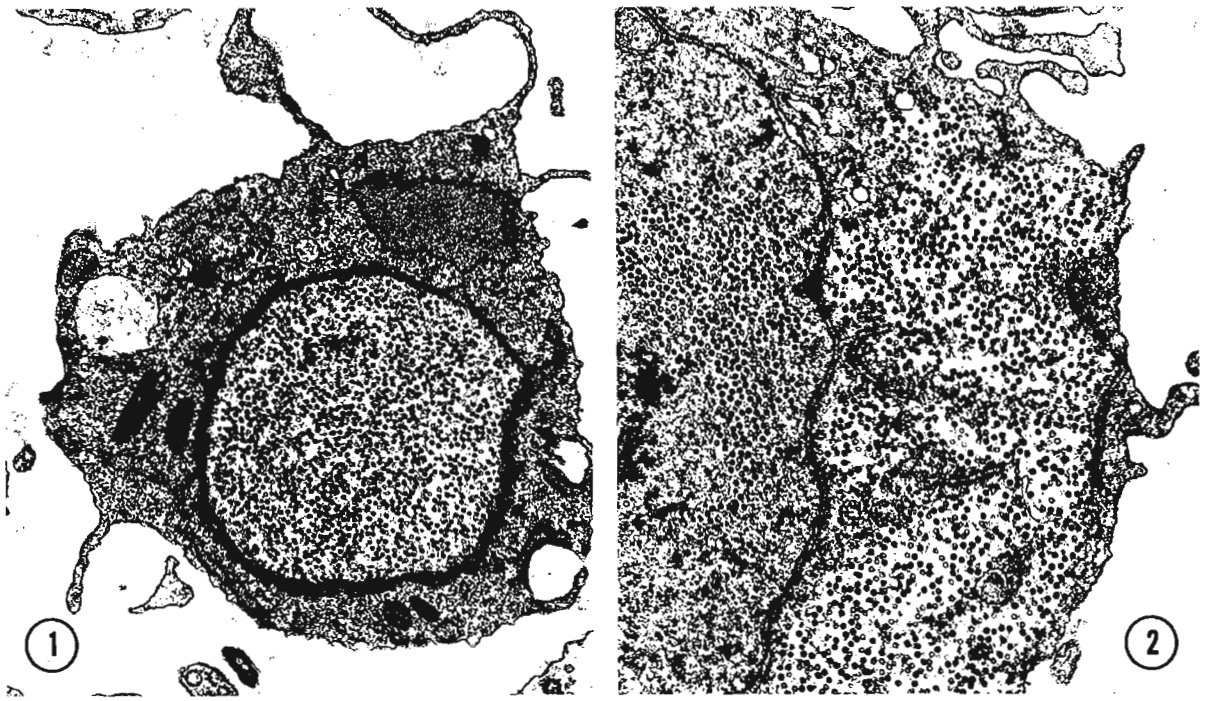

Fig. 1. Cell from Schneider's Drosophila cell line 2 showing virus-like particles in the nucleus. 21,000 X

Fig. 2. Cell from Schneider's Drosophila cell line 2 showing virus-like particles in both nucleus and cytoplasm. 25.000 X

visible in the nucleus of the cell. These virus-like particles are also observed in the cytoplasm of each of the three cell lines as shown in Figure 2 in which particles can be seen in both the nucleus and cytoplasm of the cell. The particles are spherical in shape with a diameter of ≅ 43 nm. Particles are observed in most sections of cells, though the number seen varies from single particles to large aggregates. The cell lines grow vigorously in spite of the presence of the particles, and the nature of the relationship of the particles to the cell remains unknown.

This note is intended to bring to the attention of those working with Schneider's Drosophila cell lines that the presence of these particles may confound any studies being carried out on the nucleic acids of these cell lines. Supported by NIH Grant AI-10950 to DLW and NIH Grant AI-09945 to RPK. We are grateful to Dr. Imogene Schneider for supplying us with the cell lines.

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Narda, R.D. and R.K. Gupta. Punjab Agricultural University, Ludhiana, India.
Mutation studies in D. melanogaster.

Role of protein synthesis in the induction of chromosomal aberrations was studied in the larvae of Oregon-K stock of D. melanogaster. Protein synthesis was inhibited by chloramphenicol (CPL) or streptomycin (ST), chromosomal aberrations were induced by ethylmethane sulphonate (EMS), methylmethane sulphonate (MMS), and hydrazine sulphate (HZ). For treatment with mutagen and/or the inhibitor, the larval period was divided into two halves. Chromosomes were examined for aberrations in fully grown third instar larvae.

EMS induced higher frequency of inversions when applied in the second larval half, whereas, MMS and HZ did so when applied in the first larval half. A few deletions were also induced by EMS and MMS and one translocation was induced by HZ (Table 1).

Regarding the effect of inhibition of protein synthesis on inversion frequency, excluding one case there was an overall increase in all treatments. This indicates that protein synthesis is involved in induction of chromosomal aberrations.

Further EMS, MMS and HZ induced maximum frequency of inversions (46.81%, 30.77% and 41.82% respectively) in 3L chromosome. In X-chromosome HZ induced higher frequency of inversions (13.62%) as compared to EMS (6.37%) and MMS (5.12%) and HZ induced not even a single

Table 1. Effect of protein inhibitors on the frequency of induced by EMS, MMS and HZ

Treatment	No. of larvae studied	No. of inversions scored	Frequency of inversions
NIL	95	0	0.0%
O + EMS	86	10	11.6%
CPL + EMS	107	13	12.1%
ST + EMS	90	5	4.3%
*EMS + O	85	7	8.2%
EMS + CPL	71	7	9.8%
EMS + ST	76	7	9.2%
O + MMS	70	8	11.4%
CPL + MMS	81	13	16.0%
ST + MMS	75	18	24.0%
**MMS + O	104	14	14.2%
MMS + ST	96	38	39.5%
MMS + ST	90	29	32.2%
***O + HZ	90	12	13.3%
CPL + HZ	70	19	27.1%
ST + HZ	70	11	15.7%
HZ + O	79	16	13.3%
HZ + CPL	75	30	40.0%
HZ + ST	75	25	33.3%

* 3 deletions were also induced
** 5 deletions were also induced
*** 1 translocation was also induced

inversion in the 2L chromosome in any of the treatments. The observed number of inversions induced by different mutagens in different chromosomal arms is non-random. Possibility that the number of aberrations induced on a chromosome depends upon its length is thus ruled out.

It was also revealed by the study of breakage-union points that EMS acts specifically at proximal end of 3L chromosome, MMS does so at the distal end of 2R and proximal end of 3R and HZ in the central one third 3L chromosome.

It is concluded that the type of spectrum of mutations induced by various mutagens is different and mode of action of each mutagen is specific in itself.

Miquel, J., P.R. Lundgren and R. Binnard. Ames Research Center, NASA, Moffett Field California. Negative geotaxis and mating behavior in control and gamma-irradiated Drosophila.

Oregon R wild type male Drosophila melanogaster were used in this study. They were housed at 21°C and 45% relative humidity in bottles containing standard corn meal-molasses medium enriched with brewer's yeast. Once each week the flies were shaken into bottles containing fresh food.

Negative geotaxis was measured every week using a glass-stoppered volumetric cylinder of 250 ml fitted with a layer of soft plastic on its bottom. When shaken to the bottom by tapping the cylinder against a rubber mat, the flies quickly ran or flew to the upper region. The technique was standardized by using 50 flies for each measurement, tapping 10 consecutive times, and counting the number of flies that crossed the 250 ml mark in 20 sec.

For investigation of mating behavior, 24 control and 24 irradiated flies were used. The mating behavior of the irradiated flies was observed every week after shaking them into a bottle containing 72 virgin females that were 8 days old. The same procedure was used to investigate the mating behavior of the controls. At the end of 10 min., the number of matings was recorded and, after spontaneous separation of the males and females, the females were discarded and the males were saved for future matings.

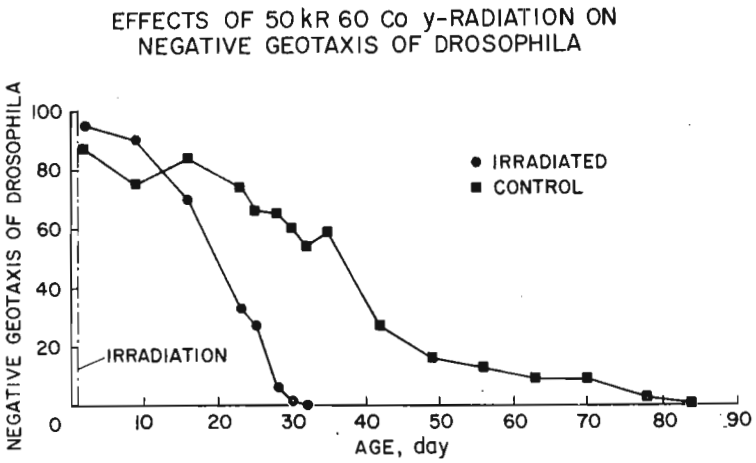


Fig. 1. Effects of 50 kR ^{60}Co γ-radiation on negative geotaxis of Drosophila. The points represent the percentage of flies that reached the 250 ml line on a volumetric cylinder 20 sec. after shaking them to the bottom. Each point is the mean of 10 consecutive readings.

Figure 1 shows that negative geotaxis of the irradiated Drosophila is in striking contrast with that of the controls. Whereas unirradiated Drosophila show a plateau of high activity until approximately 20 days, the negative geotaxis of irradiated flies starts declining sharply 8 to 16 days after irradiation. Zero values are attained at about 30 days of age versus 80 to 85 days for control flies. The shape of the curve for exposed Drosophila is

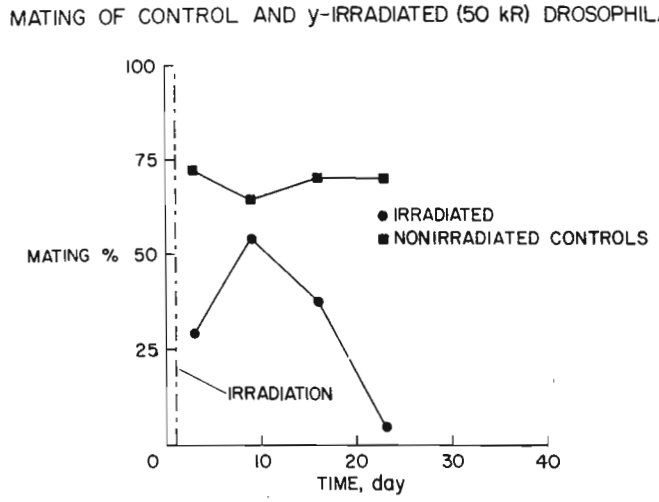


Fig. 2. Mating of control and γ-irradiated Drosophila. The points indicate the percentage of males that were able to start copulation in 10 min. Twenty-four control and 24 irradiated males were used in this study. Each group was left in a container with 72 virgin females that were 8 days old.

consistent with a radiation syndrome that rapidly progresses until death of the fly.

The data on mating frequency show that young control flies have an approximately constant high activity (Fig. 2). Mating of irradiated Drosophila, however, is depressed at 2 days after exposure, recovers at 8 days, and declines sharply thereafter. These observations suggest that 50 kR produce in Drosophila both an acute reversible injury and a chronic syndrome that eventually results in death.

Most male flies can copulate even after being completely sterilized by a dose of 50 kR. This finding agrees with our unpublished observations that control senescent male flies can also mate up to 91 days of age, several weeks after they have become sterile. This suggests that the status of the sex organs in Drosophila is not as important in mating behavior as the condition of the nervous system and the muscles. The degradation in performance for both negative geotaxis and mating of 9- to 16-day-old irradiated flies correlates well with the pathological changes of the brain observed starting at 14 days after exposure.

Vítek, J. J.E. Purkyně University, Brno, Czechoslovakia. The selection coefficients of heterozygotes for the recessive lethal mutations of D. melanogaster.

In many papers, selection coefficients of heterozygotes for recessive lethals were estimated by means of different tests (e.g. Cy/Pm). The adaptive values for lethal mutations in heterozygous condition were studied either in natural populations (Dobzhansky and Wright, 1941; Cordeiro, 1952; Dobzhansky and Spassky, 1968; and others), or in population cages (da Cunha, 1963 Sankaranarayanan, 1966; and others).

The majority of these authors found either the increase or the decrease of adaptive values of heterozygotes for lethals from 2% to 4%.

We have studied the selection coefficients of heterozygotes for three lethals of the chromosome 2: 1(2)ax (chromosome al dp b bw 1(2)ax), Bl, L^2; in the population cages and in five different populations, on the genetic background of Oregon-K. The initial genotypes of these populations were: 1(2)ax/+; L^2/+; Bl L^2/+ +; L^2 +/+ 1(2)ax; Bl L^2 +/+ + 1(2)ax. The selection coefficient of each studied allele was estimated by comparing the theoretical relation between the frequency of normal allele and of the mutant allele with the empirical relation. The results are presented in the table.

The selection coefficients of heterozygotes for recessive lethal mutations Bl, L^2, 1(2)ax, regarding the standard alleles, in the different experimental populations

generation	population mutation	1(2)ax/+	L^2/+	Bl L^2/+ +	L^2 +/+ 1(2)ax	Bl L^2 +/+ + 1(2)ax
		selection coefficients				
1	Bl			0.02		0.10
	L^2		0.47	0.05	0.58	0.07
	1(2)ax	0.20			0.09	-0.01
2	Bl			0.36		0.22
	L^2		0.74	0.35	0.63	0.09
	1(2)ax	0.02			0.62	0.08

Some of the selection coefficients are ten or more times higher than the values estimated by other authors. This increasing of selection coefficients may be caused by the specific environment of populations, further by the specific genetic background (compare the population Bl L^2 +/+ + 1(2)ax to others), and the specific properties of studied lethal mutations. The selection coefficients of the second generation are higher than those of the first one. This increase is caused by the increasing size of populations.

References: Cordeiro, A.R. 1952 Proc. Natl. Acad. Sci. USA 38:471-478; da Cunha, A.B. et al 1963 Proc. XI Intern. Congr. Genet., The Hague 1, 158; Dobzhansky, Th. and S. Wright 1961 Genetics 26:23; Dobzhansky, Th. and B. Spassky 1968 Genetics 59:411-425; Sankaranarayanan, K. 1967 Genetics 57:653-664.

McKay, C.M. The Flinders University of South Australia, Bedford Park, S.A., Australia. Quantitative measurement of pteridines.

Preliminary investigations using paper chromatography techniques indicate that the two wild type stocks Canton-S and Loxton (isolated from a South Australian Population) plus the recessive mutations chocolate-2, purple, and sepia of D. melanogaster all differ chromatographically with respect to the fluorescent eye pigments, pteridines.

Figure 1 shows that for the recessive mutations and wild types certain pigments: (1) may be totally lacking, (2) may be produced in greater quantity than either of the two wild types tested, (3) the quantity may be suppressed, or (4) new pigments may be formed which are not present in either of the two wild types tested.

Reference: Hadorn, E. and H. Mitchell, 1951 P.N.A.S. 37:650-665.

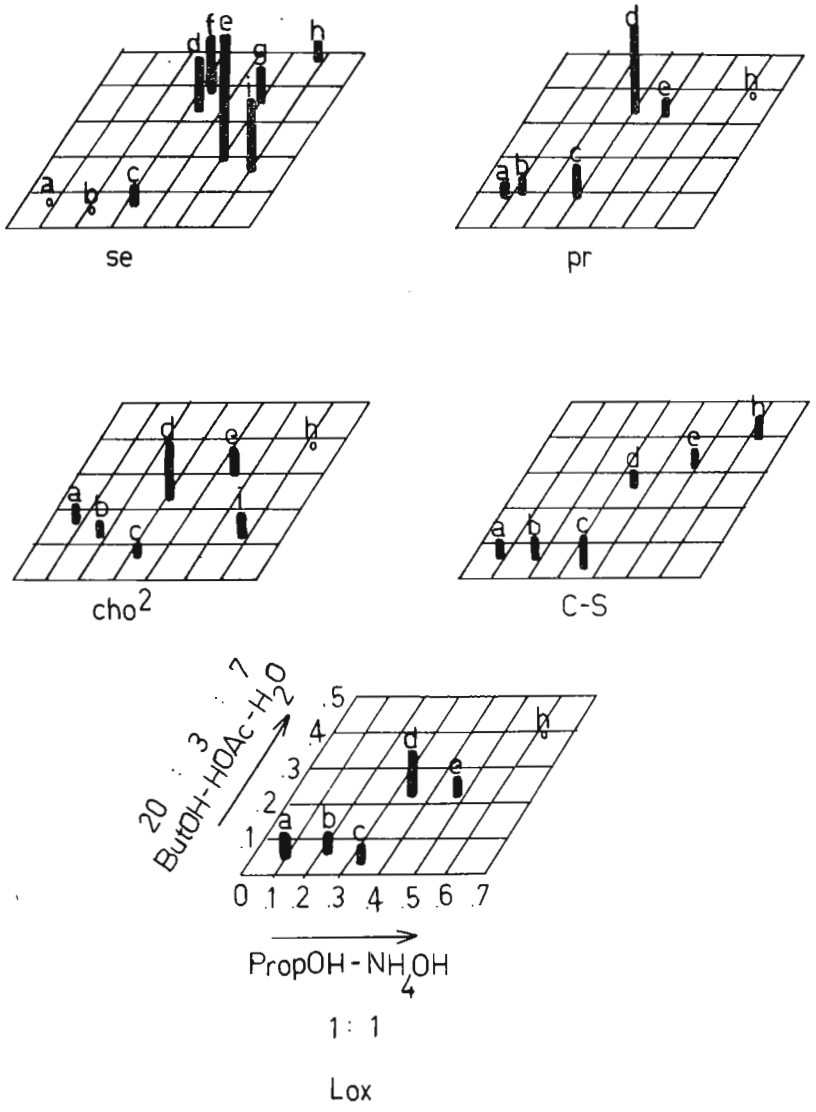


Figure 1. Three dimensional chromatograms. The heights of the columns represent the relative quantities of pteridines as measured by an Unicam SP. 800 Ultraviolet Spectrophotometer in two-dimensional chromatograms. Substances: a, drospterin; b, isodrospterin; c, isoxanthropterin I; d, isoxanthropterin II; e, xanthropterin I; f, xanthropterin II; g, sepiapterin; h, 2-amino-4-hydroxypterine; i, biopterin (Hadorn and Mitchell, 1951). The Rf values and solvent systems are the same for the five chromatograms as represented by the one for Loxton wild type. An open circle indicates the lack of the respective substance.

Beck, H.* Zoologisches Museum der Universität Zürich, Switzerland.
Mutants from natural populations of D. subobscura in Switzerland.

The following mutants have been extracted from two widely separated populations of D. subobscura in Switzerland. The progenies of 54 inseminated ♀♀ caught in the wild were inbred (6 single-pair cultures on the average). Mutant strains were established from F_2 and further generations. Names and symbols used are derived from earlier work on D. subobscura. Names in quotation marks refer either to similarity with known phenotypes when allelism has not been established or are simply descriptive. The number of independently established strains of one mutant is given in brackets. If not mentioned otherwise, the mutants are recessive and autosomal.

s, scarlet (Burla 1967)(1)
ma, maroon (Gordon et al. 1939)(1)
"light eye color" (3): allelism-tests with different laboratory strains negative.
pp, poppy (Gordon et al. 1939)(3): crosses between this pp strain and with a pp strain from the laboratory gave either 100%, 50% or no pp-phenotypes in single pair cultures. Presence of a suppressor of pp not established.
"rough eyes" (2): similar to rough shaven, but eyes are only partially roughened. Penetrance variable.
"moisty eyes" (1): eyes look as if covered with a thin layer of oil. Eye color slightly lighter than wildtype.
"bladder" (1): lymph-bladder preferentially at inner wing margin.
"roof" (1): folded wings inversely V-shaped. Penetrance incomplete.
"curved wings" (1): wing borders bent upwards, wing surface wavy. Penetrance incomplete.
"outspread" (2): phenotype identical with outspread (Gordon et al. 1939).
"plexus" (4): distally inserted wing veins between Costa and LII. Weak manifestation in F_2, penetrance complete in F_5. Allelism between different "plexus" not tested.
"delta"(1): wing vein inserted parallel or sloping to posterior crossvein. Weak penetrance.
"multiple crossveins"(1): variable number of inserted veins generally parallel to and between anterior and posterior crossvein. Weak penetrance.
"stiff bristles" (1): scutellars not bent, slightly shortened and thin. Fully penetrant in F_4.
"thin dorsocentrals" (1): dorsocentrals shortened and thin. Fully penetrant in F_4.
"thin scutellars" (2): bristles, especially scutellars, thin. Length of bristles not affected. Complete penetrance in F_4.
"translucent bristles" (1): scutellars thin, translucent at the tip. Penetrance incomplete.
"short bristles" (2): phenotype similar to bobbed.
"short scutellars" (1): dorsocentrals and scutellars shortened and stiff. Penetrance variable.
"crossed scutellars" (1): posterior scutellars strongly converging. Penetrance variable.
"singed" (1): phenotype comparable with singed. Penetrance variable, low fertility.
"aristapedia" (1): similar to aristapedia (UCL Report, DIS 20:82-83.)
ho, hoary (1): (Gordon et al. 1939).
"missing bristles" (2): first orbital and anterior ocellar bristle missing. Occasionally second orbital missing. Position of ocelli variable. Sexlinked.

Frequent phenotypes:

"crossveinless", cv1 (11): posterior crossvein absent or incomplete, often asymmetrically expressed. Phenotype found in offspring of 36 ♀♀. 11 strains with variable penetrance and expressivity established. Crosses between different strains gave results similar to those obtained by Gordon et al. (1939).
"short vein", sv (10): different strains with incomplete longitudinal wing veins: sv_2, sv_4, sv_5, sv_{2-5}. Phenotypes found in offspring of 32 ♀♀. 10 strains established. For descriptions and frequencies see also Gordon 1936, Gordon et al. 1939, Prevosti 1951.
"three dorsocentrals", tdc (13): three or more dorsocentrals present on one or both sides, the additional bristle preferentially inserted anterior to the normally present dorsocentrals. Found in offspring of 36 ♀♀. 13 strains with variable penetrance.
"short scutellar", shsc (12): (Burla 1968) 1-4 scutellars shortened, giving 16 phenotypic combinations when positions are considered. Other bristles may be affected. Found in offspring of 40 ♀♀, 12 strains established. Penetrance incomplete.
"extra scutellars" (6): (Burla 1967) additional scutellars near normal bristle positions.

Number of supernumerary bristles variable. Found in offspring of 24 ♀♀, 6 strains with variable degrees of penetrance.

High frequencies of cvl and sv phenotypes have been found in all populations investigated. tdc and shsc phenotypes have not been described from natural populations of D. subobscura. Phenotypes similar to esc were found in Greek populations (Pentzos da Ponte et al. 1967).

The extremely low occurrence of the newly described phenotypes (tdc, shsc, esc) in F_2 cultures and the difficulty of detecting them presuppose the idea that these types might not be specific for the populations in Switzerland; perhaps their presence or absence reflects different intensity of observation.

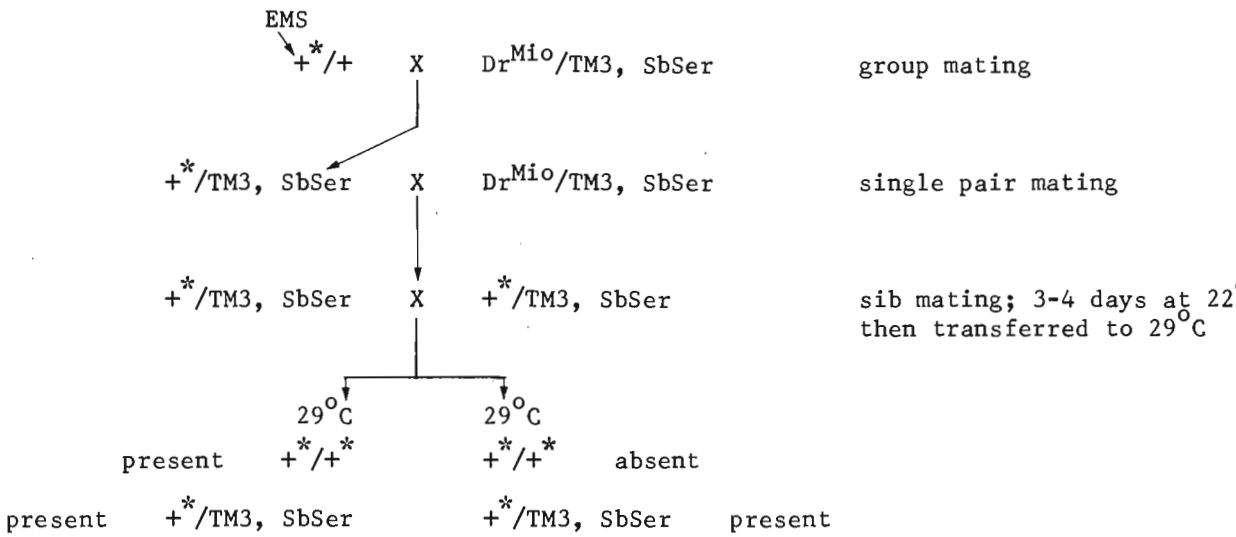
References: Burla, H. 1967 DIS 42:66; _____ 1968 DIS 43:76-78; Gordon, C. 1936 J. of Genetics 33:25-60; Gordon, C., H. Spurway and P.A.R. Street 1939 J. of Genetics 38:37-90; Pentzos-Daponte, A., E. Boesiger and A. Kanellis 1967 Thessaloniki physikomathematikes scholes 10:133-159; Prevosti, A. 1951 Genetica Iberica 3, 1/2:37-46.

* Present address: Heinz Beck, Génétique animale et végétale, 154 Route de Malagnou, 1224 Genève, Switzerland.

Fattig, W.D. and W.L. Rickoll University of Alabama in Birmingham, Alabama.

Isolation of temperature sensitive mutants of the third chromosome of D. melanogaster.

A screening procedure for the detection of recessive temperature sensitive lethal mutations on the third chromosome of Drosophila melanogaster has been devised and tested. Oregon-R (Oak Ridge) males were treated with ethylmethane sulfonate (EMS) according to the method of Lewis and Bacher (DIS 43:193, 1968), and mated according to the following diagram.



Recessive temperature sensitive lethality was indicated in those crosses in which both homozygous and Stubble Serrate progeny were present at 22°, but only Stubble Serrate progeny were present at 29°.

All stocks in which these results were observed were retested to confirm their temperature sensitive lethality. Crosses between the heterozygous Stubble Serrate progeny and between the homozygous progeny were incubated at 22° and 29° and subsequently scored for the production of homozygous progeny. Some of the mutant stocks obtained from the original isolations were sterile when homozygous. In these cases crosses between the heterozygous Stubble Serrate progeny incubated at 22° and 29° were scored for the production of homozygotes. Those retests in which homozygotes were produced at 22° but were completely absent at 29° resulted in the classification of the mutant stocks as confirmed recessive temperature sensitive lethals.

Two separate isolations series were done using different concentrations of EMS. In the first isolation series (0.025 M EMS) 4.7 per cent of all chromosomes tested (235) were confirmed temperature sensitive lethals, and in the second isolation series (0.005 M EMS) the recovery frequency was 4.0 per cent of all chromosomes tested (251).

Pulvermacher, C. and W. Köhler. Institut für Genetik der Freien Universität Berlin, Germany. Frequency of successful matings.

In order to find out the intervals between copulations of female D. mel., the following mating scheme was used: For each cross, a male and a female were paired for a certain period of time. The whole experiment was divided into three main systems, in which the females were allowed to pair for one, two and three days successively. Each female was then transferred into a new vial and allowed to pair with the respective male as described in the scheme. This was repeated five times for every system. The flies used in this experiment were separated at eclosion and stored for 3-4 days to attain the maximum reproductive stage. The F_1 phenotype of females indicates which males had successfully copulated.

	p generation ♀	x	♂	F_1 phenotype ♀♀
1)	w/w	x	+/Y	+
2)	w/w	x	w/Y	w
3)	w/w	x	B/Y	B
4)	w/w	x	Sb/Me	Sb or Me
5)	w/w	x	Ly/D	Ly or D

(The arrows indicate the transfer of the same female.)

The tables show that at least 15% of the females copulated again after 24-48 h, 37% after 48-72 h and 50% after 72-96h. Moreover, with the increasing time intervals, there is a rise of multiple fecundations.

The simultaneous appearance of the different phenotypes indicates that the sequence of the copulations had no influence upon the sequence of fertilization of the eggs.

In contrast to Manning (1), in our mating scheme (one to one crosses) rapid remating is quite common and obviously not necessarily due to rape. According to Nonidez (see Miller, in Demerec (2)) sperm stored in the seminal receptacle are probably used first, those from the spermathacae later. In case one successful copulation is sufficient to fill up at least the seminal receptacle, our results show that this sequence may be doubted. But if the seminal receptacle is not filled at one copulation or if the reserved sperm is reduced by a certain percentage, then the multiple fertilizations can lead to surmise such that the sperm disperse at random among the seminal receptacle and the spermathecae.

Table 1. (see next page).

Table 2. Total of successful multiple copulations

	cross no.	N	1x	2x	3x	4x	5x
	1	66	100.0	x	x	x	x
	2	73	84.9	15.1	x	x	x
I	3	38	92.1	7.9	0.0	x	x
	4+	13	100.0	0.0	0.0	0.0	x
	5	40	75.0	22.5	2.5	0.0	0.0
	1	78	100.0	x	x	x	x
	2	51	62.7	37.2	x	x	x
II	3	70	47.0	49.9	2.8	x	x
	4	69	69.4	24.9	5.7	0.0	x
	5	57	22.8	54.3	15.8	5.2	1.8
	1	55	100.0	x	x	x	x
	2	42	50.0	50.0	x	x	x
III	3	45	26.6	55.5	17.8	x	x
	4	40	45.0	37.5	10.0	7.5	x
	5	37	37.8	40.5	21.6	0.0	0.0

N number of fertile cultures
I, II, III mating systems with one, two and three day intervals
+ N too small

References: (1) Manning, A. 1962 Nature 194:252-253; (2) Demerec, M. (ed.) 1950 The Biology of Drosophila (Wiley, New York).

Table 1. Frequency of successful matings

			F_1 ♀♀ from cross					F_1 ♀♀ from crosses									
	cross nr.	N	1	2	3	4	5	1&2	1&3	1&4	1&5	2&3	2&4	2&5	3&4	3&5	4&5
	1	66	100.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	2	73	84.9	0.0	x	x	x	15.1	x	x	x	x	x	x	x	x	x
I	3	38	81.6	2.6	7.9	x	x	5.3	2.6	x	x	0.0	x	x	x	x	x
	4	13	69.7	0.0	23.0	7.8	x	0.0	0.0	0.0	x	0.0	0.0	x	0.0	x	x
	5	40	30.0	2.5	15.0	5.0	22.5	0.0	10.0	0.0	10.0	0.0	0.0	0.0	0.0	2.5	0.0
	1	78	100.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	2	51	23.5	39.2	x	x	x	37.2	x	x	x	x	x	x	x	x	x
II	3	70	1.4	37.1	8.5	x	x	20.0	15.7	x	x	14.2	x	x	x	x	x
	4	69	0.0	24.6	31.8	13.0	x	2.9	2.9	0.0	x	2.9	10.1	x	5.7	x	x
	5	57	0.0	8.8	0.0	10.5	3.5	1.8	0.0	0.0	0.0	8.8	15.8	17.5	3.5	3.5	3.5
	1	55	100.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	2	42	40.5	9.5	x	x	x	50.0	x	x	x	x	x	x	x	x	x
III	3	45	2.2	2.2	22.2	x	x	4.4	26.7	x	x	24.4	x	x	x	x	x
	4	40	0.0	0.0	42.5	2.5	x	0.0	5.0	0.0	x	27.5	0.0	x	5.0	x	x
	5	37	0.0	0.0	24.3	10.8	2.7	0.0	2.7	0.0	2.7	8.1	0.0	0.0	0.0	18.9	8.1

N number of fertile cultures
I, II, III mating systems with one, two and three day intervals

Berg, R.L. Institute of Cytology and Genetics, Novosibirsk-90, U.S.S.R. The inheritance of abnormal abdomen in the offspring of wild males of Drosophila melanogaster.

In 1968 a high frequency of abnormal abdomen (aa) was observed among D. melanogaster inhabiting wineries of Crimea and Transcausasus. 263 aberrant males detected in the fall of 1968 among wild males in the winery Magarach (Crimea, near Nikita Botanical Gardens) were crossed individually with "y w f" or "y f" attached-X females. 88 of these males manifested the character abnormal abdomen (aa), 175 other phenotypical abnormalities. The 88 aa males proved to be bearers of 76 hereditary abnormalities of the abdominal tergites. In the progeny of 13 aa wild males the character did not appear in two subsequent generations. One male out of 75 was heterozygous for two mutations - one sex linked and one autosomal dominant with low penetrance in homozygotes. Out of 76 aa mutations, 4 proved to be sex linked, 72 autosomal (5 recessive and 67 dominant). Out of 67 dominant mutations 17 revealed a 100% penetrance in heterozygotes as well as in homozygotes. 35 mutations were characterised by low penetrance in heterozygotes but the penetrance being high in homozygotes. 12 mutations manifested low penetrance in homozygotes as well as in heterozygotes. In the progeny of three males bearing a dominant aa character with low penetrance in heterozygotes no homozygous flies were observed. In the progeny of 175 males bearing other phenotypical abnormalities the aa flies were found in 37 lines or in 21.1 percent. The genetical analysis showed that out of 37 aa mutations 8 mutations proved to be recessive, 17 dominant with 100% of penetrance in homozygotes and 12 with low penetrance in heterozygotes as well as in homozygotes. The mode of inheritance of aa is strikingly similar to the inheritance of wing venation abnormalities widespread in D. melanogaster populations in past years.

Berg, R.L. Institute of Cytology and Genetics, Novosibirsk-90, U.S.S.R. A sudden and synchronous increase in the frequency of "abnormal abdomen" (aa) in geographically isolated populations of D. melanogaster.

The study of the phenotypical polymorphism in geographically isolated populations of D. melanogaster carried out by me since 1937 revealed a relatively low frequency of the abdominal segmentation abnormalities designated as abnormal abdomen (aa). It was rare till 1968 when a sudden and simultaneous increase in its concentration occurred (Table 1). In 1967 its frequency was not higher than in previous years and no drift was observed. In 1968 the populations of Magarach (Crimea), of Dilizhan and Erivan (Armenia) were studied. The concentrations of aa among males were 2.3, 1.08, 2.9 per cent respectively. 222 aa males were collected and the inheritance of the character was investigated. In 1969 the concentration reached 11.0, 12.2, 13.5 per cent respectively. In the same year the population of Frunze (Kirghizia) contained 7.9 percent of aa males. A hypothesis of the global increase of the aa concentration was put forward and the increase of aa in the other populations predicted. In 1970 three Uman populations as well as two other Ukraine populations - Cherkassy and Zolotonosha - were studied. The character aa was met with 21.4, 18.5 and 17.3 per cent of males in Uman populations and 12.2 and 13.2 per cent in Cherkassy and Zolotonosha. The frequency of aa in females was much higher - 43.9, 42.4, 60.6 in Uman, 40.4 and 37.8 per cent in Cherkassy and Zolotonosha, respectively. The Frunze population contained in 1970 14.5 per cent of aa males and 52.2 per cent of aa females. In 1971 the three Uman populations and that of Frunze were investigated again. The concentration of aa males in Uman decreased significantly (Table 1). In Frunze a significant decrease was observed among females. Six other populations were investigated during 1971 - three Transcaucasian (Dilizhan, Erivan, Burakhan), the population of Magarach, of Baku (Azerbaijan) and of Vladivostok (Far East). A slight increase was observed in Erivan, all other indices being constant. All "new" populations revealed a high frequency of aa comparable to that observed in populations previously studied. The concentration of aa was lower in Vladivostok - the single population investigated not by myself but by Dr. J.N. Ivanov who used however the same method of registration of aa as I did. The parallel with the sickle cell anemia in man seems clear. The simultaneous increase in geographically isolated populations in frequencies of a gene complex causing harmful developmental abnormalities and at the same time securing resistance is supposidly dependent on some pandemic fly disease acting as a powerful positive selective factor.

Concentration of "abnormal abdomen" phenotype in geographically isolated populations of Drosophila melanogaster

	Population	Year	MALES n	MALES number	MALES percent	FEMALES n	FEMALES number	FEMALES percent
Moscow district	Kashira	1940	1282	1	0.08	980	4	0.41
	Serpukhov	1940	190	0	0	185	0	0
	Kashira	1960	1601	4	0.25	420	1	0.24
		1962	243	1	0.41	283	0	0
Ukraine	Uman	1937	10159	8	0.08	10543	5	0.05
	Odessa	1946	1584	2	0.13	1963	3	0.15
	Uman	1946	3652	9	0.25	2292	13	0.57
		1963	1509	1	0.07	651	1	0.15
		1970	1544	293	19.0	1142	567	49.6
	Cherkassy	1970	584	71	12.2	502	203	40.4
	Zolotonosha	1970	660	87	13.3	749	283	37.8
	Uman	1971	1516	124	8.2	1236	585	47.3
Moldavia	Tiraspol	1946	6016	8	0.13	5441	10	0.18
		1962	1382	1	0.07	1533	5	0.39
Crimea	Nikita	1937	7115	3	0.04	5204	5	0.10
	Botanical Gardens	1938	1260	0	0	1446	2	0.14
	+ Magarach	1960	4081	5	0.12	5287	8	0.15
	Magarach	1963	1279	1	0.08	1678	4	0.24
		1965	7988	15	0.19	426	0	0
		1966	5000	16	0.32	-	-	-
		1967	6502	21	0.32	-	-	-
		1968	5302	121	2.28	-	-	-
		1969	661	73	11.04	-	-	-
		1971	876	97	11.07	539	303	56.2
Caucasus	Nalchik	1957	539	0	0	581	0	0
	Inozemtsevo	1957	1546	2	0.13	1180	2	0.17
	Pyatigorsk	1957	3702	3	0.08	4258	4	0.09
Trans-caucasus	Kutaissi	1945	6564	5	0.08	5828	6	0.10
	Dilizhan	1939	5238	5	0.10	4462	3	0.07
		1960	1024	2	0.20	1339	1	0.08
		1961	1306	1	0.08	-	-	-
		1962	272	0	0	310	1	0.32
		1964	300	0	0	270	0	0
		1965	318	2	0.63	307	0	0
		1966	179	1	0.56	-	-	-
		1967	326	1	0.31	-	-	-
		1968	278	3	1.08	-	-	-
		1969	793	97	12.23	-	-	-
		1971	836	115	13.76	862	317	36.8
	Erivan	1939	2759	1	0.04	2548	0	0
		1961	1526	0	0	228	0	0
		1965	3778	2	0.05	824	1	0.12
		1967	2109	1	0.05	-	-	-
		1968	3434	98	2.85	-	-	-
		1969	1684	228	13.54	-	-	-
		1971	471	80	17.00	541	279	51.6
	Burakhan	1971	333	41	12.31	280	128	45.7

(Table continued next page)

Table 1 (Continued)

	Population	Year	MALES n	MALES number	MALES percent	FEMALES n	FEMALES number	FEMALES percent
	Lenkoran	1967	1148	0	0	-	-	-
	Baku	1971	158	18	11.39	294	111	37.8
Middle	Alma Ata	1961	2013	0	0	1625	3	0.19
Asia	Frunze	1969	1668	132	7.9	-	-	-
		1970	595	86	14.5	412	215	52.2
		1971	699	97	13.9	551	200	36.3
Far East	Vladivostok	1971	185	13	7.0	219	40	18.3

Grell, R.F. Oak Ridge National Laboratory, Oak Ridge, Tennessee. Viability of tetra-4 flies.

A number of papers concerned with meiotic mutants and their effects on segregation have been published recently. In each paper it has been stated or tacitly assumed that the tetra-4 genotype is lethal; no provision has been made to distinguish it phenotypically from the triplo-4 fly; and segregation analysis has proceeded on this assumption. When a reference to the lethality of the tetra-4 is cited, it is E.H. Grell (1961). However, the purpose of the Grell paper was to demonstrate that tetra-4 flies do survive, although under the conditions of the experiment they appeared infrequently. As pointed out by Grell, their rare appearance was attributable, at least in part, to the segregation pattern required for their recovery - namely, that all three parts of the double X:4 translocation, $T(1:4)w^{m5}T(1:4)B^{S}$, move to the same pole at meiosis I in both the heterozygous translocation-bearing mother and the hemizygous translocation-bearing father. Further, his scheme precluded the recovery of a tetra-4 male, since the recovery of two X chromosomes necessarily accompanied the recovery of the four 4's.

Recent studies by Moore and R.F. Grell (1972) have established that the very low recovery of tetra-4 flies with the translocation method was largely segregational in origin. The Moore and Grell experiments utilized compound-4's constructed by Lewis and Roberts (E.H. Grell, 1963), and in the course of the work they recovered tetra-4's in large numbers. As shown in Table 1, crosses of diplo-4 mothers carrying a compound-4, phenotypically wild-type, to triplo-4 fathers carrying a compound-4 homozygously marked with ci and ey^{R} as well as a single 4 marked with ci^{D} produced diplo-4, triplo-4, and tetra-4 progeny which were phenotypically distinguishable as ci ey^{R}, ci^{D}, and +, respectively. In the first set of crosses, approxi-

Table 1. Numbers of diplo-4, triplo-4 and tetra-4 progeny from crosses of C(4)RM, ci ey^{R}/gvl sv^{n}♀♀ x C(4)RM, ci ey^{R}/ci^{D}♂♂

Set	diplo-4 (ci ey^{R})	triplo-4 (ci^{D})	tetra-4 (+)	Total	Viability of tetra-4 % of diplo-4	Viability of tetra-4 % of triplo-4
1	30,357	36,581	23,190	90,128	76	63
2	9,764	11,429	6,593	27,786	68	58

mately 26% of the 90,128 progeny were tetra-4; in the second set, approximately 24% of the 27,786 progeny were tetra-4 (Table 1, col. 4 and 5). Viability of the tetra-4 is calculated to be 76% of the diplo-4 and 63% of the triplo-4 in the first set of crosses and 68% and 58%, respectively, in the second set. Marker-wise, the tetra-4 possesses a viability advantage since it is wild-type. Nevertheless it is clear that the tetra-4 is far from lethal, and genetic experiments which fail to distinguish the tetra-4 from the triplo-4 on the grounds that it is must contain some error.

References: Grell, E.H. 1961 Genetics 46:1177-1183; Grell, E.H. 1963 Genetics 48:1217-1229; Moore, C. and R.F. Grell 1972 Genetics (in press).

Research sponsored by the U.S. Atomic Energy Commission under contract with the Union Carbide Corporation.

Basden, E.B. Institute of Animal Genetics, Edinburgh, Scotland. The Hymenopterous parasites of the Drosophilidae.

As more parasites of Drosophila are being used experimentally, the following list may be of service. It is compiled from records I can immediately recall to mind so is of a preliminary nature. Only skeleton references are given, and some older parasite names may have been changed. Many more records would doubtless be forthcoming if larvae and puparia from natural habitats were isolated. Spontaneous infestations of laboratory cultures are treated as natural parasitism, but purely experimental hosts are indicated by an asterisk*.

ICHNEUMONOIDEA (Braconidae, Ichneumonidae)

1. Aspilota sp.
   Bickley, 1956, J. ec. Ent. 49:419. U.S.A. Drosophila melanogaster
2. Aspilota concolor Nees.
   Thompson, 1943, Cat. Pars. Preds. Ins. Pests 1(2):32 D. funebris
3. Dacnusa (=Rhizarcha) faeroensis Rom. (=lestes Nix.)
   Griffiths, 1956, 1962, 1964 Ent. mon. Mag. 92:27; in litt; Beit. Ent. 14:870, 16:893. England. Scaptomyza graminum ("incana")
   Basden, 1959 unpub. Scotland. Ex Stellaria leaves from which Sc. graminum, Sc. griseola, Parascaptomyza pallida emerged
4. Dacnusa (=Rhizarcha) maculipes Thom. (det Nixon)
   Basden, 1959 unpub. Scotland. Ex Stellaria leaves from which Sc. graminum, Sc. griseola, Parascapt. pallida emerged
5. Dacnusa scaptomyzae Gah.
   Gahan, 1913 Can. Ent. 45:152-153. U.S.A. Scapt. "flaveola"
   Frost, 1924 Cornell Me. 78:91, 132. U.S.A. Sc. flaveola, Sc. adusta.
   Pimentel, 1961 An. Ent. Soc. Am. 54:328, 332. U.S.A. Sc. flaveola, Sc. adusta, Parascapt. pallida (=disticha)
6. Dacnusa (=Pachysema) temula Hal.
   Frey, 1951 Z. Pfl.-Krankh. 58:10-20. Germany. Scaptomyza flava
   Nixon, 1954 Ent. mon. Mag. 90:269. G.B. Sc. flava ("flaveola")
   Basden, 1957 unpub. (det. Nixon). Scotland. Sc. flava (=apicalis)
   Stein, 1963 Z. angew. Ent. 52:51. Germany. Sc. flava
   Griffiths, 1964 Beit. Ent. 14:870. G.B. Sc. flava ("apicalis")
7. Opius sp.
   Basden, 1957 unpub. Scotland. Sc. flava (=apicalis)
   Griffiths, 1962 in litt. England. Scaptomyza sp.
8. Opius sp. n.
   Guido & Ruffinelli, 1958 Proc. 10th Int. Cong. Ent. 4:915 Uruguay. Drosophila sp.
9. Opius quebecensis Prov.
   Frost, 1924 Cornell Mem. 78:91, 132 U.S.A. Scaptomyza adusta
10. Opius trimaculatus Spin.
    Brncic, 1966 Evol. 20:22-23 Chile. Dros. flavopilosa
11. Phaenocarpa tabida Nees.
    Jenni, 1951 Act. Zool. (Stockh.) 32:240, 242 Switzerland. Dros. melanogaster, Drosophilids
12. Phygadeuon ? curvispina Th.
    Stein, 1963 Z. angew. Ent. 52:51 Germany. Scapt. flava

CYNIPOIDEA (Cynipidae, Eucoilidae, Figitidae)

13. Ganaspis sp.
    Brncic, 1966 Evol. 20:22-23 Chile. Dros. flavopilosa
14. Ganaspis (=Xystus) musti Rond.
    Rondani, 1875 Boll. Com. Ag. Parm. 8:148; 1876 Bull. Soc. Ent. Ital. 8:84, 258 Italy. D. melanogaster ("uvarum"), ?funebris ("aenopotae")
    Martelli, 1910 Boll. Lab. Zool. Port. 4:172 D. melanogaster ("ampelophila")
15. Pseudeucoila (=Eucoila) sp.
    Jenni, 1947 Rev. Suis. Zool. 54:252, 258 Switzerland *(D. melanogaster, D. busckii)
    Blight, 1953 Amer. Nat. 87:112 U.S.A. Dros. americana-group
16. Pseudeucoila bochei Weld.
    Weld, 1944 Proc. Ent. Soc. Wash. 46:65-66 U.S.A. D. melanogaster *(D. simulans)

Jenni, 1951 Act. Zool. (Stockh.) 32:177, 249 Switzerland. D. melanogaster *(D. funebris, littoralis, hydei, phalerata, busckii, subobscura, Zaprionus "tuberosus")
Oprecht & Hadorn, 1952 DIS 26:116 *(D. melanogaster)
Schlegel-Oprecht, 1953 ZIAV 85:245 *(D. melanogaster)
Nöstvik, 1954 Sympos. Genet. (Pavia) 2:140 Italy. Drosophila sp. *(D. melanogaster)
Walker, 1959-1962 Rev. Suis. Zool. 66:579-; 68:252-; 69:209- *(D. melanogaster, simulans, hydei)
Hadorn & Walker, 1960 Rev. Suis. Zool. 67:216 *(D. melanogaster)
Meyer-Grassmann, 1967 Rev. Suis. Zool. 74:409- *(D. melanogaster)
Streams, 1968-1969 An. Ent. Soc. Am. 61:159-; J. Inv. Path. 12:379-, 13:371 U.S.A. D. ?melanogaster *(D. melanogaster, immigrans, affinis, algonquin, athabasca, robusta, putrida)
Nappi, 1969-1971 An. Ent. Soc. Am. 63:321-, 1217; J. Ins. Phys. 15:1551; J. Inv. Path. 16:408 *(D. melanogaster. Abortive development in D. paramelanica, melanica, melanura, euronotus, micromelanica, nigromelanica)

17. Pseudeucoila (=Eucoila) drosophilae Kieff.
Kieffer, 1913 Boll. Lab. Zool. Port. 7:112 French Guinea. Drosophila sp.
Imms, 1930 Parasitol. 22:19 (Kieffer's record)
Boche, 1938, 1939 Coll. Net. 13:149; Genetics 24:95 Drosophila spp. *(D. melanogaster)

18. [Pseudeucoila hookeri Crawf.
Muma, 1968 Co-op. Econ. Ins. Rep. (USDA) 18:54 ?Drosophila sp.]

19. Pseudeucoila mellipes Say.
Streams, 1969 J. Inv. Path. 13:372 U.S.A. *(D. melanogaster, robusta, immigrans, paramelanica)
Nappi, 1969 J. Ins. Physiol. 15:1553 *(D. immigrans)

CHALCIDOIDEA (Encyrtidae, Eulophidae, Eupelmidae, Miscogastridae, Pteromalidae, Signiphoridae/Thysanidae)

20. Callitula bicolor Spin.
Simmonds, 1952, 1953 Bull. Ent. Res. 43:529; 44:388-. Canada *(D. melanogaster)

21. Chrysocharis sp.
Frost, 1924 Cornell Mem. 78:91, 132 U.S.A. Scap. adusta
Basden, 1961 unpub. (det. Huddleston) Scotland. Scap flava (=apicalis)

22. Chrysocharis petiolata Thoms.
Stein, 1963 Z. Angew. Ent. 52:51 Germany. Scap. flava

23. Cryptogaster vulgaris Walk
Stein, 1963 Z. Angew. Ent. 52:51 Germany. Scap. flava

24. Eupelmus sp.
Williams, 1931 Hndbk. Ins. Haw. Sug. Fields : 19 Hawaii. Drosophilid (perhaps Titanochaeta)

25. Eupterolmalus sp.
McCoy, 1960 Dissert. Abstr. 21 (6) U.S.A. Drosophila spp.

26. Halticoptera sp.
Stein, 1963 Z. Angew. Ent. 52:51 Germany. Scap. flava

27. Miscogaster cinctipes Walk.
Curtis, 1860 (1883) Farm Insects: 85 England. Scaptomyza ("Drosophila") flava

28. Myiocnema sp.
Clausen & Berry, 1932 USDA Tech. Bull. 320:43-44 Java. Acletoxenus indica

29. Pachyneuron (=Pteromalus) vindemmiae Rond.
Rondani, 1875 Boll. Com. Ag. Parm. 8:148; 1876 Bull. Soc. Ent. Ital. 8:85, 249 Italy. D. melanogaster ("uvarum")
Martelli, 1910; Silvestri, 1917 Boll. Lab. Zool. Port. 4:169; 12:143 D. melanogaster ("ampelophila")
Milani, 1947 DIS 21:87 Italy. Drosophila sp.
Ghesquière, 1949 Acad. Ag. France (Séance 23.XI.49) D. melanogaster
Vayssière, 1953 C.R. Assem. Un. Int. Sci. Biol., Rapp. 7. France. Drosophila sp.

30. Pachycrepoideus dubius Ashm.
Timberlake, 1924 Proc. Haw. Ent. Soc. 5:424 Hawaii. Drosophila sp.
Swezey, 1934 Proc. Haw. Ent. Soc. 8:389 Hawaii. D. melanogaster
Dresner, 1954 Proc. Haw. Ent. Soc. 15:308 Hawaii. *(Drosophila sp.)
Whiting, 1954 Evol. 8:138-140 U.S.A. Drosophila sp. *(D. virilis, funebris)
Young & Meyer, 1954 DIS 28:167 U.S.A. D. melanogaster

31. Pleurotropis flaviscapus Thoms.
Frey, 1951 Z. Pfl-Krankh. 58:10-20 Germany. Scaptomyza flava
32. Pterosemoidea drosophilae Dodd.
Dodd, 1917 Tr. Proc. Roy. Soc. S. Austral. 41:351 Australia. Drosophilid (perhaps Gitonides)
Fulmek, 1943 Ent. Beiheft. 10:62 Australia. Drosophilid.
33. Signiphora reticulata Gir.
Dodd, 1917 Tr. Proc. Roy. Soc. S. Austral. 41:353 Australia. Drosophilid (perhaps Gitonides)
34. Spalangia spp.
Dresner, 1954 Proc. Haw. Ent. Soc. 15:264 Hawaii. Drosophila sp.
35. Spalangia lanaiensis Ashm.
Perkins, 1913 Faun. Haw. 1(6):189 Hawaii. Drosophilid
Fullaway, 1954 Proc. Haw. Ent. Soc. 15:264 Hawaii. Drosophilid
36. Spalangia drosophilae Ashm.
Ashmead, 1887 Tr. Am. Ent. Soc. 14:199; 1894 Proc. Ent. Soc. Wash. 3:37 U.S.A. Drosophila sp.
Simmonds, 1944-1956 Bull. Ent. Res. 35:222; 43:524-; 44:388-, 773-; 45:527-; 47:361-. Canada *(D. melanogaster; Drosophilid sp.)
Simmonds, 1948 Phil. Tr. Roy. Soc. Lond. B. 233:387 *(D. melanogaster)
Bouček, 1963 Act. Ent. Mus. Nat. Prag. 35:480, 506 U.S.A. D. melanogaster
37. Syntomosphyrum albiclavus Kerrich.
Saunders, 1961 Bull. Ent. Res. 52:414 *(D. melanogaster)

PROCTOTRUPOIDEA (Ceraphrontidae, Diapriidae, Proctotrupidae)

38. Ashmeadopria drosophilae Kieff.
Kieffer, 1913 Boll. Lab. Zool. Port. 7:111 Nigeria. Drosophila sp.
39. Ceraphron niger Curt.
Curtis, 1860 (1883) Farm Insects:85 England. Scaptomyza (Drosophila) flava
40. Loxotropa sp. (?tritoma Thoms.)
Simmonds, 1944, 1952, 1953 Bull. Ent. Res. 35:222; 43:522; 44:391 Canada. *(D. mel.)
41. Loxotropa tritoma Thoms.
Maybee, 1956 Ann. Rep. Ent. Soc. Ont. 86:53-. Canada. *(D. melanogaster)
42. Phaenopria sp.
Perkins, 1913 Faun. Haw. 1(6):189 Hawaii. Drosophilid
43. Proctotrupes ("Proctotrypes") hawaiiensis Ashm.
Perkins, 1913 Faun. Haw. 1(6):189 Hawaii. Drosophilid
44. Spilomicrus sp.
Barker, 1965 DIS 40:66 Australia. D. melanogaster, D. nebulosa, D. pseudoobscura, D. simulans (Lab. stocks)
45. Trichopria sp.
Dresner, 1954 Proc. Haw. Ent. Soc. 15:308 Hawaii. *(Drosophila sp.)
46. Trichopria (Planopria) rhopalica Kieff.
Kieffer, 1913 Boll. Lab. Zool. Port. 7:111 Lagos. Drosophila sp.
47. Pseudeucoila bochei
Bakker et al. 1967:295- *(D. melanogaster)

Grossfield, J. New England Institute, Ridgefield, Connecticut. A new class of light dependent behavior in Drosophila.

Many species of Drosophila are known to be partially or completely light dependent in their sexual behavior. A few species mate equally well in light or darkness (Grossfield, PNAS 68: 2669). Table 1 demonstrates that two white eye mutants (see DIS 45:55) of D. auraria do not mate in the light. Both mutants were derived from race A of D. auraria and were tested after 7 generations of isogenization with race A as the recurrent parent. In addition to demonstrating the importance of vision in the initiation of courtship, the fact that these mutants will mate in darkness but not in light suggests that a switch in the relative importance of different sensory stimuli occurs under different environmental conditions. Since race A will mate in both darkness and light but these mutants will not mate in light, it appears that perturbations of image formation in the visual system under illuminated conditions blocks courtship. However, the complete absence of light merely

transfers courtship stimuli to a different processing system and allows courtship. This indicates that there may be interconnected alternate CNS integration centers for different types of stimuli. Supported in part by Grant GB-8140 to W.L. Pak.

Table 1. Degree of insemination of flies homozygous for the w or w^{saf} mutations of D. auraria under conditions of constant light (LL) and constant darkness (DD). Both light conditions tested for 2 h and 24 h exposure periods. Unless otherwise noted, all chi-square values are significant at the .001 level. N = number of females dissected; % = per cent inseminated. All tests performed in vials containing 10 ♀♀ and 5 ♂♂.

		2 h					24 h				
		LL		DD			LL		DD		
♀♀	♂♂	N	%	N	%	χ^2	N	%	N	%	χ^2
w^{saf}	w^{saf}	50	0.0	50	36.0	19.6	220	0.0	230	93.5	390.0
w	w	100	0.0	100	67.0	97.8	80	0.0	90	98.9	162.0
A	w^{saf}	50	0.0	50	50.0	30.7	50	0.0	50	94.0	84.9
							50	88.0*			
w^{saf}	A	50	88.0	50	48.0	16.6	40	92.5	50	96.0	n.s.

* Done under a normal diurnal cycle (LD)

Borack, L.I. Rutgers, The State University, Newark, New Jersey. Histochemical localization of B-L-Hydroxy acid dehydrogenase.

Third instar larvae of the strain Daekwanryeong were dissected in cold insect Ringers solution. Individual organs were first transferred to spot plates containing cold insect Ringers and washed 2X with this solution, then transferred to spot plates containing the staining mixture. The staining organs were kept in the dark. Each test was done in triplicate with identical results.

Staining mixture: 10 mls. .05M Tris-Hcl pH. 8.2; 1 ml. NAD (25mg./ml.); 2.5 mls. NBT (5 mg./ml.); .3 mls. PMS (2 mg./ml.); 2 mls. IM Pyrazole - inhibits drosophila ADH (Borack and Sofer, 1971).

	No Substrate			1 ml. 1 M D-L-B-oH Butyrate			.5 mls. 1 M D-Gulonate			.5 mls. 1 M L-Gulonate		
	30 min	1 hr	2 hr	30 min	1 hr	2 hr	30 min	1 hr	2 hr	30 min	1 hr	2 hr
Malpighian	-	-	-	++	+++	+++	-	-	-	+++	+++	+++
Intestine	-	-	-			++	-	-	-	+	++	++
Carcass	-	-	-	-	-	-	-	-	-	-	-	-
Musculature	-	-	-	-	+	++	-	-	-	-	++	++
Fat body	-	-	-	-	-	+	-	-	-	-	+	+
Brain	-	-	-	-	-	-	-	-	-	-	-	-
Salivary	-	-	-	-	-	-	-	-	-	-	-	-
Imaginal discs	-	-	-	-	-	-	-	-	-	-	-	-

Histochemically the enzyme appears specific for the L-isomer of gulonate and reacts less intensely with D-L-B-oH butyrate. This specificity is identical to that found for the purified enzyme (Borack and Sofer 1971a).

Drosophila B-L-hydroxy acid dehydrogenase is localized predominantly in the malpighian tubules and less in the intestine, musculature and fat body. This tissue distribution corresponds to that found in the analogous organs in the sheep for cytoplasmic 3-hydroxy-butyrate dehydrogenase (Koundakjian and Snoswell, 1970), subsequently shown to be L-gulonate dehydrogenase (Williamson and Kuenzel, 1971).

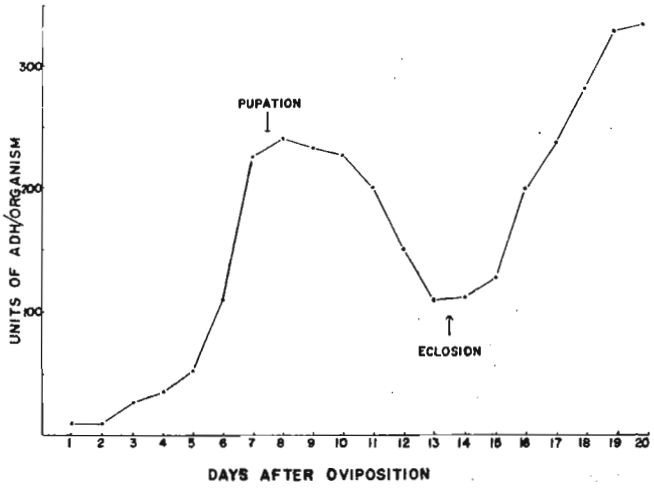
References: Borack and Sofer 1971 DIS 46:156; _____ 1971a, J. Biol. Chem. 246:5345; Koundakjian and Snoswell 1970 Biochem. J. 119:49; Williamson and Kuenzel 1971 Biochem. J. 121:569.

Supported by Rutgers Research Council Grant 07-2315 to L.I.B.

Imberski, R.B. and C. Strommen. University of Maryland, College Park, Maryland.

Developmental changes in alcohol dehydrogenase activity in Drosophila hydei.

The activity of alcohol dehydrogenase (ADH) has been determined at specific times of development and adult life in D. hydei. A wild-type strain derived from a stock described by Berendes (1965) was studied. The method of synchronizing development and staging was substantially the same as reported by Berendes, except that the flies were reared on "Instant Drosophila Medium" (Carolina Biological Supply Company). Cultures were started by placing 3-4 week old adults into fresh food containers for a period of 2 hours. Offspring were then collected at 24 hour intervals following oviposition for a period of 480 hours. A constant temperature of 25°C was maintained throughout this time. Preparation of homogenates and assay for ADH activity was accomplished by the methods of Ursprung, Sofer and Burroughs (1970).



The pattern of change in ADH activity shown on the figure approximates that reported by Ursprung et al. (1970) for D. melanogaster. However, in D. hydei we observe a slower rate of decrease in ADH activity following pupation. At the mid-point of pupal life the level of activity is approximately 75% of the difference between maximum and minimum values, whereas in D. melanogaster the level of ADH activity is close to the minimum at the corresponding time. Following eclosion ADH activity increases for at least 6 days, reaching values higher than the peak at the time of pupation. Dunn, Wilson and Jacobson (1969) report similar findings in D. melanogaster. During this period of increase in the adult, changes in isozymic forms of ADH have been observed in both D. melanogaster (Dunn, et al.) and in D. hydei (Imberski, 1971).

References: Berendes, H.D. 1965 Chromosoma 17:35-77; Dunn, G.R., T.G. Wilson and K.B. Jacobson 1969 J. Exp. Zool. 171:185-190; Imberski, R.B. 1971 Isozyme Bull. 5:48; Ursprung, H., W.H. Sofer and N. Burroughs 1970 W. Roux' Arch. 164:201-208.

Supported by grants from the General Research Board of the University of Maryland and the N.S.F. Undergraduate Research Participation Program.

Korochkina, L.S. Institute of Cytology & Genetics, Siberian Branch Academy of Science of USSR, Novosibirsk, USSR.

Change of the ring gland in post-natal development of Drosophila melanogaster Canton S and in 1(2)gl mutant.

On permanent total preparations of the ring gland of Drosophila melanogaster, a study was carried out of the changes of cells and nuclei cell number and volume in peritracheal gland and corpora allata for 3 larval ages in the strain Canton S. The characteristics of the age groups are given in Table 1.

In the larvae mutant for the 1(2)gl gene, the condition of the ring gland was studied at the end of the 3rd larval age, and in the larvae which had survived 20-24 hours at larval stage (Table 2).

The cell number of the ring gland throughout 3 larval ages is unchanged and maintained at the level of 45-55 cells in the peritracheal gland and 18-25 cells in corpora allata.

The volume of nuclei and cells in both glands at the 1st two ages, as seen in Table 1, increases simultaneously, so that the ratio between the mean volume of nuclei and cells of the peritracheal gland, and the corresponding volume in corpora allata remains constant. However, at the period of the 3rd larval age the volumes of cells of peritracheal gland increase sharply, while the cells of corpora allata almost reach their maximal size by the end of the 2nd larval age and change very little during the 3rd larval age. In this connection, peritracheal cells begin to occupy predominant volume in the total structure of the ring gland.

In larvae heterozygous for 1(2)gl gene, the volume of peritracheal gland and corpora allata cells does not differ from those in normal larvae (Table 2). The larvae homozygous for this gene, phenotypically we divided into 2 groups: the 1st group which formed gigantic larvae, and the 2nd group which did not form gigantic larvae. In both groups of homozygous larvae,

Table 1. Size of ring gland in μ3 in Drosophila melanogaster (Canton S) during post-embryonic development.

stage	gland	volume nucleus	volume cells	peritr. gland / CA ratio (nuclei)	peritr. gland / CA (cells)
1st larval stage 1-24 hours	peritr.	150 ± 16	610 ± 90	2, 1:1	2, 6:1
	CA	70 ± 4	234 ± 4		
2nd larval stage 24-72 hours	peritr.	550 ± 60	2100 ± 190	2, 4:1	2, 5:1
	CA	230 ± 40	840 ± 96		
3rd larval stage 72-90 hours	peritr.	2500 ± 186	8800 ± 1416	9, 6:1	9, 7:1
	CA	260 ± 53	900 ± 76		
4th larval stage 90-120 hours	peritr.	3785 ± 272	12710 ± 1096	13, 7:1	10, 4:1
	CA	275 ± 16	1220 ± 86		

Table 2. Size of ring gland in homo- and heterozygous 1(2)gl mutants of Drosophila melanogaster at the 3rd larval stage, in μ3.

larva type	gland	nucleus volume	cell volume	peritr. nucl. / CA nucl. ratio	petitr. cells / CA cells ratio
heterozyg. end of the 3rd larval stage	peritr.	4300 ± 356	14770 ± 1366	14, 8:1	11, 0:1
	CA	290 ± 16	1350 ± 98		
1st group homozyg. (gigantic larvae)	peritr.	1600 ± 201	5760 ± 779	4, 4:1	4, 8:1
	CA	360 ± 16	1200 ± 85		
2nd group homozyg.	peritr.	1400 ± 107	4800 ± 380	10, 7:1	8, 6:1
	CA	130 ± 7	560 ± 63		

there occurred a sharp decrease of volume of peritracheal gland cells (Table 2); however, the condition of corpora allata was different. In the 1st group, CA cells were somewhat larger than normal, so that the volumes ratio was maintained at the level close to that of the 1st two stages of normal larval development. In the 2nd group, where we suppose pseudopupae to have developed, the volumes of CA cells diminished simultaneously with the cells of peritracheal gland, so that the ratio remained at the level characteristic of the end of 3rd larval stage. The number of cells both in peritracheal gland and in CA did not differ from the normal.

It is possible that for the transformation of larvae into pupae, the fact of activity of peritracheal gland cells (and in this connection, the quantity of ecdisone) is not as important as the maintenance of a definite ratio between the activity of peritracheal gland and corpora allata cells.

The author expresses her gratitude to Dr. V. Novak (Prague, Czechoslovakia) for help in work and to Dr. I. Oster from Bowling Green State University for providing Drosophila stocks.

Grace, D. University of Leiden, The Netherlands. Disputant exceptionals from experiments involved in mapping dumpy alleles.

In 1962 Southin and Carlson reported an experiment in which a single exception was found having an outside marker which was contradictory to other results. In a cross involving o-bm x ed cm-2, they found 7 ed recombinants and 1 cl recombinant from 42,000 flies scored (Genetics 47, 1962). This antithesis was not followed up. Over the years a similar situation has arisen three times in my recombination experiments with dumpy alleles. One such fly was found in an experiment involving the dumpy alleles 0-DG531 x ed lv-CB1 cl. From this cross 3 ed and 1 cl recombinants were recovered and verified from 29,000 flies scored. Three separate subcultures were made from the stock using a single ♂ for each line. All three stocks were again mapped with ed lv-1 cl. A total of 16 exceptional ed flies were recovered from the three lines, 12 of which were fertile and verified (86,000 flies were scored). There were no cl recombinants recovered. The "contradictory" recombinants presumably do not result from the process of recombination which is normally encountered within the dumpy region. They may have resulted from a reversion or conversion phenomenon along with a normal recombinational event involving an outside marker. Reversion and/or possibly conversion does occur at a low frequency within the dumpy region. Whatever the mechanism, this is not a normal occurrence at dumpy since from nearly 300 recombinants involving dumpy alleles which have been recovered, only four of these have been cases of disputant exceptionals.

This work was carried out within the framework of the Association between Euratom and the University of Leiden, contract 052-64 I BIAN. Support was also received from the J.A. Cohen Institute for Radiopathology and Radiation.

Vlachová, E. J.E. Purkyně University, Brno, Czechoslovakia. Searching for a technique of application of chemomutagens on melanogaster males in the food.

The effect of the concentration of chemical mutagens is yet little known because of difficulties connected with method of application and exactness of dosage, especially if the mutagen is given in the food.

The effect of concentration in relation to exposure and pre-treatment of males was studied using N-methyl-N-nitrosourea (MNU) and N-ethyl-N-nitrosourea (ENU) in the food. The aim was to find the shortest possible exposure in order to ensure comparability with the irradiation experiments, and to limit chemical changes of the mutagens. Concentrations to 18 mM, exposures of 6, 12 and 24 hours, and different pre-treatments of males were used. The mortality of treated males was taken as a measure of the effect. It was found, for example, that young males kept without water and food for 18 hours, exposed for next 12 hours on filter paper wetted with 15 mM ENU in 5% sucrose, had about 50% survival.

The conditions given above were then tested for induced genetic effects. The frequency of induced lethals and changes of the mean relative viability were studied by means of the Cy technique. The results (see Table) suggest that the described method of application of ENU was effective in inducing both lethals and subvitals:

Pretreatment	Treatment	Chromosomes tested	% Induced lethals	Mean relative viability ± s.e.
none	control	90	.00	31.57 ± .64
without water and food	control	90	.00	30.92 ± .60
none	12 mM ENU	90	4.44	24.78 ± 1.23
without water and food	12 mM ENU	90	7.77	22.65 ± 1.36

Obviously, the effectiveness of the mutagen given in the food can be increased when the males are kept dry and without food before application of the mutagen.

Wheeler, M.R. and L. Wheeler. University of Texas at Austin, Austin, Texas. Notes on some introduced Drosophila in Hawaii.

D. polychaeta was known from Hawaii for many years only from specimens taken by Gordon Mainland at banana baits on the University of Hawaii campus (March 1948). On August 30, 1970 we caught one female at Pupukea, Koolau Mountains, Oahu. A year later (June 1971) we found it on two other islands. It was collected on mangos in Hilo, at baits in Hilo and at Akaka Falls west of Hilo, at bait at both Kamuela and Honokaa; these localities are on the big island, Hawaii. One female was caught at Kokee State Park, Kauai. We got none on Maui although many collecting sites were tried.

D. virilis was found for the first time in Hawaii; one male, one female came to bait behind a small store at Kihei, Maui.

Kaneshiro (pers. Comm.) found Leucophenga in Hawaii for the first time in early 1971. It was L. maculosa, common in North America, and came from the Pohakuloa area, Saddle Road, Hawaii (ca. 6000 ft). He later found three more on Oahu. We captured nearly 40 L. maculosa at baits behind the Kamuela Inn, Kamuela, Hawaii in June, 1971. At least two species of Mycodrosophila have been found by Kaneshiro (pers. comm.), both unidentified but known not to be North American. With these new records, the number of introduced species of Drosophilids in Hawaii is now 22.

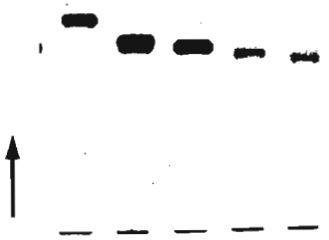
D. melanogaster is rare in Hawaii although simulans is common and widespread. We found both (D. mel. in small numbers) at Prince Kuhio Park, Kauai; at Pulehu Gulch on the upper Haleakala Road, upper Paia, Iao Needle area, and Kihei on Maui; and at the Hukilau Hotel, Hilo, Hawaii. In three localities the numbers were large enough to make comparative male counts, as follows: at Waihee Valley, Maui (mel. = 8.5% of male sample, T = 82); at Lower Paia, Maui (mel. = 22% of male sample, T = 41); and at Manoa Valley, Oahu (mel. = 32% of male sample, T = 56).

Rodinò, E. and G.A. Danieli University of Padua, Italy. Three more alleles at the locus Est^6 in D. melanogaster.

Following the line of investigation previously carried out in our laboratory on the Est^6 polymorphism (Zamburlini, 1971; Rodinò and Martini, 1971), an extensive sampling was made on D. melanogaster wild populations.

In a selected area (garden biotope) of about 500 m^2, samples of the local Drosophila populations were taken regularly from July to October, using fruit traps. Drosophila melanogaster females and other species were discarded while males were collected and examined by acrylamide gel electrophoresis. Details of the technique have been described previously (Zamburlini, 1971).

Six different forms can be identified on the gel slabs stained for Esterase, on the basis of their differential electrophoretic mobilities; two of them are the slow and the fast forms originally described by Wright (1963). A third form (V) with a much greater mobility was reported in a previous DIS research note (46:139). The three new forms found in our sampling can be identified as follows: F1 (faster than F, but slower than V), S1 (slower than S), S2 (slower than S1).



If the relative mobility of each form is compared to the mobility of the most frequent form (S), the following values are obtained: S2 = 0.85; S1 = 0.97; F = 1.07; F1 = 1.11; V = 1.21. The distribution and the frequency of each allele in the population are: S2 = 0.2%; S1 = 1.2%; S = 80.7%; F = 15.7%; F1 = 1.0%; V = 1.2% over a total of 1536 alleles. An attempt was also made to isolate homozygous stocks for all the different electrophoretic varients. From the original population five different stocks have been isolated; specimens from each stock are shown in a slab in Fig. 1. From left to right S1, S, F, F1, V. We didn't succeed in the isolation of the S2 stock, because of the extreme rarity of this phenotype. Reciprocal crosses with flies from these stocks show that these characters segregate as true alleles.

References: Rodinò, E. and A. Martini 1971 DIS 46:139; Wright, T.R.F. 1963 Genetics 48:787; Zamburlini, P. 1971 DIS 46:51.

Futch, D.G. San Diego State College, San Diego, California. A preliminary note on parthenogenesis in D. ananassae.

Virgin females from the genetically differentiated light and dark Drosophila ananassae populations of Samoa have been found to exhibit low rates of parthenogenesis. A small percentage of uninseminated females taken from any of the light and dark stocks, plus a dark stock from Tonga, maintained in this laboratory lay eggs which begin development. Many of these developing eggs die as embryos, but some do survive and develop successfully into adults. All such impaternate adults recovered from unselected laboratory stocks have been females. Although none of these females has produced any impaternate offspring when challenged to do so, most have proved to be fertile when mated.

A systematic examination has been made of Samoan ananassae stocks as well as other ananassae and ananassae-like stocks kept in the San Diego State College laboratory. To do this, individual newly eclosed virgin females were isolated in small shell-vials of cornmeal-agar food medium and were thereafter transferred into fresh vials twice a week for a period of four weeks. Each old vial was kept for observation for at least one week after the transfer. In this manner signs of larval activity, pupal formation, etc. could be noted. At least 100 isolated virgin females from each of the stocks tested have been challenged. As noted above, positive results were obtained from all of our Samoan stocks, as well as the Tongan stock. Egg counts were not made in these tests, so only the percentages of fertile virgin females will be reported here. They are as follows:

	Locality of origin	% virgin ♀♀ fertile
Dark ananassae	Apia, Upolu, Western Samoa	1.0
	Taputima, Tutuila, American Samoa	2.0
	Tongatapu Island, Tonga	7.6
Light ananassae	Apia, Upolu, Western Samoa	2.2
	Aopo, Savaii, Western Samoa	1.2
	Taputima, Tutuila, American Samoa	6.0
	Pago Pago, Tutuila, American Samoa	10.5

Stocks which were tested but which produced negative results are the following: Drosophila ananassae: Merida, Yucatan, Mexico; Honolulu, Hawaii; Palmyra Island; Majuro and Rongerik, Marshall Islands; Suva, Viti Levu, Fiji; Rarotonga, Cook Islands. New Guinea ananassae: Port Moresby, Papua; Popondetta, Papua.

An entirely parthenogenetic line of light ananassae has been established from the Taputimu light stock. This line was begun by one female after four generations of selection. The selection was done by crossing isolated parthenogenetic females taken from the Taputimu light stock to single males also from the Taputimu light stock. Daughters produced by these crosses were tested individually for parthenogenesis and those showing parthenogenesis were mated individually to several of their brothers. The F_2 daughters of these crosses were treated in the same manner as their F_1 mothers. In this way F_3 and F_4 generations were produced. The F_4 female used to start our parthenogenetic line showed an unusually high degree of parthenogenetic fertility producing 21 impaternate offspring; 20 daughters, 15 of which proved to be parthenogenetically fertile, and one sterile son, presumably XO. This stock has now been maintained in relatively vigorous condition for 25 generations. 99.5% of the flies in this stock are normal appearing, apparently diploid females; 88% of those tested have shown parthenogenetic fertility with a successful egg-adult development in 3% of the eggs laid. About 0.5% of the flies are males which have all been shown to be sterile when tested and are undoubtedly XO.

The mechanism involved in the development of uninseminated eggs of this parthenogenetic line of light Samoan ananassae may be identical to the automictic type of parthenogenesis in Drosophila mercatorum reported by Carson, Wei, and Niederkorn (1969) in which approximately 94% of the impaternate offspring produced by females heterozygous at one locus are homozygous for one or the other of the two alleles and only about 6% are heterozygous like their mothers. In one of our experiments, females heterozygous for a recessive mutant allele in chromosome 3 (the gene is probably homologous to abrupt in D. melanogaster; wing vein L V is terminated distally just beyond its intersection with the posterior crossvein in homozygotes) produced 108 impaternate daughters (64 wild-type and 44 abrupt) which were fertile in testcrosses. Of this 108, 44 were homozygous abrupt, 60 were homozygous wild-type, and only 4 (3.7%) were heterozygous for the two alleles.

Reference: Carson, H.L., I.Y. Wei and J.A. Niederkorn, Jr. 1969 Genetics 63:619-628.
This work was supported in part by San Diego State College Foundation Grant No. 233002(706).

Kernaghan, R.P. S.U.N.Y. at Stony Brook, New York. Intracellular symbionts in the larval gonad of Drosophila paulistorum.

A Mycoplasma-like organism has been implicated in the hybrid male sterility observed in crosses between some semi-species of Drosophila paulistorum (Kernaghan and Ehrman 1970a). Further support for this hypothesis is provided by the observation of an increase in the proportion of fertile F_1 males when such hybrids are allowed to develop upon media containing antibiotics known to suppress the growth of these organisms (Kernaghan and Ehrman 1970b). Except in rare circumstances, the testes of the sterile hybrid male is the only adult male organ infected by this symbiont (Kernaghan 1971a).

Fertile sisters of sterile male hybrids have the ability to produce sterile sons. Coincident with this ability is the observation of similar Mycoplasma-like organisms within the germinal and nutritive cells of the ovary as well as within the mature unfertilized egg (Ehrman and Kernaghan 1971). Numerous such organisms may be dispersed throughout the matrix of a single egg. Following fertilization, such symbionts could be captured as cell boundaries are established.

In larval development the gonad is segregated early as an isolated island of cells. Examination of the third instar F_1 hybrid larval gonads of both sexes commonly reveals the presence of many Mycoplasma-like organisms within the cytoplasm of these cells. (See Plate 1) Often every cell of such a larval gonad exhibits one or more clusters of this microorganism. As an intracellular symbiont of these larval gonad cells, the microorganism is often enclosed within a cytoplasmic vacuole exhibiting concentric lamellar layers of granular endoplasmic reticulum or limited by a dense region formed by the juxtaposition of the outer membrane of the organism and the vacuolar membrane of the host (Kernaghan 1971b). At the ultrastructural level these microorganisms appear to be similar if not identical in morphology to the organisms observed in the adult sterile testes, adult hybrid ovary and the fertilized egg.

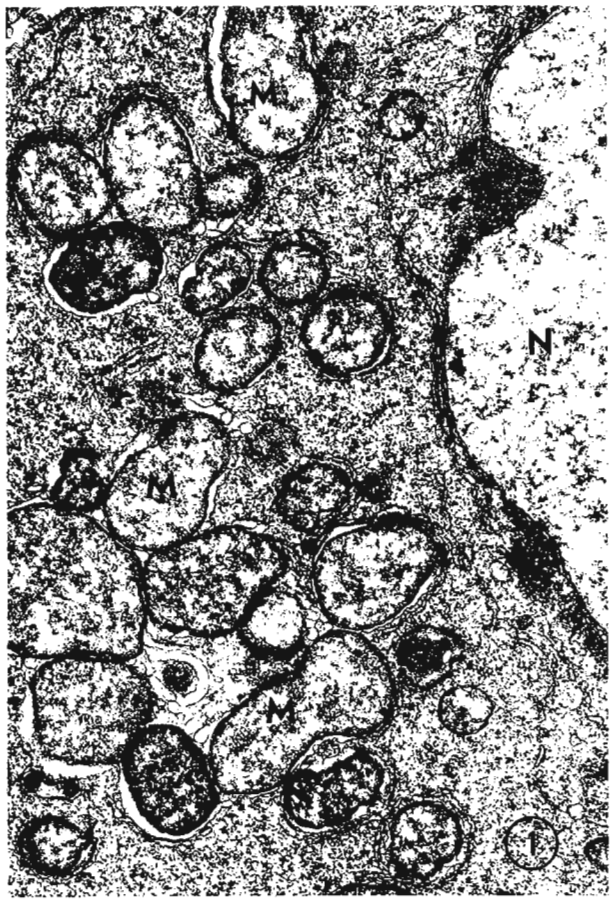


Plate 1. An electron micrograph of a perinuclear area of a cell from an F_1 hybrid third instar larval gonad showing many pleomorphic microorganisms dispersed throughout the cytoplasm. Note the reticulate form of the organism and the electron dense area at the periphery. Also illustrated are lamellar arrays of concentric granular endoplasmic reticulum surrounding some symbionts. N = nucleus, m = mycoplasma-like organisms. From a cross Mesitas females x Santa Marta males. 18,500X.

Should these forms prove to be identical, the segregation of these microorganisms to the larval gonad assures transmission of the symbiont to the adult structures derived from these primordia. The microorganism involved in hybrid male sterility in Drosophila paulistorum then exhibits a special tissue affinity to effect direct passage from the female parent via the egg cytoplasm to the reproductive organs of the adult. R.P. Kernaghan acknowledges support of NIH Grant # AI09945.

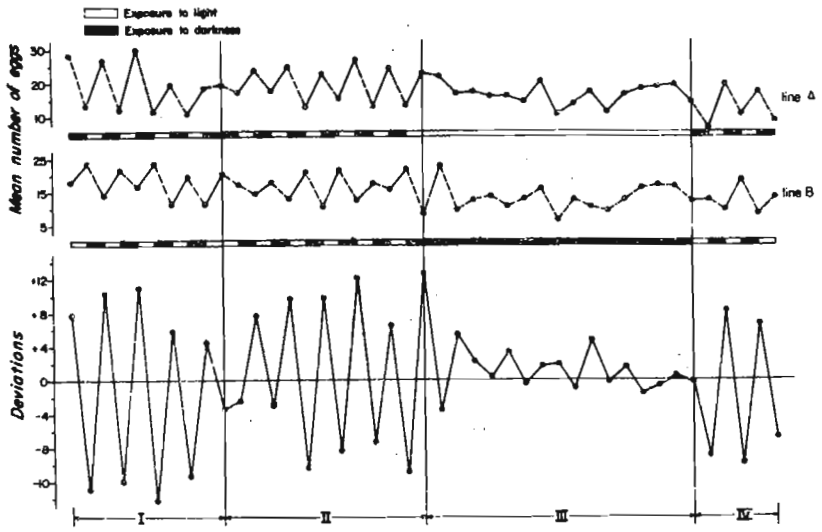
References: Ehrman, L. and R.P. Kernaghan 1971 J. Hered. 62:66; Kernaghan, R.P. 1971a Prod. 11th Ann. Meet. Amer. Soc. Cell Biol. 149:290; _____ 1971b DIS 47:69; Kernaghan, R.P. and L. Ehrman 1970a Chromosoma 29:291; _____ 1970b Science 169:63.

Kambysellis, M.P.* and M.R. Wheeler. University of Texas, Austin, Texas.

Light-dependence of oviposition in D. virilis.

In studies of oviposition in D. virilis we observed a striking difference between the number of eggs laid during the day and night time. Thirty females, ten days old, were placed individually in Plastainer bottles (Richardson, R.R. DIS 42, 1967) together with two males per bottle and allowed to lay eggs for a period of 12 hours. The illumination was controlled as follows:

I. Fifteen of the flies (Line A) maintained in 12 hrs darkness (12D) followed by 12 hrs of light (12L), while the other fifteen (Line B) were exposed to reverse illumination, 12L:12D. II. After ten sets of observations the conditions in both lines were reversed. III. After ten more observations, Line A was placed in continuous light and Line B in continuous darkness for 8 days. IV. Finally, Line A was placed in 12D:12L and Line B in 12L:12D.



The results summarized in Figure 1 show that at each observation in the sets I, II and IV, the mean number of eggs laid during the illuminated periods was significantly larger than those of the dark periods. No significant difference was found during continuous darkness or light (set III).

The deviations between the mean number of eggs for Line A and Line B for each set of observations illustrate more clearly the significance of illumination on the oviposition. Since the light conditions for each line were consistently the mirror image of each other, assuming that the alternation of light-darkness environment of the flies is the only or the primary stimulus for the periodicity, then we should expect the deviations in sets I, II and IV would take successive positive and negative values, the magnitude of which will indicate the significance of the difference between the means. In set III, the deviations should be equal to zero, if alternations of illumination is the only causal factor. Positive or negative values would be observed if a free running rhythm exists in light or dark environment. The lower part of Figure 1 shows that in sets I, II and IV, each positive value of the deviation is followed by a negative one, indicating that increased egg productivity in one of the lines is accompanied by a decrease in egg productivity for the other line.

In set III, the deviations fluctuate near zero, with a slight preference toward positive values. This indicates that an increase or decrease in egg productivity in Line A is accompanied by a parallel increase or decrease in Line B. A free running rhythm cannot be detected if the flies are considered as a group, although several individuals showed a clear persistence of the rhythm in total darkness.

*Present address: Department of Biology, New York University, University Heights, Bronx, New York.

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Behnia, A. and G. Koliantz. Teachers Training College, Tehran, Iran.

Genetic viability in D. melanogaster.

In the summer 1971, flies were collected from north of Tehran and lethal effects of the population were compared with a cage population. The Cy/Pm;D/Sb method was used for the detection of lethals, and in the F_3 four kinds of phenotype (Cy Sb, Cy, Sb, +) with the ratios of 4, 2, 2, 1 respectively, were observed (Tsuno,

1970). The following results were observed:

1) The frequency of lethal genes in the natural population was 32.5% for the third chromosome and 8.3% for the second.

2) In the cage population the frequencies of both second and third chromosome lethals were at the same level, 11.7%.

3) No significant differences were observed in sl + sv genes on both chromosomes in the cage and the natural populations.

4) Between 14 Cy/l genotypes in the cage population, 45 (observed) crosses were made and 6 (with the frequency of 13.3%) were observed to be alleles. The same percentage was calculated for the third chromosome. From the natural population, 2 alleles for the second and 18 for the third chromosomes were observed. The frequencies were 4.4% and 7.2% respectively. All flies were raised in Mostashfi medium and reared at 23 ± 1°C.

Conclusion: In natural populations of D. melanogaster in Tehran, the number of lethal genes on the third chromosome is higher than the second chromosome. In cage populations (set 15 years ago), the frequencies of lethal genes on both major autosomes are in equilibrium. No seasonal changes are observed in the natural population of Tehran.

Gerasimova, T.I., V.A. Gvozdev and V.J. Birstein. Kurchatov's Institute of Atomic Energy, Moscow, USSR. Position effect variegation of Pgd locus determining 6-phosphogluconate dehydrogenase in Drosophila melanogaster.

The structural gene Pgd for 6-phosphogluconate dehydrogenase (6PGD) was located at 0.65 to the left of pn locus of the X-chromosome of D. melanogaster (1). Position effect variegation of Pgd locus has been studied in the duplication Dp(1;f)R carrying the Pgd^A allele. This duplication covers y to kz (according to Schultz's data). Flies were cultivated at 18° in order to increase the extent of variegation. We have obtained the marked variegation for sc, dor and pn loci for XO males only. The specific activity of 6PGD in these mosaic XO males was compared with that of non-mosaic XY males. The results demonstrate that the variegation for dor, sc and pn correlates with the decrease of 6PGD activity. Various genotypes and X-chromosomes were used for the study of the position effect for Pgd locus (see Table). In the first two series of experiments the specific activity of 6PGD of XO males has been diminished approximately to 80% level of XY males. In the third series with X-chromosome lacking the Pgd locus (Pgd-kz deficiency) the enzyme activity of XO mosaics was reduced to 70% level of non-mosaic XY males. In this latter series the genotype of mosaic males differed from that of non-mosaics by the absence of Y-chromosome only.

The ratio of 6PGD specific activities of mosaic (XO) to non-mosaic (XY) males.

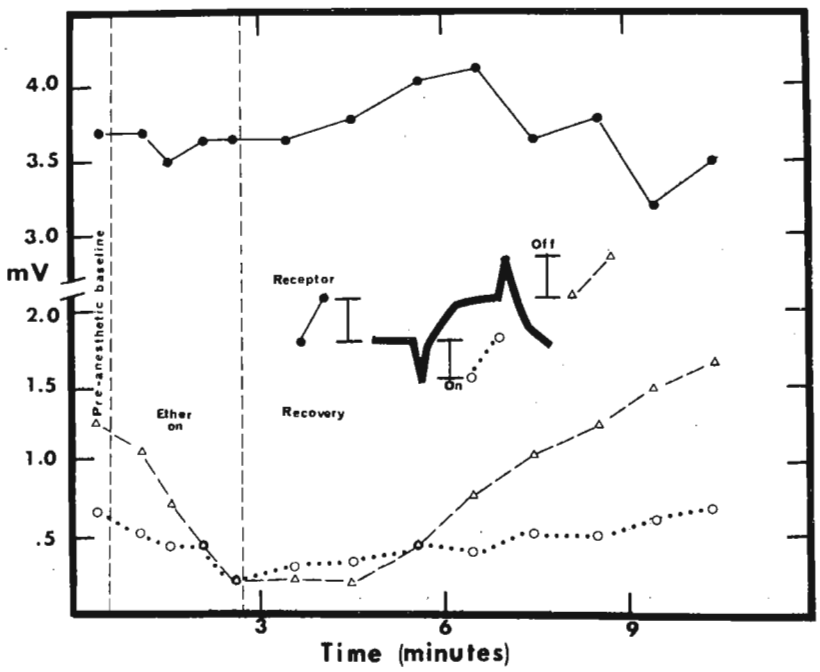
Series of exp.	No of tests	Markers of X-chromosome	Character of variegation	XO:XY ratio of 6PGD activities
1	11	y dor^1 Pgd^A	dor^v	0.79 ± 0.03
2	13	y ac sc Pgd^B w	sc^v	0.83 ± 0.02
3	15	Df(1)Pgd-kz (Pgd^- pn^-)	pn^v	0.71 ± 0.05

The elimination of Y chromosome from normal males without rearrangements leads to 20% increase of 6PGD activity. Therefore the absence of Y chromosome masked the true decrease of Pgd locus inactivation induced by position effect. The isozyme patterns of 6PGD obtained in acryl amide gel electrophoresis of crude extracts of XO and XY males carrying Pgd^B in the X-chromosome and Pgd^A in duplication Dp(1;f)R have been compared (see Table, the second series of experiments). The Pgd^A allele determines the fast isozyme of 6PGD and the Pgd^B the slow one (2). In the XO males the activities of the fast and hybrid isozymes were diminished while that of the slow one was not affected. We interpret the decrease of the total 6PGD activity and the change of isozyme pattern in phenotypically expressed mosaics as result of variegated position effect of Pgd locus.

References: 1. Gvozdev, V.A., V.J. Birstein and L.Z. Faizullin 1970, Moleculjarnaja Biologia (Russ.) 4:876; 2. Young, W.J. 1966, Science 57:58.

Stark, W.S. University of Wisconsin, Madison, Wisconsin. The effect of ether and carbon dioxide on the components of the ERG of Drosophila.

By fixing adult Drosophila melanogaster on the surface of hardening agar at room temperature, one can prepare specimens for recording the electroretinogram (ERG) without prior anesthetization. This preparation can be used to study the effects of anesthetics on the ERG during recording. The agar fixation is gentle enough to permit subsequent release of flies which can live for several weeks and mate. With the agar block in the bottom of a chamber, ether vapor or pure CO_2, both heavier than air, can be made to surround the preparation and can later be removed by blowing fresh air into the chamber.



The accompanying figure shows the typical effect of anesthetic ether on the ERG of an Oregon-R wild-type male eclosed within the past 24 hr. It was consistently found that the off-transient was diminished most, while the on-transient was also selectively reduced. Short etherization was usually followed by complete recovery. Etherization for longer than 3 min often irreversibly blocked both transients and sometimes also lowered the receptor wave. It cannot be determined how the time scale in these experiments corresponds to the typical 20-30 sec. anesthetization of flies in an etherizer since the agar might protect the fly with a small pocket of air.

Carbon dioxide also diminished both transients selectively and reversibly. The off-transient usually disappeared in less than 5 sec., and the on-transient in less than 10 sec. when pure CO_2 was applied to the preparation. Recovery usually took about the same time as the period of exposure. Long exposure sometimes permanently altered the ERG, although recovery from 5 min exposure has been seen. Probably permanent alterations in the ERG with ether or CO_2 are cuased by near-lethal effects of over-anesthetization and would not take place with normal anesthetization.

These anesthetics cause the ERG to look like the ERGs of the blind mutants such as tan and ebony whose ERGs have been characterized by Hotta and Benzer and Pak, Grossfield, and White. The metabolic and synaptic effects of CO_2 and ether may provide a clue to the mechanism of action of the genes causing blindness without impairing receptor function.

References: Hotta, Y. and S. Benzer 1969 Nature 222:354-356; Pak, W.L., J. Grossfield, and N.V. White 1969 Nature 222:351-354.

Supported by NSF grant GB-8581, an NSF predoctoral fellowship, and by the Wisconsin Alumni Research Foundation.

Chinnici, J.P. Virginia Commonwealth University, Richmond, Virginia. The effect of age on crossing over in the X-chromosome of Drosophila melanogaster.

Recently, I have published the results of a bi-directional section experiment (involving both family and chromosomal selection) which resulted in an increase and a decrease in the amount of crossing over between the sex-linked genes sc and cv in Drosophila melanogaster (Chinnici 1971). Recombination of the regions cv-sn^3 and sn^3-m were also followed throughout the course of the experiment. In odd-numbered generations, the progeny of 14 to 37 single-pair (family)

Table 1. Regression coefficients of standardized crossover values on age of the female parent. The L and H notations indicate low and high lines, respectively.

Generation	Region of X-Chromosome and Rank [(1) > (2) > (3)]		
	sc-sc	cv-sn3	sn3-m
1	+0.0206 (1)	+0.0125 (2)	-0.0021 (3)
3L	+0.0192 (1)	+0.0045 (3)	+0.0097 (2)
3H	+0.0088 (2)	+0.0120 (1)	+0.0003 (3)
5L	+0.0139 (2)	+0.0259 (2)	-0.0056 (3)
5H	+0.0204 (2)	+0.0406 (1)	+0.0039 (3)
7L	+0.0104 (1)	+0.0057 (2)	+0.0030 (3)
7H	+0.0150 (1)	+0.0080 (3)	+0.0113 (2)
9L	+0.0228 (1)	+0.0154 (2)	-0.0016 (3)
9H	+0.0261 (1)	+0.0202 (2)	+0.0014 (3)
11L	+0.0191 (1)	+0.0146 (2)	+0.0104 (3)
11H	+0.0214 (1)	+0.0117 (2)	-0.0026 (3)
13L	+0.0165 (1)	+0.0092 (3)	+0.0099 (2)
13H	+0.0303 (1)	+0.0031 (3)	+0.0063 (2)
15L	+0.0443 (1)	+0.0196 (3)	+0.0246 (2)
15H	+0.0328 (1)	-0.0124 (3)	+0.0229 (2)
17L	-0.0112 (3)	+0.0533 (1)	+0.0029 (2)
17H	+0.0158 (2)	+0.0485 (1)	+0.0062 (3)
19L	+0.0327 (1)	+0.0074 (2)	-0.0140 (3)
19H	+0.0078 (1)	-0.0066 (3)	-0.0009 (2)
21L	+0.0163 (2)	+0.0272 (1)	+0.0029 (3)
21H	+0.0118 (1)	-0.0649 (3)	+0.0054 (2)
23L	+0.0225 (2)	+0.0509 (1)	+0.0047 (3)
23H	+0.0225 (2)	+0.0504 (1)	-0.0052 (3)
25L	+0.0270 (2)	+0.0356 (1)	+0.0130 (3)
25H	+0.0093 (1)	+0.0056 (2)	+0.0001 (3)
27L	+0.0411 (2)	+0.0536 (1)	-0.0092 (3)
27H	+0.0191 (1)	+0.0039 (3)	+0.0077 (2)
29L	-0.0098 (2)	-0.0150 (3)	-0.0077 (1)
29H	+0.0106 (2)	+0.0323 (1)	-0.0152 (3)
31L	+0.0282 (2)	+0.0365 (1)	+0.0229 (3)
31H	+0.0033 (2)	-0.0305 (3)	+0.0097 (1)
33L	+0.0074 (2)	+0.0406 (1)	+0.0045 (3)
33H	+0.0215 (2)	+0.0370 (1)	-0.0031 (3)
45L	+0.0006 (3)	+0.0249 (1)	+0.0194 (2)
45H	+0.0185	+0.0097 (1)	+0.0054 (3)

Table 2. Analysis of rankings of regression coefficients found in Table 1 by the ranking correlation W.

High Line (H)

Ranking	Frequency of Ranking Region of X		
	sc-cv	cv-sn3	sn3-m
1	11	6	1
2	7	5	6
3	0	7	11
Sum	25	37	46

W = 0.3425
z = 1.4469
P > 0.01

Low Line (L)

Ranking	Frequency of Ranking Region of X		
	sc-cv	cv-sn3	sn3-m
1	8	9	1
2	8	5	5
3	2	4	12
Sum	30	31	47

W = 0.2803
z = 0.9450
P > 0.01

matings were scored to determine the amount of crossing over in the heterozygous female parent. Since each family mating was set up so that the parents were allowed four consecutive 3-day laying periods, the data could be analyzed to determine the effect of female ageing on crossing over between these sex-linked genes. All female parents were two days old at the beginning of the first laying period.

The data thus obtained were analyzed in the following manner: 1) The crossover frequency in each region of the X for each age group was determined for each family.

2) Each crossover percentage was transformed into angular values and the mean crossover value for each region was determined using the transformed data.

3) The three X-regions were standardized for differences in mean crossover values so that they could be directly compared for change in recombination over time per map distance. For each region, this was accomplished by dividing the mean crossover value for each laying period by the value obtained for the first laying period. This gave each region a mean crossover value of 1.0 for the first laying period, with the values for the other laying periods being expressed as proportions of this standardized map length.

4) Regression analysis of standardized crossover values for each laying period on mean age of the female parent for that period (3 days old for the first, 6 days for the second, 9 for the third, and 12 for the fourth) was performed for each region. These regression coefficients (b) are listed in Table 1. In each generation, these b values were ranked, with a value of 1 given to the highest b, 2 to the second highest, and 3 to the lowest b.

5) The Coefficient of Concordance (W; see Kendall, 1962) for the total rankings of the 18 low line family mating generations and the 18 high line family mating generations for each region were calculated. A non-parametric ranking statistic (W) was used because regression coefficients calculated by using standardized values may not be parametrically compared. W was used to test the significance of ranking orders by employing Fisher's z-test (Kendall, 1962). These statistics are presented on Table 2.

These data may be summarized as follows. For all of the three X-chromosome regions analyzed, ageing of the female parent has a very small positive effect on recombination frequency. By rank correlation analysis (W), it has been shown that sc-cv $>$ cv-sn^3 $>$ sn^3-m in the magnitude of this ageing effect.

Bridges (1915) and Plough (1921) both tested the effect of increasing age of the female parent on recombination in the X-chromosome of D. melanogaster and both concluded that ageing did not affect the rate of recombination in the X. However, Plough's data show a very small change in recombination in the entire chromosome. This small change is directional since the sc-ec (most distal) region shows a small increase with age, ec-ct shows a smaller increase, ct-v shows a slight decrease, and v-g (most proximal region) shows a slightly greater decrease. He also observed a large increase in crossing-over in the g-f region, which is quite close to the centromere. The very small magnitude of these changes led Plough to disregard them. Rendel (1957), however, found that increasing age of female parents caused a significant decrease in crossing-over between sex-linked genes, with or without the presence of the second chromosome inversion Curly.

The data gathered in the present experiment agree well with those of Plough (1921). In each of the three X-chromosome regions studied, recombination increased very slightly, though significantly, with sc-cv $>$ cv-sn^3 $>$ sn^3-m in the magnitude of increase. It appears, therefore, that female ageing in Drosophila, besides affecting the frequency of recombination significantly in chromosomes 2 and 3 (Plough, 1921; Bridges, 1915, 1927), also affects recombination in the X-chromosome, but in a polarized fashion and to a smaller extent. Rendel's observations are inconsistent with this statement, for reasons which are not understood.

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Higgins, C.O. and B. Hochman. University of Tennessee, Knoxville, Tennessee. Free amino acids and the genetic control of transfer RNA in Drosophila.

Minute (M) mutations have been detected at some 55 different loci distributed over the four chromosome pairs of Drosophila melanogaster. Regardless of the mutation's location, or whether the M^+ gene has been delated or simply altered to an M allele, the phenotypic effects of the genetic changes are essentially similar; i.e., homozygotes (M/M) die as embryos or larvae and heterozygotes (M^+/M) have delayed development, short, thin bristles and reduced viability and fertility.

One hypothesis (advanced by Atwood and Ritossa) for the Minute syndrome is that the various M^+ genes each specify a particular transfer RNA and heterozygotes (with only one dose of a normal gene) suffer from a reduced protein synthesizing capacity while M/M flies die due to inability to utilize adequately the amino acid corresponding to the species of t RNA they are unable to encode. (See Ritossa et al., 1966.)

There is at least one M^+ locus on the fourth chromosome in D. melanogaster. As a test of the above hypothesis, we measured the free amino acids in samples of 150 adults carrying different doses of chromosome 4 and of the M^+ gene(s) therein situated. Our idea was simply that an otherwise diploid fly with one fourth chromosome (haplo-4) might exhibit a higher concentration of at least one amino acid than normal (diplo-4) individuals. Actually, the tests involved eleven different genotypes as follows: triplo-4, c(4)RM (attached-4), Oregon-R and Canton-S (two wild-type diploid strains), $M(4)^{57g}$/Df(4)G, $M(4)^{63a}/ci^D$, Df(4)M/ey^D, Df(4)M/Df(4)G and two haplo-4 types (Oregon-R and Canton-S). ($M(4)^{57g}$ is a presumed point mutation, $M(4)^{63a}$ is a small deletion and Df(4)M a large deficiency for the M^+ and neighboring loci, Df(4)G is a deficiency for the distal 10-15 percent of the chromosome, ey^D is a small duplication and ci^D is a dominant visible.)

Samples were prepared both from flies fed on a standard medium and those fed only a 1% sucrose solution for 48 hr prior to the extraction of amino acids. The effect of differences in age of adults (0-24 hr versus 72-96 hr) on amino acid content was also examined. A Beckman-Spinco amino acid analyzer, located at the University of Tennessee Medical Research Center and made available through the courtesy of Dr. D. Dupourque, was utilized.

Fifteen amino acids were found in measurable amounts in all samples tested and traces of threonine were also detected. Technical difficulties prevented the resolution of asparagine, cysteine, glutamine and tryptophan. The concentration of proline was consistently highest followed by serine, glutamic acid and arginine in order of abundance varying from sample to sample.

On the basis of t-tests it was concluded that no important differences existed between the samples of fed and 48 hr-"starved" flies and the two sets of data could be considered experimental replicates. To test the eleven genotypes for possible significant differences in amino acid content, Duncan's multiple range tests were performed. It was found that the concentration of proline was significantly different between triplo-4 and attached-4 samples and that the concentration of alanine in Oregon-R differed significantly from that in triplo-4, attached-4, $M(4)^{63a}/ci^D$ and Df(4)M/ey^D. These differences, however, were not correlated with the number of doses of chromosome 4 or the M^+ locus.

While apparent differences in amino acid content were found between one and three day old adults, the absence of replicates precluded statistical analysis.

These results confirm what others (Chen, 1962 and Fahrig, 1970) have reported for free amino acids in Drosophila and other insects but they do not support the Atwood-Ritossa hypothesis. On the other hand, no outright rejection of the hypothesis is warranted for the following reasons: (1) The M^+ locus on 4 might specify a t RNA for one of the four amino acids not measured in these experiments; (2) The small number of replicates in this study (dictated by insufficient funds) unfortunately engendered a high within-group error. Significant differences in amino acid content, correlated with doses of M^+, may exist but statistical limitations prevent their exposure; (3) It is possible that an amino acid in high concentration as a result of t RNA inadequacy may be altered or metabolized so as to render it undetectable by the methods here employed.

Additional studies, in which all of the common acids are measured and a greater number of replicates of the crucial genotypes (haplo-4, diplo-4 and triplo-4) are tested, are required before conclusive evidence, either confirming or rejecting the hypothesis, can be obtained. Results from such experiments could then be compared to proposed nucleic acid hybridizations of 4s RNA (t RNA) with polytene chromosome DNA (Steffensen and Wimber, 1971) to determine the correctness of the postulated M^+ - t RNA relationship.

Literature cited: Chen, P.S. 1962 In Amino Acid Pools, pp. 115-135, Elsevier, Amsterdam; Fahrig, R. 1970 DIS 45:62; Ritossa, F.M., K.C. Atwood and S. Spiegelman 1966 Genetics 54: 663-676; Steffensen, D.M. and D.E. Wimber 1971 Genetics 69:163-178.

Premlatha, N. and M. Sanjeeva Rao Osmania University, Hyderabad, India. Induction of mutations by thioridazine hydrochloride in Drosophila melanogaster.

The pioneering work of Auerbach and Robson (1942) on the chemical induction of mutations by mustard gas in D. melanogaster followed by an extensive study on chemical induction of mutations led us to understand how the genes act. Various chemicals have been tried for their genetic damage in various organisms. However, the studies on the mutagenic potential of tranquilizers has been scanty. The review available was only on their toxic and physiological effects. With a view to find out whether these tranquilizers commonly used would also produce genetic damage, experiments were undertaken to assess the damage, if any, of thioridazine hydrochloride, a chemical which is one of the most important ingredients in tranquilizers.

Oregon-K strain of D. melanogaster flies were allowed to feed on a normal medium containing 10 mgs of thioridazine hydrochloride for every 100 cc of food and 20 mgs. of the chemical for every 100 cc of food. The males developed on these media were crossed to y sc^{S1} In-49 sc^{8}; bw;st virgin females, to screen the incidence of sex-linked recessive lethals and translocations. A brood pattern of 3 days interval was used and six broods were studied. Each male was allowed to mate with 3 virgin females. The virgin F_1 females were mated individually with y sc^{S1} In-49 sc^{8} males, while the F_1 males were mated individually with bw;st virgin females to score for sex-linked recessive lethals and translocations respectively. The results are presented in Table 1.

Table 1.

Sex-linked recessive lethals.

Brood	Control			thioridazine hydrochloride 10mg/100cc food			thioridazine hydrochloride 20mg/100cc food		
	T	l	%	T	l	%	T	l	%
A Brood	1336	3	0.22	477	6	1.34	362	4	1.10
B Brood	1716	8	0.47	424	6	1.40	364	1	0.27
C Brood	1894	3	0.24	322	5	1.52	243	3	1.23
D Brood	1599	7	0.43	123	4	3.25	257	7	2.72
E Brood	1015	0	-	283	10	3.60	301	12	3.98
F Brood	1073	3	0.27	179	4	2.23	125	4	3.20
Translocations									
				T	t	%	T	t	%
A Brood	1516	0	-	388	0	-	357	0	-
B Brood	1496	0	-	411	2	0.48	486	4	0.82
C Brood	1668	0	-	276	1	0.39	152	4	2.62
D Brood	1539	0	-	173	4	2.30	244	4	1.63
E Brood	1321	0	-	229	6	2.62	264	3	1.52
F Brood	1367	0	-	295	8	2.71	300	4	1.33

T = total number of X chromosomes or F_1 sons scored
l = lethals recorded
t = translocations recorded

The chi square test has been done to compare the following groups: 1) control versus thioridazine hydrochloride, 10mg/100cc food; 2) control versus thioridazine hydrochloride,

20mg/100cc food; 3) thioridazine hydrochloride 10mg/100cc food versus thioridazine hydrochloride 20mg/100cc food. The results of statistical analysis are presented in Table 2.

Table 2. Chi square values for the difference in sex-linked recessive lethals for the groups compared.

Group	Brood A	Brood B	Brood C	Brood D	Brood E	Brood F
1. Control vs 10mg	3.97	4.71	14.87	14.37	-	10.54
2. Control vs 20mg	2.09	0.03	8.90	15.90	-	15.84
3. 10mg vs 20mg	0.37	4.33	0.45	0.37	0.087	0.26

The statistical analysis of the data presented in Table 2 clearly established that the chemical thioridazine hydrochloride is mutagenic more particularly in the pre-meiotic stages of the germ plasm.

Paik, Y.K. and K.C. Sung. University of Hawaii, Honolulu, Hawaii. Altitudinal survey of "cosmopolitan" species of Drosophila on the island of Hawaii.

An extensive effort is being made by Professors Carson and Hardy of the University of Hawaii and their collaborators toward understanding the evolutionary process of endemic Hawaiian drosophilids, which represents one of the most striking examples of "explosive" evolution known in the animal kingdom. Parallel study of cosmopolitan species on the islands is highly desirable. For this reason, a pilot survey on the distribution of introduced species with elevations was attempted in 1971 on the island of Hawaii. The bait used for trapping was yeasted banana and collection was done twice at the same testing sites as shown in Tables 1 and 2.

Table 1. Drosophilid species and relative abundance collected at different altitudes in the vicinity of Hawaii Volcanoes National Park between April 7 to 11, 1071

	Collecting Sites							
	Mauna Loa Strip Road					Kilauea Forest	Main Road	
Species	4000'	4300'	5100'	6100'	6700'	5300'≠	3000'	Total
D. immigrans*	301	138	164	13	22	11	36	685
D. simulans*	73	45	127	1			38	284
D. busckii*			107	21				128
D. mercatorum*			1					1
D. kikkawai*							3	3
D. engychoracea	5	4						9
D. mimica·		29						29
D. imparisetae		18	2					20
D. pectinitarsus		1			3			4
D. basisetosa		1						1
D. silvestris						1		1
D. murphyi						1		1
D. fungiperda		1						1
Fungus feeder spp.	1	1						2
D. reducta	1		10					11
Antopocerus sp.							1	1
S. cuspidata		10	46	7	8	2		73
S. (Tantalia)sp.		6						6
D. trichaetosa						2		2
D. sp. (mitchell?)							1	1
Total	381	254	457	42	33	17	79	1263

*Denotes introduced species; ≠ A virgin rain forest

Table 2. Collection between December 23 - 27, 1971.

Species	Collecting Sites: Mauna Loa Strip Road 4000'	5100'	6700'	Kilauea Forest 5300'	Total
D. immigrans*	463	110	3	38	614
D. simulans*	71	5			76
D. mimica	13		1		14
D. imparisetae	4				4
D. fungiperda	1				1
D. reducta	1	1			2
D. silvestris				3	3
D. undulata				2	2
S. (Trogloscapto.) sp.		11	3	3	17
S. (Tantalia) sp.		1			1
Total	553	128	7	46	734

The most noticeable feature from the tables is that among the cosmopolitan species collected, D. immigrans occurs as a majority and its ecological tolerance appears to be the widest at the high elevations. This is plausible evidence of a great colonizing ability of this species. The data further show the success of this species in the endemic niches of mountain sides on the island. Another interesting point of this collection is the abundant occurrence of D. busckii, known as domestic species, in the first collection at the high elevations between 5000 and 6000 feet. Whether or not the populations were temporary ones is not clear.

Acknowledgements: The authors are most grateful to Mr. K. Kaseshiro of the Department of Entomology for the classification of Drosophilid species during the present survey.

Alexandrov, I.D. Research Institute of Medical Radiology, Academy of Medical Sciences of U.S.S.R., Obninsk, U.S.S.R.

The test of antimorphic action of w mutations in D. melanogaster x D. simulans hybrids.

It had been described (DIS 46:72) that the drastic difference in antimorphic action of two pseudo-allelic w mutations (w^{10gA} and w^{69gA}) was manifested in twelve different lineal hybrids of D. melanogaster. The further analysis of action of these w mutations in D. melanogaster x D. simulans hybrids was undertaken. Hybrids from crosses of w^{10gA} or w^{69gA} homozygous females of D. melanogaster to wild-type males of D. simulans were obtained. The quantities of red eye pigments in hybrid females were estimated by spectrophotometric method, described previously (DIS loc. cit.). In addition, the determinations of red eye pigments in w^+/w^+ females of D. simulans of the same origin as the males were made. The quantities of red pigments were expressed as the extinction (E) per 10 heads extracted per 1 ml of 30% AEA.

The results of these analyses listed in the table below are essentially self-explanatory.

Genotype of females	E*	Conf. limits at $P_{0.05}$
1. D. simulans (w^+/w^+)	1.195	1.243 - 1.147
2. Hybrids (w^+/w^{10gA})	1.028	1.050 - 1.006
3. Hybrids (w^+/w^{69gA})	0.874	0.898 - 0.850

*Means of at least 12 repetitions

The mean E values for both hybrids differ significantly from one another as well as from the E value for w^+/w^+ females of D. simulans. These data appear to confirm our early assumption that the influence of w mutations studied is a locus-specific rather than a genotypic one. The data suppose the functional homology of w^+ locus in both species.

Falke, E.V. and T.R.F. Wright University of Virginia, Charlottesville, Virginia.

Induction of dominant temperature sensitive lethals into the CyO balancer, (In 2LR)O, and the Pm balancer, (In2LR)bw^{V1}, chromosomes.

Certain selection schemes for the recovery of mutations could be run more efficiently if an autosomal balancer chromosome were available which also carried a dominant temperature sensitive mutation (DTS). For this reason an attempt was made to induce a DTS into the Pm, CyO, TM2, and TM3 chromosomes.

Males heterozygous for the balancer chromosome were fed with 0.025M EMS in 1% sucrose (Lewis and Bacher, DIS 43:193, 1968). Virgin females were collected using Wright's method (DIS 44:63, 1969) except Cross 1 virgin females were collected in the usual way.

Scheme for inducing a DTS into the Pm balancer.

Cross 1 OR virgin ♀♀ X Pm/mr bs^2 EMS fed ♂♂

$22^{\circ}C$

Cross 2 (5 $\overline{XX}$/Y virgin ♀♀ X 1 Pm*/+ ♂)$_n$

Vial 1 at $22^{\circ}C$ — After 4 days transfer parents → Vial 2 at $30^{\circ}C$

Live	Pm*/+	Pm-eyed	Die
Live	+/+	Red-eyed	Live

If no Pm-eyed flies hatch in Vial 2 at $30^{\circ}C$ go back to Vial 1 at $22^{\circ}C$ and isolate the Pm,DTS chromosome.

Of 690 Cross 2 vials made, 616 vials were analyzable at $30^{\circ}C$ and one DTS was found and designated Pm,DTS18.

Scheme for inducing a DTS into the CyO chromosome.

Cross 1 bw;st virgin ♀♀ X CyO/Pm;st/st EMS fed ♂♂

$22^{\circ}C$

Cross 2 (5 $\overline{XX}$/Y;bw;st virgin ♀♀ X 1 CyO*/bw;st/st ♂)$_n$

Vial 1 at $22^{\circ}C$ — After 4 days transfer parents → Vial 2 at $30^{\circ}C$

Live	CyO*/bw;st/st	scarlet-eyed	Die
Live	bw/bw;st/st	white-eyed	Live

If no scarlet eyed flies hatch in Vial 2 at $30^{\circ}C$ go back to Vial 1 at $22^{\circ}C$ and isolate the CyO,DTS chromosome.

Of 1834 Cross 2 vials made, 1555 were analyzable at $30^{\circ}C$ and three CyO chromosomes were found containing a DTS. These have been designated as CyO,DTS100, CyO,DTS486, and CyO,DTS513.

An attempt was made to induce a DTS into TM2, Ubx^{130} and TM3, Ser Sb using a crossing scheme analagous to that used for the CyO chromosome. Of 2513 Cross 2 vials made, 2285 vials were analyzable at $30^{\circ}C$ and none of the third chromosomes tested had a DTS.

The balancer DTS chromosomes were tested by making reciprocal crosses to flies from an OR stock in 1/2 pint bottles at $30^{\circ}C$. For all crosses duplicate cultures were made with bottles containing 20, 10, and 5 parental pairs. Data from duplicate cultures were lumped together.

The results in Table 1 and Table 2 indicate that as far as the testing went, all the DTS chromosomes (except CyO,DTS486) were completely lethal at $30^{\circ}C$. Pm,DTS18 and CyO,DTS486 female heterozygotes are almost completely sterile at the restrictive temperature. Earlier experiments in an incubator which fluctuated between 28.5 and $30.0^{\circ}C$ indicated there may be up to 2% escapers for Pm,DTS18 and CyO,DTS513, and 0.1% for CyO,DTS100.

Although it is possible to maintain the DTS stocks at $25^{\circ}C$, they grow much better be-

tween 21 and 23°C.

Since out of 2285 EMS-treated chromosomes no TM2, Ubx^{130} nor TM3, Ser Sb chromosomes were recovered carrying a DTS and since Suzuki, D.T. (Science 170:695-706, 1970) reports a very low induced mutation rate for DTSs on the third chromosome, the attempt to induce new DTSs in the third chromosome balancers was abandoned. Instead, DTS-1165 of Suzuki located between h and st was crossed-over into the TM2, Ubx^{130} chromosome. When flies from the presently available

Table 1. Test of the Pm,DTS18 isolate.

Cross	# Parental Pairs	CyO Progeny ♀♀	CyO Progeny ♂♂	Pm,DTS Progeny ♀♀	Pm,DTS Progeny ♂♂
Pm,DTS18/CyO ♀♀ x OR ♂♂	20	5	0	0	0
	10	3	0	0	0
	5	1	0	0	0
	Total	9	0	0	0
OR ♀♀ x Pm,DTS18/CyO ♂♂	20	292	326	0	0
	10	215	210	0	0
	5	133	155	0	0
	Total	640	691	0	0

Table 2. Test of the CyO,DTS isolates.

Cross	# Parental Pairs	Tft Progeny ♀♀	Tft Progeny ♂♂	CyO,DTS Progeny ♀♀	CyO,DTS Progeny ♂♂
CyO,DTS100/Tft ♀♀ x OR ♂♂	20	333	284	0	0
	10	236	210	0	0
	5	127	112	0	0
	Total	696	606	0	0
OR ♀♀ x CyO,DTS100/Tft ♂♂	20	283	281	0	0
	10	188	180	0	0
	5	143	115	0	0
	Total	614	576	0	0
CyO,DTS486/Tft ♀♀ x OR ♂♂	20	0	1	0	0
	10	0	1	0	0
	5	0	1	0	0
	Total	0	3	0	0
OR ♀♀ x CyO,DTS486/Tft ♂♂	20	299	330	29	10
	10	202	200	12	7
	5	140	151	13	4
	Total	641	681	54	21
CyO,DTS513/Tft ♀♀ x OR ♂♂	20	290	283	0	0
	10	217	205	0	0
	5	92	86	0	0
	Total	599	574	0	0
OR ♀♀ x CyO,DTS513/Tft ♂♂	20	159	165	0	0
	10	116	114	0	0
	5	185	198	0	0
	Total	460	477	0	0

TM2, Ubx^{130} DTS-I165/Sb stock were reciprocally crossed at 30°C to flies from an Oregon-R wild type stock no Ubx progeny survived in the +/+ ♀♀ x TM2, Ubx^{130} DTS-I165/Sb ♂♂ cross, but in the reciprocal cross 7% of the progeny were Ubx,non-Sb. In addition TM2, Ubx^{130} DTS-I165/ ru h th st cu sr e^s ca ♀♀ have been checked for crossing-over. Exchanges involving ca occurred with a frequency of .026. The frequency in the ru-h region was .003 and in the h-th region .005.

Supported in part by National Science Foundation Grant GB-20910 and National Institutes of Health Traineeship Number 1 TOL GM 01450-01A1.

Hunter, A.S. University of the Pacific Stockton, California. Distribution of Drosophila of Gothic, Colorado.

During a 5-week visit in June and July of 1971 at the Rocky Mountain Biological Laboratory in Gothic, Colorado, collections of Drosophila were made in two different community types in order to compare the distribution of species. A banana and yeast bait was spread on the ground in the shade of trees and sweepings were made at half hour intervals during the day. The species collected were the same as those found by Dr. D.D. Miller in 1963. The number of each species collected in each community type is shown in Table 1.

Table 1. Drosophila collections Gothic July 1971

Site 1 Aspen community

	athabasca	pseudoobscura	montana	subquinaria	suboccidentalis	Totals
Week 1	7	6	45	34	37	129
Week 2	7	23	42	69	34	175
Week 3	13	36	64	38	30	181
Total	27	65	151	141	101	485

Site 2 Spruce community

Week 1	30	18	10	14	26	98
Week 2	22	27	11	27	36	123
Week 3	26	23	19	15	34	117
Total	78	68	40	56	96	338

At that time of year, D. montana, D. subquinaria and D. suboccidentalis were the most abundant species. Of the five predominant species collected, three differed in the number collected in an aspen community as compared with those collected in a spruce-fir community. D. subquinaria and D. montana were collected in greater numbers in the aspen community while with D. athabasca the reverse was found. An analysis of variance of the data of Table 1 is shown in Table 2.

Table 2. Analysis of variance

	Sum of squares	Degrees freedom	Mean square	F
Species	1,224	4	306	3.4
Location	719	1	719	7.9
Interactions	2,978	4	745	8.3
Deviations	1,802	20	90	

Conclusions

Significant effect of location	P = 0.005
Questionable effect of species	P = 0.05
Definitely significant interaction	P = 0.005

These preliminary data support the hypothesis that some species are more abundant in certain community types.

Shannon, M.P.[1], T.C. Kaufman[2], M.W. Shen[1], and B.H. Judd[1] [1]University of Texas, Austin, Texas. [2]University of British Columbia, Vancouver, Canada. Lethality patterns of zw mutants in D. melanogaster.

Judd, Shen and Kaufman (in press) have derived 116 lethal and semi-lethal recessive point mutations that map between z (3A3) and w (3C2) on the X chromosome of Drosophila melanogaster. These zw (zeste-white) mutations have been arranged into 12 complementation groups which correspond on a one to one basis to the 12 salivary gland chromomeres in this region. The genetic sequence from z to w of the complementation groups (designated by number in the order of discovery) is zw1, zw8, zw4, zw10, zw2, zw3, zw6, zw12, zw7, zw5, zw11, zw9. By use of mutant males marked with the gene y, we have determined the lethality patterns of 42 mutants representing all zw complementation groups. (The lethality pattern of a mutant includes both its effective lethal phase (see Hadorn, 1955) and observations on its rate of growth and longevity.)

Mutants within a given complementation group have similar lethality patterns, as would be expected for members of an allelic series. The zw mutants are primarily post-embryonic in time of death, with the highest concentration of mortality occurring in the larval period (cf. Oster, 1952, 1954; Rizki, 1952; Seto, 1954). One group (zw2) is characterized by late embryonic-early larval "boundary lethality" (Hadorn, 1951). Three groups (zw6, zw12, zw5) show monophasic first instar lethality, and one group (zw7) shows diphasic first and second instar lethality. The remaining groups exhibit varying degrees of polyphasic lethality. Semi-lethal mutants show polyphasic lethality, even if lethal mutants within the same complementation group are monophasic in time of death. Our observations generally support the concept of the phase specificity of lethal factors (Hadorn, 1948, 1951, 1955); i.e., critical (lethal) phases are interspersed with relatively insensitive periods when deaths rarely occur. The zw mutants resemble other lethal Drosophila mutants in that they usually live for a considerable time after development has ceased (cf. Hadorn, 1955).

Phenogenetic studies (Kaufman, 1970) reveal that members of each zw complementation group also have similar morphological and cellular autonomy characteristics. We infer that the mutations in any one complementation group are quite specific in action, apparently affecting the same developmental processes.

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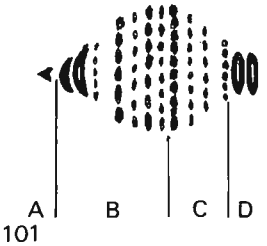
Roberts, P.A. Oregon State University, Corvallis, Oregon. A revised map of basal 4R.

We have reported elsewhere (Genetics 61:s50; ms. in preparation) that the behavior of T(3;4)10, recovered as one of a series of translocations producing ci position effect (Genetics, in press), strongly suggests that the centromere of 4 has not been correctly localized on the older map. The thin, rarely seen arm to the left of 101D is usually referred to as the "left arm" of 4 and the regularly visible remainder of 4, the "right arm" (Lindsley and Grell 1968). In T(3;4)10, the entire 101A-D region of the old map has been translocated to a point near the tip of 3R.



Metaphase views of the translocation show that the centromere of 3 is in its normal position. For this and other reasons (discussed more fully elsewhere), it seems unlikely that any one of the dark bands in 101D is the centromere of 4. The extra thickness of basal 4R, as we prefer to call 101A-D of the old map appears to be due to a position effect on DNA replication in this region in T(3;4)10. It provides a clear view of the pattern of bands in this region.

The revised map of this region (Figure 1) has fewer faint bands but is approximately the same length as the previous map. The revised map begins with subdivision 101B; we have left 101A for the unmapped 4L, centromere, and extreme proximal part of 4R. These parts of 4, attached to the other element of the reciprocal translocation, are not distinguishable, as yet, from the rest of the heterochromatin.

Lakovaara, S. and A. Saura. University of Helsinki, Helsinki, Finland. Location of 13 enzyme loci in D. willistoni.

By the means of starch gel electrophoresis and by using the following visible marker stocks: w^e y sn ru, w^e lz and se (X-chromosome), bw abb px (chromosome II) and Dl p and p (chromosome III), the chromosomal locations presented in the tabulation have been established for thirteen enzyme loci in D. willistoni. The observed locations are compared with those of corresponding loci of D. melanogaster in the cases where information on the latter was available. The locations fit the proposed homology between the chromosomes of D. willistoni and D. melanogaster (1). Due to inversions, loci in chromosome III of D. willistoni could not be reliably located and the locations in chromosomes X and III are tentative.

Locus	Location in D. willistoni	Location in D. melanogaster
Adenylate kinase-2 (Adk-2)	1 - 49	-
Alcohol dehydrogenase (Adh)	2 - 66	2 - 50.1 (2)
Alkaline phosphatase-1 (Aph-1)	1 - 58	-
Esterase-5 (Est-5)	2 - 57	-
Esterase-7 (Est-7)	1 - 52	3 - 36.8 (Est-6) (2)
α-Glycerophosphate dehydrogenase (α-Gpdh)	2 - 59	2 - 20.5 (2)
Isocitrate dehydrogenase (Idh)	1 - 60	3 - 27.1 (2)
Leucine aminopeptidase-5 (Lap-5)	3	-
Malate dehydrogenase-2 (Mdh-2)	2 - 62	2 - 41.2 (2)
Malic enzyme-1 (Me-1)	3	3 - 53.1 (4)
Octanol dehydrogenase-1 (Odh-1)	3	3 - 49.2 (2)
Phosphoglucomutase-1 (Pgm-1)	1 - 70	3 - 43.4 (2)
Tetrazolium oxidase (To)	1 - 46	3 - 32.5 (3)

Lengths of D. willistoni chromosomes: X, 90 units; II, 78 units; III, 50 units (1).

References: 1. Spassky, B. and Th. Dobzhansky, 1950 Heredity 4:201; 2. Fox, D.J., E. Abächerli and H. Ursprung, 1971 Experientia 27:218; 3. Jelnes, J.E., 1971 Hereditas 67:291; 4. Franklin, J.R. and W. Rumball 1971 DIS 47:37.

Gerasimova, T.I. and E.V. Ananjev. Kurchatov's Institute of Atomic Energy, Moscow, USSR. Cytogenetical localization of structural gene Pgd for 6-phosphogluconate dehydrogenase in D. melanogaster.

The structural gene Pgd for 6-phosphogluconate dehydrogenase (6PGD) has been located on the X chromosome at 0.65 position between the broad and prune. For its localization, w^+Y chromosome and Df(1)Pgd-kz deficiency were employed. Isozyme patterns in polyacrylamide gel electrophoresis and estimates of total 6PGD activity in males with w^+Y chromosome and Pgd^B allele in X chromosome proved the location of Pgd^A allele in the w^+Y duplication (1). The w^+Y chromosome contains the insertion of a part of X chromosome including the 2D1-3D6 region. Since the pn locus has been located at the 2D5-6 region(2) to the right of Pgd (1) the latter may be concluded to lie on the 2D1-2D6 region. The more exact localization of Pgd locus has been made using the deficiency Df(1)Pgd-kz obtained by γ-irradiation of Canton S males carrying Pgd^B allele. The electrophoretic patterns of isozymes from Pgd^A/Df(1)Pgd-kz heterozygotes and the decreased level of 6PGD activity in these heterozygotes suggested that the X chromosome with Pgd-kz deficiency lacks Pgd locus. Genetic analysis has shown that this deficiency covers pn and kz loci, but not broad and white while cytologically it was identified as Df(1)2D1.2-2D6;2F3.4-3A1 according to the revized Bridges map. Thus, the results obtained for the two rearrangements (w^+Y and Df(1)Pgd-kz) suggested the location of Pgd locus in the 2D3-6 region. This conclusion is in accord with the data of Seecoff et al. (3) showing the presence of Pgd locus in the X chromosome with 2D6-3C2 deficiency.

References: (1) Gvozdev, V.A., V.J. Birstein, L.Z. Faizullin 1970 Moleculjarnaja Biologia (Russ.) 4:876; (2) Lindsley, D.L. and E.H. Grell Genetic Variations of D. melanogaster; (3) Seecoff, R.L. et al. 1969 Proc. Nat. Acad. Sci. USA 62:528.

Jousset, F.X. Station de recherches cytopathologiques, Saint Christol-les-Alès, France. Presence of iota virus in French strains of Drosophila immigrans.

Iota, a Drosophila immigrans virus, induces a CO_2 sensitivity when injected into Drosophila melanogaster ♂ flies (Jousset, 1970). Despite this symptom, iota virus is entirely different from sigma virus. Iota virions are paraspherical, 30 nm in diameter (Jousset, 1972). Iota virus is morphologically similar to P virus of D. melanogaster (Plus and Duthoit, 1969) which affects the fecundity and the life span of the flies (David and Plus, 1971). P virus belongs to the Picorna viruses family (Téninges and Plus, 1972).

Eleven strains of D. immigrans from different regions of France were checked for the presence of iota virus. A sample of flies of each strain was ground in Ringer solution, the extract centrifuged, filtered through a 450 nm pores filter and injected into standard melanogaster free of known Drosophila viruses (sigma, P and iota). In all cases, the CO_2 sensivity appeared in the injected males at the first or the second passage on melanogaster. The other characteristics of iota infection on melanogaster flies, sterility of the ♀ and early death of ♂ and ♀, appeared at the following passages. One of the immigrans strains, captured in Alès, Gard, was further investigated for the presence of iota virus in each of 25 individual ♀ and each group of 3♂♂. The 30 extracts were injected into groups of melanogaster ♂♂ submitted later on to CO_2 gas. The CO_2 sensivity occurred in each group of injected ♂♂. Thus, iota virus is likely to be present in every fly of the Alès strain of immigrans. Furthermore, iota seems to exist in all the French strains of D. immigrans, as endemic virus.

References: Jousset, F.X. 1970 C.R. Acad. Sci. Paris 271:1141-1444; _____ 1972 C.R. Acad. Sci. Paris, D, 274:749-751; Plus, N. and J.L. Duthoit 1969 C.R. Acad. Sci. Paris 268: 2313-2315; David, J. and N. Plus 1971 Ann. Inst. Pasteur 120:107-119; Teninges, D. and N. Plus 1972 J. Gen. Virology, in press.

Bennett, J. and A.M. Hathaway Northern Illinois University, DeKalb, Illinois. Behavioral correlates of the w, w^+ gene substitution, observations in day 2.

A pair of isogenic, inbred, Oregon-R lines, differing only at the white locus (DIS 45:140-141) were examined for differences in behavioral patterns. Flies were separated on the day of eclosion and examined on the second day between 2 and 6 pm. All observations were made between 2 December 1971 and 6 January 1972. Individual flies were observed for 10 minute periods in 16 mm Blister™ slides (DIS 47: 75). Observations were recorded on a checklist of 13 behavioral patterns. Only one incidence of a given pattern was recorded in each 10 minute period. 100 flies of each sex and for each line were observed. The table records the observations for those patterns showing significant differences, and the Chi-square probabilities. An earlier

Line and Sex		Rub Proboscis	Rub Antenna	Rub Thorax	Comb Abdomen	Comb Wings	Activity (sum of all)
w^+	♀	16	45	20	24	50	405
w^+	♂	14	50	19	18	47	389
w	♀	12	40	16	7	47	359
w	♂	3	44	9	13	39	338
w vs. w^+	P = <	0.001	0.01	0.03	0.003	0.006	0.01
Greatest Discrepancy		♂	♂	♂	♀	♂	

study (DIS 47:75) recorded similar differences in Antenna, Wings, and Total Activity, with flies of a greater age spread "2 to 4 days". Three other patterns (Proboscis, Thorax & Abdomen) that show significant differences between lines in this study did not show such great differences in the earlier study. Similarly three patterns (Rub Forelegs, Rub Head & Pull Anus) that were significant in the earlier studies did not show such great differences in this group. Some of the differences between the studies may be dependent upon the age of the fly, time of day of observation (morning hours in the earlier study), and season (summer months in the earlier study). Additional observations are being devoted to these factors.

Moree, R. Washington State University, Pullman, Washington. Heterozygosis and elimination rate of a heterozygously detrimental lethal of D. melanogaster.

The viability effects of the amount and distribution of general heterozygosity on the carriers of the heterozygously detrimental Dr mutant (DIS 45:71-72) provide a basis for studying the behavior of Dr/+ in four genetically different types of populations. These types are: 1) low heterozygosity in both the linked and unlinked backgrounds of Dr/+; 2) high heterozygosity in the unlinked background only; 3) high heterozygosity in the linked background only; and 4) high heterozygosity in both the linked and unlinked backgrounds. Each of the four types of populations was started with Dr/+ flies only and was run in triplicate in Bennet type cages; adult samples were withdrawn, counted, and returned, at two-week intervals. Type-1 populations had the initial structure S/S;S/S;S/S^o, where S indicates a Canton-S chromosome and S^o a Canton-S chromosome carrying Dr. Type-2 populations were initially X/S;W/S;S/S^o, where W indicates a Wawawai chromosome and X a chromosome containing Wawawai, Canton-S and other segments in about the ratio of 1:1:4. Type-3 populations were initially S/S;S/S;S/W^o, W^o being a Wawawai chromosome carrying Dr. Type-4 populations were initially S/W;S/W;S/W^o. In types 3 and 4 the phenotypic +/+ competitors of Dr/+ would, initially, have a lower third chromosome heterozygosity than the latter, although with time and recombination the third chromosome heterozygosities of the two genetic types would tend toward equality and might also tend to be diminished, although this last would be, I think, contrary to general expectation. And to the extent that fitnesses depend on heterozygosity, they would be accordingly affected. The pooled and rounded results are summarized in the following table, with counting times indicated at two-week intervals (t), elimination percentages of Dr/+ flies in population types 1-4, theoretical elimination percentages for Dr/+ (T) and, in the lower part of the table, estimates of the average adult population size per cage, given in hundreds.

t)	0	1	2	3	4	5	6	7	8	10	12	14	16
1)	100	58	37	19	12	8	4	2	0.8	0.4	0.08	0.02	-
2)	100	64	46	34	20	12	6	4	2.0	0.7	0.30	0.02	-
3)	100	65	54	44	31	21	15	10	7.0	2.0	1.00	0.50	0.1
4)	100	67	58	45	33	23	18	14	10.0	5.0	3.00	2.00	0.8
T)	100	67	50	40	33	29	25	22	20.0	16.7	14.29	12.50	11.1
1)	10	15	14	9	12	14	15	15	11	18	28	28	33
2)	10	33	34	49	59	62	62	69	63	66	65	54	-
3)	10	25	33	42	45	46	58	56	58	62	69	62	66
4)	10	32	43	39	49	53	53	43	41	46	52	66	67

In Type-1 populations the frequency of Dr/+ decreased rapidly since Dr is heterozygously deleterious. Elimination, which was complete by the 28th week, occurred more rapidly than expected on the basis of the previously determined viability effect of Dr (DIS 45:71-72); evidently Dr is deleterious for other fitness components as well as for viability.

In Type-2 populations the elimination rate was significantly lower than in Type-1; but somewhat surprisingly the extinction point was the same as for the Type-1 populations. One might almost suppose that high initial background heterozygosity was rapidly lowered by continuous recombination.

There was some overlapping of the elimination rates for the individual cages of the Type-3 and Type-4 populations; the data of two Type-3 and two Type-4 populations appear at present to be inextricable. The pooled results show a slight but consistently lower elimination rate for Type-4 populations; but ultimately this difference may prove to be statistically not significant. However, in Type-3 populations the elimination rate was significantly lower than in populations of Type-2. In fact, the Type-3 Dr/+ flies were temporarily superior in fitness as is shown by their frequencies being higher than the theoretical values from about the 3rd to the 7th weeks (see underlines, table). By the 36th week there remained but an average of 1.67 Dr/+ flies per cage, at which time these cages were terminated. In Type-4 populations this temporary superiority in fitness, compared to the theoretical values, occurred from the 2nd to near the 8th week (see underlines, table). This, together with the fact that at the 40th week the pooled Dr/+ frequency in Type-4 populations was still at 0.2%, suggests a real biological difference between Type-3 and Type-4 populations despite a seeming lack of signifi-

cant statistical difference. Unfortunately these last populations had to be terminated at this point; so it can not be known at present whether a low level polymorphism might have been developing.

With respect to adult population size, Types 2-4 form a group clearly in contrast with Type-1 and clearly in agreement with their greater heterozygosity. But, rather surprisingly, they do not differ especially among themselves even though their total heterozygosities do. Heterozygosity, in this respect, does not appear to be acting in any simple, additive way. (Aided by funds from the State of Washington Initiative Measure No. 171 for the Support of Biological and Medical Research.)

Benedík, J.K. J.E. Purkyně University, Brno, Czechoslovakia. Effect of disruptive and directional selection.

A possibility was tested of the increase of genetic variance in long term directionally selected populations of D. melanogaster by means of disruptive selection. This attempt was made to introduce a new genetic material into highly inbred selected lines in order to make possible a new selection progress.

After 54 generations of directional selection on sternopleural bristle number in two natural populations of D. melanogaster (Su - Suchumi and Kr - Krnov) in which selection limit seemed to be achieved, three generations of disruptive selection with 50 per cent gene flow (see Millicent and Thoday, 1961) were used and the comparison of disruptive and directionally selected lines as for the changes in the population mean and variance was made. The results are given in the Table. No significant difference (except one) occurred in variance during

Test of differences in variance between disruptive and directional selection

Tested lines	First generation	Second generation	Third generation
Su A+/Su+	1.648[x]	0.845	1.283
Su B+/Su+	1.222	0.936	1.128
Su C+/Su+	1.248	0.768	1.727
Su D+/Su+	0.960	0.730	1.159
Su A-/Su-	1.177	0.889	0.959
Su B-/Su-	0.921	1.023	0.959
Su C-/Su-	0.883	1.305	0.743
Su D-/Su-	0.023	1.102	0.753
Kr A+/Kr+	0.999	1.031	1.427
Kr B+/Kr+	0.778	0.872	1.041
Kr C+/Kr+	0.699	0.846	1.026
Kr D+/Kr+	0.760	0.861	1.241
Kr A-/Kr-	1.083	1.004	0.821
Kr B-/Kr-	0.938	0.893	0.851
Kr C-/Kr-	0.819	1.091	0.746
Kr D-/Kr-	0.734	0.986	0.873

x - $P < 0.10$

three generations between four lines of disruptive selection (A - B) and the corresponding line selected directionally. This conclusion doesn't correspond with the results of Gibson and Thoday (1962) and others, in the experiments in which disruptive selection leads to the increase of variance.

As for the differences between disruptive and directional selection in the population mean, the number of significant differences gradually increased with the increasing number of generations. These differences were caused by relatively lower selection intensity in the disruptive selection so that the disruptive selection operated in the same way as the relaxation of selection.

According to these results disruptive selection is not suitable either for the increasing of genetic variance nor lengthening of reaction in directionally selected populations.

References: Millicent, E. and J.M. Thoday 1961 Hered. 16:199-217; Gibson, J.B. and J.M. Thoday 1962 Hered. 17:1-26.

De la Rosa, M.E., J.G. de Jiménez, O. Olvera R. and R. Félix. National Institute of Nuclear Energy, Mexico City, Mexico. Monosodium glutamate effects on X chromosome loss and non-disjunction in D. melanogaster.

Schaumburg (1968) proposed monosodium glutamate (MSG) as the cause of the Chinese restaurant syndrome in man. Further studies (Schaumburg et al. 1969) reported MSG as the cause of such syndrome, as it was determined that both intensity and duration of symptoms were related to the ingested amount of MSG. Onley & Sharpe (1969) and Arees & Mayer (1970) induced brain lesions in the hypothalamus of newborn mice and Rhesus monkey by subcutaneous injection of MSG. Bazzano et al. (1970), Blood (1969), and Morselli and Garattini (1970) demonstrated that relatively high doses of MSG orally administered did not provoke any symptoms of Chinese restaurant syndrome. No morphological differences were found in the hypothalamic regions of treated and control monkeys by Raynolds et al. (1971). Like Arees and Mayer (1970), they found lesions in one brain region when fixation was poor, while immediately adjacent areas showed a well-fixed appearance.

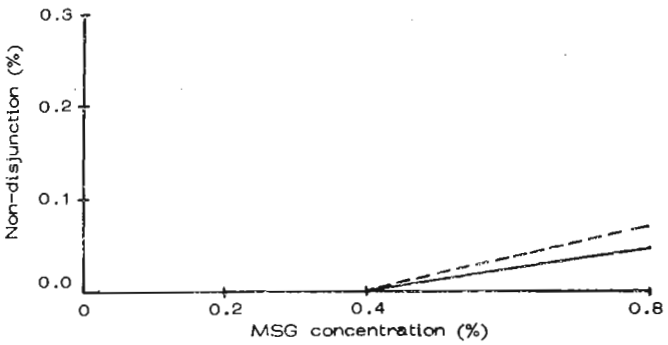


Fig. 1. MSG mutagenic effect on D. melanogaster non-disjunction.

—— definition 1.
--- definition 2.

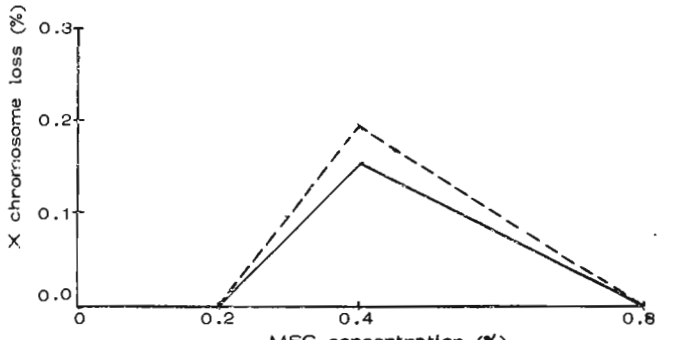


Fig. 2. MSG mutagenic effect on D. melanogaster. X chromosome loss.

—— definition 1.
--- definition 2.

Table 1. MSG mutagenic effect on D. melanogaster

Treatment	Non-disjunction (%) definition 1	Non-disjunction (%) definition 2	X loss (%) definition 1	X loss (%) definition 2
Control	0.00	0.00	0.00	0.00
MSG 0.2%	0.00	0.00	0.00	0.00
MSG 0.4%	0.00	0.00	0.15	0.19
MSG 0.8%	0.05	0.07	0.00	0.00

Since Back and associates (1952) have insisted on the importance of the amino groups presence in some radioprotective substances, the present work was made to determine the action of MSG as a radioprotective substance on D. melanogaster, as well as its mutagenic effect, because this compound is widely used as a food additive.

Table 2. MSG radioprotective effect on D. melanogaster.

Treatment	Non-disjunction (%) definition 1	Non-disjunction (%) definition 2	X loss (%) definition 1	X loss (%) definition 2
2500 r	1.09	1.20	4.30	6.10
MSG 0.2%+2500 r	0.90	1.10	2.60	3.20
MSG 0.4%+2500 r	0.10	0.12	1.99	2.52
MSG 0.8%+2500 r	0.45	0.64	1.26	1.77

MSG was administered to Drosophila adults mixed with the food rather than by injection, in order to test its effects as a food additive (human dietary concentration: 0.2% to 0.5%).

Moree, R. Washington State University, Pullman, Washington. Heterozygosis and elimination rate of a heterozygously detrimental lethal of D. melanogaster.

The viability effects of the amount and distribution of general heterozygosity on the carriers of the heterozygously detrimental Dr mutant (DIS 45:71-72) provide a basis for studying the behavior of Dr/+ in four genetically different types of populations. These types are: 1) low heterozygosity in both the linked and unlinked backgrounds of Dr/+; 2) high heterozygosity in the unlinked background only; 3) high heterozygosity in the linked background only; and 4) high heterozygosity in both the linked and unlinked backgrounds. Each of the four types of populations was started with Dr/+ flies only and was run in triplicate in Bennet type cages; adult samples were withdrawn, counted, and returned, at two-week intervals. Type-1 populations had the initial structure S/S;S/S;S/S^o, where S indicates a Canton-S chromosome and S^o a Canton-S chromosome carrying Dr. Type-2 populations were initially X/S;W/S;S/S^o, where W indicates a Wawawai chromosome and X a chromosome containing Wawawai, Canton-S and other segments in about the ratio of 1:1:4. Type-3 populations were initially S/S;S/S;S/W^o, W^o being a Wawawai chromosome carrying Dr. Type-4 populations were initially S/W;S/W;S/W^o. In types 3 and 4 the phenotypic +/+ competitors of Dr/+ would, initially, have a lower third chromosome heterozygosity than the latter, although with time and recombination the third chromosome heterozygosities of the two genetic types would tend toward equality and might also tend to be diminished, although this last would be, I think, contrary to general expectation. And to the extent that fitnesses depend on heterozygosity, they would be accordingly affected. The pooled and rounded results are summarized in the following table, with counting times indicated at two-week intervals (t), elimination percentages of Dr/+ flies in population types 1-4, theoretical elimination percentages for Dr/+ (T) and, in the lower part of the table, estimates of the average adult population size per cage, given in hundreds.

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Three concentrations were tested feeding all stages of development of $y^2\ w^a/y^2\ w^a$ D. melanogaster females. The applied method for detecting non-disjunction and X chromosome loss gives particularly reliable evidence concerning the origin of each exceptional female and male making use of a tester male stock with attached $Y^S.X.Y^L$ chromosomes.

Virgin females of the genotype $y^2\ w^a/y^2\ w^a$ were taken from cultures containing agar-cornmeal medium with MSG. In each culture a treated female was mated with 3 attached $Y^S.X.Y^L$ males and eliminated after 48 hours. In the second part of the experiment virgin females feeding on MSG medium were irradiated at 2500 r before being mated to males with the markers described above. All the cultures were kept at 25°C throughout the experiment.

The F_1 flies were scored for non-disjunction and X chromosome loss 13 to 15 days after the MSG treatment of the females. From Traut (1964) the X chromosome loss and non-disjunction frequencies can be based on either the number of regular males (definition 1), or on the number of regular females (definition 2) in the F_1.

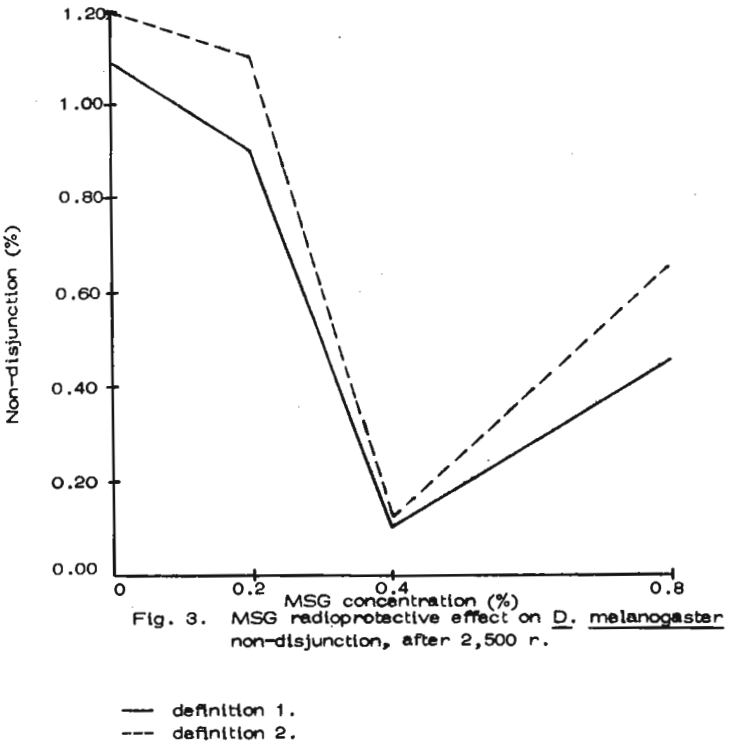

Fig. 3. MSG radioprotective effect on D. melanogaster non-disjunction, after 2,500 r.

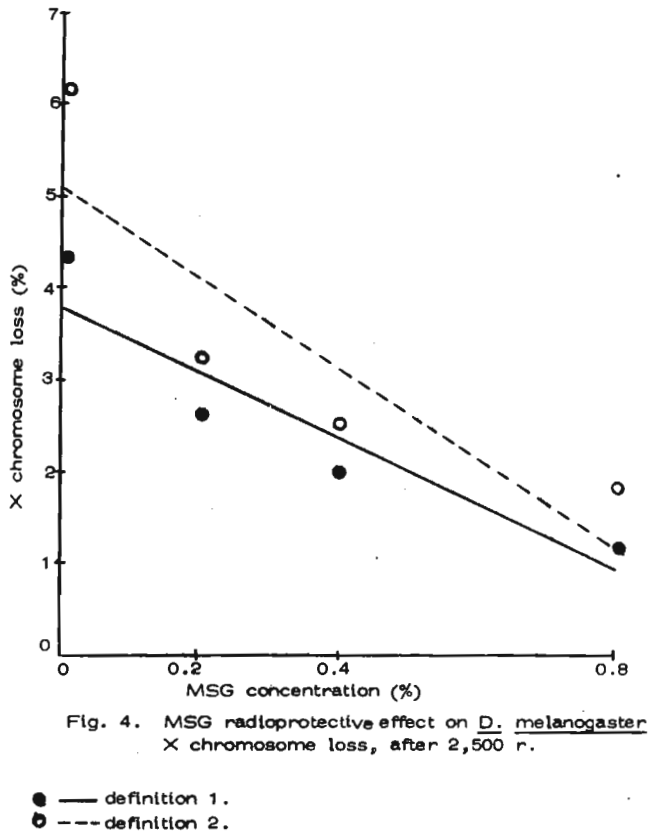

Fig. 4. MSG radioprotective effect on D. melanogaster X chromosome loss, after 2,500 r.

MSG effect on non-disjunction (Table 1 and Fig. 1) was observed only at the highest concentration assayed (0.8%). X chromosome loss was observed after feeding with 0.4% MSG concentration (Table 1 and Fig. 2).

Data on Table 2 shows that MSG has a radioprotective effect on non-disjunction frequency which, however, is not significant (Fig. 3). Table 2 and Fig. 4 show that the increase of MSG concentration in relation to frequency of X chromosome loss are also not significant (χ^2 test).

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Coyne, J.A. The Rockefeller University, New York, New York. Quantification of xanthine dehydrogenase allozymes in mass samples of D. pseudoobscura.

The use of electrophoretic techniques to detect cryptic genetic variation in Drosophila populations has been limited by the necessity of using homogenates of individual flies; this procedure is tedious and subject to sampling errors when a small number of flies are used. Homogenization and electrophoresis of multiple-fly samples could provide a quick estimate of the degree of enzyme polymorphism in populations or, if not employed quantitatively, could at least indicate the presence or absence of such polymorphism. We have made efficient use of mass sampling in experiments with one allozyme locus in Drosophila.

Two strains of D. pseudoobscura homozygous for the allozymes .90 and 1.02 of the second-chromosome locus xanthine dehydrogenase (XDh) were obtained from stocks originally developed by Dr. Richard Lewontin at The University of Chicago. Fifty-fly samples consisting of different proportions of these genotypes were homogenized in 100 microliters of buffer. After centrifugation, 0.3 microliters of the supernatant was applied to cellulose acetate strips and subjected to electrophoresis at 100 volts for 24 minutes at room temperature. Strips were stained for XDh with a modification of the procedure of Prakash et al. (1969). After incubation, the strips were cleared and the allozyme bands quantified with a Millipore PhoroScope densitometer. Figure 1 shows the relationship between genotypic proportions of the two

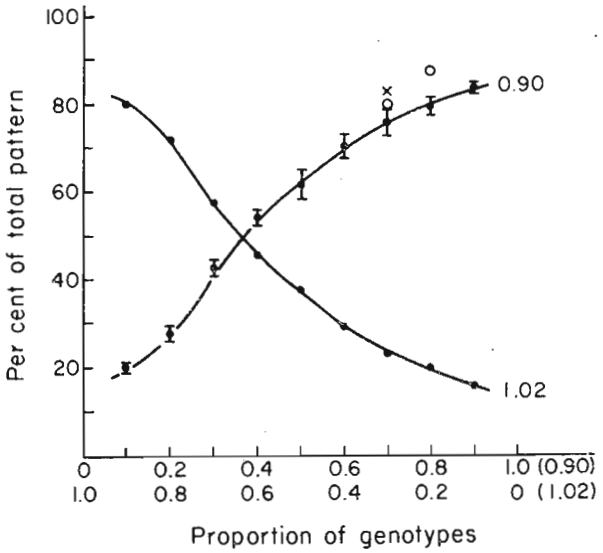

Figure 1. Standard curve of percentage of total banding pattern (quantified with densitometer) versus genotype frequency for homozygotes of the .90 and 1.02 allozymes of XDh. Open circles represent trials in which 150 microliters of homogenization buffer was used; X's represent 200-microliter trials. 100 microliters of buffer was used in all other runs.

strains and relative allozyme band intensity. The curve is roughly sigmoid, possibly indicating lack of saturation of those allozymes present in high proportions. This hypothesis is supported by the increase in relative staining of high-concentration allozymes evident when the homogenate is diluted with additional buffer.

The figure also shows the accuracy and reproducibility of the method: the maximum standard deviation in relative band intensity for any one point was only 2.7%. The experiments were expanded to include homogenates of up to 200 flies without significant change in relative intensity.

The accuracy of results obtained in construction of this standard curve thus indicates the feasibility of such quantitative analyses of mass samples of natural or laboratory populations of Drosophila. Although XDh heterozygotes - which exhibit a heterospecific band - were not employed in these experiments, the method could be useful for investigation of those allozymes which do not show hybrid bands. The development of quantitative methods for allozymes which do form heterospecific molecules should be investigated, however, for the hybrid band may enable one to calculate directly the percentage of heterozygotes in a mass population sample.

This work was supported in part by a National Science Foundation Predoctoral Fellowship. The author is grateful to Mr. J.R. Powell for his help and encouragement.

Reference: Prakash, S., R.C. Lewontin and J.L. Hubby, 1969 Genetics 61:841.

Heed, W.B. University of Arizona, Tucson, Arizona. Distribution extensions and gene arrangements for D. parthenogenetica and D. montana.

Three specimens of D. parthenogenetica were collected July 27 and 28, 1971, by banana traps near highway 15, 4 miles south of the state line of Sonora - Sinaloa, Mexico, in tropical thorn forest along with 456 D. arizonensis, 34 D. mojavensis, 6 D. simulans, and 2 D. aldrichi. The morning collection was better. At 7 A.M. the rel. humidity was 80% and the temp. was 90°F. This represents a northern range extension of almost 900 miles for D. parthenogenetica (from Atlixco, Pueblo). Chromosome 2L, the only polymorphic arm, was fixed for inversion A' which is the more common sequence north of Panama. (Heed and Russell, 1971, Univ. Texas Publ. 7103).

One fertile D. montana female was collected at dusk (7:45 P.M.) under hot windy conditions July 10, 1971, by banana traps at the Radar Collecting Station (9000') on the north slope of the Santa Catalina Mts., Tucson, Arizona, in a Douglas Fir community among 2,429 specimens representing 7 other species and among 15,700 specimens for the 2 week period. This represents a western range extension of approximately 120 miles from Glenwood, N.M. The strain was homozygous and was checked for specific inversions by hybridizing with strain 1218.8d from Cottonwood Canyon, Utah, with which it was also homozygous. Therefore, the montana female was fixed for inversions 4g and 4h, the typical arrangements in Utah, Colorado, and New Mexico (Moorhead, 1954, Univ. Texas Publ. 5422). This record is probably the result of long distance dispersal from the north or west. Only 1 other montana has ever been captured in the Santa Catalina Mts. over a more than 10 year collecting period. (Thanks to M.R. Wheeler for providing the Utah strain.)

Heed, W.B. and S.R. Heed. University of Arizona, Tucson, Arizona. Ecology, weather, and dispersal of Drosophila on an island mountain.

The breeding sites of 75% of the 36 described species of Drosophila inhabiting southern Arizona and the Gulf Coast of Sonora, Mexico, are now known. Fermenting cactus accounts for 37%, rotting fungus for 26%, and slime flux from trees and fermenting bark for 22% of the 27 species. The remaining few were bred from flowers and fruits. The only substrates of any importance in the mountains are the fungi (Hirtodrosophila, macroptera gp., rubrifrons gp., quinaria gp.) and tree fluxes (obscura gp., melanica gp.). However, the second most abundant species in the Santa Catalina Mts., Tucson, is D. hamatofila, which breeds in Opuntia pads on the desert floor, where it is the most abundant form (Heed et al., 1962, DIS). The Basin and Range Province in S. Arizona permits the treatment of its mountains as islands for distribution studies since they are surrounded by deserts and grasslands.

It is proposed that the vast majority of D. hamatofila (and D. longicornis) in the Catalina Mts. are transients transported by air currents from the desert below at 2500 ft. elevation. Table 1 illustrates the sensitivity of these flies to daily weather conditions. Collections were made by banana bait in 5 gallon containers in Douglas Fir communities at elevations of 8500 ft. (Mt. Bigelow) and 9000 ft. (Radar Station). All collections were in the late afternoon until dark. There is an age effect by the bait but it was strongly outweighed by weather. Intense observations were made of moving flies silouetted against the sky over the traps from above on a hill slope with binoculars in the evening of July 10. Flies disturbed from the traps rose 30 to 40 ft. in the air before dispersing (actively or passively ?) in the wind. The "cross-traffic" between the tree tops was noticeable.

1971	pseudoobscura & lowei	hamatofila & longicornis	total flies	location	weather
June 22	26%	73%	4365	Mt. Bigelow	clear, dry
June 24	9%	90%	2919	Radar Station	clear, strong wind from below
July 5	76%	22%	1783	" "	cloudy
July 8	84%	14%	1995	" "	light rain
July 10	28%	70%	2430	" "	clear, warm strong wind from below

The importance of these observations lies in the fact that D. hamatofila and D. longicor-

nis are consistently abundant in early summer mountain collections but they are not part of the permanent breeding populations there. In early July, 10 specimens of the two species were collected from slime fluxes of Douglas Fir where they were actively feeding. The males had active sperm but the females were reproductively very immature. The large majority of the two species in the traps were young individuals. D. longicornis was about 10% of the total of the two species in all collections.

Moravec, J. J.E. Purkyně University, Brno, Czechoslovakia. Variability of the frequency of recombination between cn and vg in different second chromosome subpopulations of D.m. originating from nature.

Twenty different chromosome subpopulations originating from natural population samples, H. B and M, which were normal in viability were tested for recombination frequency by means of crossing with the cn vg/Oregon K strain approximately in the 50th generation. In subpopulations H7, M2 and M8, the recombination frequency was found to be significantly higher, in subpopulations B10 and M3 significantly lower than the standard value (Table 1).

Table 1

Subpopulations	H1	H5	H7	H8	B1	B4	B8	B10
Recombination frequency	9.19	7.28	11.79	7.85	9.61	8.95	8.86	5.73
$\chi^2_{(1)}$	0.52	3.81	15.27	1.29	1.69	.10	.12	17.02
Subpopulations	M2	M3	M4	M8		(standard value)		
Recombination frequency	12.36	6.79	8.37	12.12		8.66		
$\chi^2_{(1)}$	19.08	6.88	.17	15.06				

Approximately in the 70th generation, the recombination tests were repeated with the "high" subpopulation M2 and with the "low" one B10. Thirty different males were studied in each subpopulation. The crosses with cn vg/Oregon K and subsequent measurements of recombination frequency were repeated three times so that the proportion of the genetic background originating from Oregon K rose from 50 per cent in the first cross to 75 and 87.5 per cent in the second and third crosses, respectively. Other $\bar{p}$ values were found than in the 50th generation (Table 2). In the M2 subpopulation, the original high recombination frequency was preserved; it did not substantially change during the three successive crosses. On the other hand, in the B10 subpopulation, higher recombination frequencies were found than in the 50th generation, and the recombination frequencies decreased during the increase of the proportion of Oregon K genome. At the same time, this subpopulation was found to be desintegrated into two groups: in the "low" group comprising 13 original males, the recombination frequency was constant, while in the "high" one (17 original males), the recombination frequency decreased with increasing proportion of the Oregon K genome.

Table 2

Subpopulation	1st cross		2nd cross		3rd cross	
	$\bar{p}$	c.v.	$\bar{p}$	c.v.	$\bar{p}$	c.v.
M2	11.35	19.8	10.68	18.8	11.39	21.1
B10	11.27	35.7	10.38	35.0	10.01	26.9
B10 "low" group	7.29	21.6	6.83	23.2	7.57	18.0
B10 "high" group	14.32	15.0	13.08	15.5	11.86	19.3

These results suggest that (1) genetic factors modifying the recombination frequency can be present in the natural material, (2) these factors can mutate spontaneously during the long-termed cultivation, and (3) additional variability of recombination frequency can be introduced by changing the genetic background.

Murnik, M. Rengo and M.R. Bhaktual. Western Illinois University, Macomb, Illinois. The lack of mutagenicity of the herbicide 2,4,5-T in D. mel.

Phenoxyacetic acids cause chromosomal aberrations in higher plants[1], and recent studies have shown that the phenoxyacidester 2,4,5-T is teratogenic in mammals[2]. The health implications of the widespread use of this herbicide are obvious, but the genetic hazard it presents has not yet been determined. The "Muller-5" method was used to test the mutagenic activity of 2,4,5-T on Oregon-R wild type. The dosage tested was 4.8×10^{-4}g/ml in modified Carpenter's medium[3]. This approaches the highest dosage tolerable for completion of the life cycle. Very small dosages of this herbicide are teratogenic and cause chromosomal disturbances in Drosophila[4]. Treated males did not exhibit a sex-linked recessive lethal rate significantly different from that of the control. Using y^+Y^{BS} males, 2,4,5-T was also tested for the induction of chromosomal loss and nondisjunction. The rates of nondisjunction and sex chromosomal loss in the treated and control groups were not significantly different.

References cited: 1. Croker, B.H. 1953 Bot. Gaz. 114:274-283; 2. Courtney, K.D., D.W. Gaylor, M.D. Hogan and H.L. Falk 1970 Science 168:864-866; 3. Carpenter, J. 1950 DIS 24:96; 4. Davring, L. and M. Sunner 1971 Hereditas 68:115-122.

Khovanova, E.M. Research Institute of Medical Radiology, Academy of Medical Sciences, Obninsk, U.S.S.R. On some features of somatic mosaicism in two stocks of Drosophila simulans.

Somatic mosaicism was studied in heterozygous y w/y^+ w^+ females of D. simulans. In the first series virgin ♀♀ y w/y w were mated with ♂♂ y^+ w^+/Y from laboratory stock 1; in the second series ♂♂ were taken from the stock 2. Yellow mosaic spots were registered on the head and thorax, only macrochaetae were taken into consideration. In the first series 64 heterozygous females out of 7074, i.e. 0.90%, had mosaic spots. In the second series 7357 heterozygous females were analyzed; 270 of them had mosaic spots (3.67%). The difference of frequencies of mosaicism in both series were statistically significant at high level ($\chi^2 > 100$, d.f.=1).

The influence of genetic and nongenetic variables on the frequency of somatic mosaicism was found by some authors, but mostly a uniform or approximately uniform distribution of mosaic spots on different parts of the body was observed.

On the contrary, in our experiments sharply different frequencies of mosaic spots in various parts of the body were registered. Macrochaetae humeralis superior and humeralis inferior appeared yellow in 212 cases of 270 mosaic females (the second series) and in 23 of 64 (the first series), but as for the other macrochaetae, 58 non-humeral yellow spots were found in the second series, and 41 non-humeral yellow spots in the first one. So the difference of frequencies of spontaneous somatic mosaicism concerned only cells of a small imaginal disc, i. e. dorsal prothoracal, and did not concern the frequency of macrochaetae, originated from cells of other discs. In the last case differences are statistically insignificant: $\chi^2=2.287$, $0.10 < p < 0.25$.

The second interesting feature was found in our data. Mosaic by humeral macrochaetae females emerged rather uneven (the second series), while in the first one the time distribution was near to even. Non-humeral mosaics emerged uniformly in both series. As the accounting of females eclosed from pupae was not organized on an every-day basis, only the days group data are given in Table 1.

Further experiments concerning the described phenomena are in progress now.

Table 1.

days of emergence	no. of heterozygous ♀♀	humeral spots	%	other spots	%	series
1-2	3424	11	0.32	19	0.55	1
3-5	2556	6	0.23	17	0.66	1
6-9	1094	6	0.55	5	0.46	1
total	7074	23	0.32	41	0.58	1
1-2	2245	116	5.2	23	1.0	2
3-5	3923	89	2.2	28	0.70	2
6-9	1189	7	0.59	7	0.59	2
total	7357	212	2.9	58	0.78	2

Nirmala Sajjan, S. and N.B. Krishnamurthy
University of Mysore, Manasagangotri, India. New gene arrangements in D. ananassae.

Drosophila ananassae is known to possess about 45 inversions and 9 translocations. In addition four more new gene arrangements were discovered in the Chitradurga populations of Drosophila ananassae. Of these, three were heterozygous paracentric inversions and one a translocation.

One of these inversions (Fig. 1) is subterminal and has been found in the left arm of

Gene arrangements in D. ananassae: Fig. 1. Inversion 2Ld; Fig. 2. Inversion 2Ra; Fig. 3. Inversion 2Rb; Fig. 4. Translocation (2L-3L)10.

the second chromosome and designated as 2Ld. It is smaller than the inversion 2LA. The break

points are located in 17A-24F (chromosome map by Rajeshwari, 1971). Other two inversions (Fig. 2 and 3) named here as 2Ra and 2Rb are both found in the right arm of the second chromosome. The break points of 2Ra are located in 43D-47E and that of 2Rb in 45C-49C.

The translocation (Fig. 4) reported here is different from the ones reported earlier and is found in the Chitradurga population. It is a reciprocal heterozygous translocation involving the left arm of the second chromosome and the distal portion of the left arm of the third chromosome. One break has occurred in 20B of 2L and the other in 55D of 3L. It is worth noting that this translocation is associated with the inversion 2LA. In this respect it resembles the translocation reported in this DIS by Sreerama Reddy and Krishnamurthy. As this translocation is the tenth one for D. ananassae, it has been named as (2L-3L)10. The occurrence of these local and rare gene arrangements in such low frequency (1 or 2%) in natural populations of this species reflects the flexibility of its chromosome garniture.

Acknowledgements: We wish to express our gratitude To Dr. M.R. Rajasekarasetty, Professor and Head of the Department of Zoology, University of Mysore, for his helpful suggestions and encouragement. We are thankful to Sri Ramakrishna Raju for his assistance in the preparation of microphotographs. The present work is supported by Department of Atomic Energy, Government of India.

References: Rajeshwari, P. 1971 Doctoral thesis.

Mostashfi, P. and G. Koliantz.
University of Tehran, Tehran, Iran.

Genetic studies of D. melanogaster in Azarbaidjan.

In the summer of 1970, fruit flies (D. melanogaster) were collected from Tabriz City, the centre of East Azarbaidjan Province, and their genetics were studied. The collected females laid eggs under laboratory conditions and F_2 individuals were obtained by $F_1 \times F_1$ crosses, divided into seven lines. In each of the lines 1, 5, 6 and 7, no significant mutations were observed; therefore the ancestors of the seventh line, which was started with one pair of parents were subcultured (as endemic wild type) and kept for 10 generations under individual selection and from the eleventh generation they have been handled by mass culture. The wild type (also called wild-type Gayaneh) has a life cycle of 252 hours and 11 3/4 weeks of longevity.

Mutation No. 1: In the fourth line, some of the flies were distinguishable due to their pale pinky eye colour. The earlier crosses between ♀♀ mut/mut x mut/mut♂♂ and ♀♀ mut/mut x +/+ ♂♂ showed a female sterility, that is, the homozygous females produced eggs which did not hatch. Heterozygous females were normal. Further investigations proved the existence of a sterility factor in the third chromosome, at the distance of 108.6 ± 2. To maintain the mutant stock, a balanced method, derivated from G1 Sb/LVM, was used (Table 1).

Table 1

Females	Males	F1 Individuals	LVM/mut
G1 Sb/LVM	mut/mut*	G1 Sb/mut	1 LVM/LVM**
		LVM/mut	2 LVM/mut
			1 mut/mut

* mutant ** lethal

However, the mutation is one of the "fs" series in the third chromosome which has been associated with an eye color phenotype. The balanced stock is available and is called fs(3)T (female sterile of Tabriz). Homozygote females have 51 days of longevity and hybrid LVM/fs flies have 264 hours of life cycle.

Mutation No. 2: In the second and third lines, some flies showed a pentagon-like dark area on their mesonotum, associated with second and third chromosomes abnormalities. The mutation has an allelic cross with the "crown", found in 1967 from Tehran (see the papers of ISG). The mutant stock has a life cycle of 240 hours and 9 1/3 weeks of longevity, and was called "Crown of Tabriz". The latter and two former mutations are available.

All of the experiments were kept at 23 ± 0.5°C under constant white light on Mostashfi culture medium.

Reference: Mostashfi, P. and G. Koliantz, 1970, New mutations in Iranian natural populations of D. melanogaster, Second Cong. Iran. Soc. Gen. pp. 63 (in Persian).

Espinós, A. High Technical School of Agriculture, Valencia, Spain. The effect of chlorine added to the drinking water upon Drosophila stocks.

During the past summer, and without any apparent reason, the Drosophila stocks of our Laboratory started having problems. At the very beginning, the cultures seemed to be all right and even a great many eggs could be seen in two or three days after cultures were started. The trouble was that most larvae grew to a certain point and then died, and a high percentage of eggs never reached the larval stage.

We tried to vary the composition of the medium, to increase the humidity of the incubator room, to change the cultures very often, and many other modifications, but cultures still went badly.

About July, August and September we lost most of our stocks, as they did not give new generations and old flies died.

On the other hand, in the middle of July the Institute of Public Health decided to add chlorine to the drinking water in the concentration of 0.4 - 0.5 parts per million of Cl free.

It was near the end of September that we had the idea that the drinking water with chlorine used to prepare the culture medium could be the reason for our trouble. We prepared the Drosophila food using rainwater and the few cultures we could save after all summer started going on very well and so they still are at the present moment.

We have begun a further experimental work to measure the resistance of some Drosophila melanogaster mutants to different concentrations of chlorine.

Narda, R.D. and G.S. Miglani. Punjab Agricultural University, Ludhiana, India. Role of protein synthesis in induction of recessive lethals by chemical mutagens.

Mutation studies were conducted on Oregon-K stock of Drosophila melanogaster. Mutations were induced by ethylmethane sulphonate (EMS) and hydrazine sulphate (HZ); protein synthesis was inhibited by chloramphenical (CPL) or streptomycin (ST). The larval life was divided into two halves for treating the larvae with the mutagen and/or protein inhibitor. The mutagens and the inhibitors were mixed with the food, on which the larvae were fed. Frequency of sex-linked recessive lethals in the males emerging from treated larvae was scored, using brood-pattern technique; males emerging from treated larvae were mated successively to virgin Muller-5 females at intervals of two days. Information thus obtained was used to determine the effect of mutagen on various stages of spermatogenesis. The highest frequency of mutation was observed in the third brood and the fourth brood when the mutagens were administered in the first and second larval half, respectively. This implies that the stage transition from spermatogonia to primary spermatocytes is the most sensitive stage to the mutagens used.

Table 1. Effect of protein inhibitors on the frequency of sex-linked recessive lethal induced by EMS and HZ in the peak sensitive period.

Treatment	No. of sperms tested	No. of lethals induced	Frequency of lethals induced
Control	103	0	0.0%
EMS + 0	100	24	24.0%
EMS + CPL	133	10	13.3%
EMS + ST	108	9	8.3%
0 + EMS	105	14	13.3%
CPL + EMS	112	17	15.4%
ST + EMS	125	15	12.0%
HZ + 0	114	13	11.7%
HZ + CPL	125	17	12.0%
HZ + ST	120	10	8.3%
0 + HZ	102	12	11.6%
CPL + HZ	119	7	5.9%
ST + HZ	110	9	7.1%

Feeding the larvae with chloramphenicol or streptomycin in the first half and the mutagen in the second half or the other way around generally decreases the frequency of induction of recessive lethals, this decrease being less when HZ was the mutagen and more when EMS was the mutagen (Table 1). Reduction of mutation frequency by protein inhibitors indicates that protein synthesis is involved in the fixation of lethal mutations.

Gartner, L.P.* Rutgers, The State University, Newark, New Jersey. Fine structure changes in the adult Drosophila midgut as a function of age and ionizing radiation.

A Canton-S strain of Drosophila melanogaster was bred in pint milk bottles in a constant temperature cabinet at 19.0 ± 0.5°C. The experimental populations were derived from young parents, and were maintained in 25 x 90 mm shell vials, where each vial contained five males and five females. On the second day post eclosion the experimental populations were exposed to ^{60}Co gamma radiation at a dose rate of 9,000 R/min, for total doses of 0, 33, 66 and 93 kR. The flies were monitored daily, and all deaths were recorded by age and sex. Great care was exercised in the maintenance of both experimental and control populations in order to decrease the probability of accidental deaths. It was observed that females were consistently more radioresistant than males, and that the average lifespan of both sexes was an inverse function of the radiation dose (Table 1).

Table 1

Dose (kR)	Mean lifespan (days)	Significance
0	77.0 ± 4.0	-
33	60.2 ± 3.3	$p < 0.001$
66	38.0 ± 1.7	$p \ll 0.001$
93	30.2 ± 0.8	$p \ll 0.001$

Concurrently, Drosophila were also exposed at a low dose rate of 25 R/min of ^{60}Co gamma radiation for a total dose of 99 kR. The flies were maintained as above and the midguts of the males, as well as those of their own controls, were studied at the ultra-structural level at graded intervals of time.

The midguts were excised in phosphate buffered glutaraldehyde (pH 7.2), were postfixed in Palade's 1% OsO_4, and subsequent to dehydration in an ascending series of alcohols and finally propylene oxide, they were embedded in Epon-812. The sequence of time-related ultrastructural alterations, encompassing days 1 through 153 of imaginal life of the unirradiated flies, were as follows:

1) the appearance of concentric, lamellar, lipidlike deposits in the apical region of the cytoplasm;

2) the presence of viruslike particles (VLP) in the nuclei of some cells;

3) the appearance of VLP in the perinuclear region of the cytoplasm;

4) the disruption of the ordered structure of the mitochondria;

5) the appearance of autophagic vacuoles;

6) the presence of viruslike particles in the cytoplasm. The cytoplasmic VLP were significantly larger than those noted in the nucleus (Gartner, L.P. 1971 Experientia 27:562);

7) the presence of membrane bound nuclear inclusions which were non-viral in nature;

8) a moderate swelling of the mitochondria, and

9) the presence of concentric, lamellar, lipidlike deposits organized into large, spherical, membrane-bound aggregates, in the apical region of the cell. The cross sectional area of such an aggregate was only slightly less than the cross sectional area of the nucleus.

The frequency of occurrence of the above alterations as well as the intensity of their appearance, was directly related to the age of the organism. Exposure to ionizing radiation not only enhanced the rate of appearance of these finestructural changes, but was also responsible for the following additional cytoarchitectual alterations:

1) the notable absence of endoplasmic reticulum from the apical region of the cell;

2) the appearance of large, disorganized clumps of lamellar, lipidlike deposits, which were not arranged in distinct concentric whorls, and

3) an intense ballooning of the mitochondria with concommitant disorganization of the cristae mitochondriales. The diameters of the mitochondria in the apical region of the cells reached nuclear proportions, resulting in giant, misshapen organelles.

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* Current address: Dept. of Anatomy, Baltimore College of Dental Surgery, School of Dentistry, University of Maryland, Baltimore, Maryland 21201.

Leigh, B. University of Leiden, The Netherlands. X-ray induced reversion of isochromosomes in mature sperm.

Regulation during very early embryogenesis is one of the processes which has been assumed to permit operation leading to the recovery of induced autosomal isochromosomes, i.e. the loss of one chromosome arm and a doubling of the other arm relative to the other chromosomes from the male gametic nucleus. One way of further testing this hypothesis is to create a different situation in which it is necessary for an analogous type of regulation to occur in order tc obtain viable progeny.

Autosomal isochromosomes disjoin randomly during meiosis in spermatocytes. When males carrying such chromosomes are mated to females carrying regular metacentric chromosomes there are no viable progeny. 25% of the zygotes are found by the fusion of haploid female gametes with disomic male gametes. By irradiation of the disomic male gametes, before fertilization, it shoud be possible to induce reversions of the isochromosomes. These reconstituted metacentrics will be recovered in viable progeny only when there is regulation during early embryogenesis.

One-day old C(2L)RM, b;C(2R)RM, cn males were given an exposure of 1500 R and then individually mated for 2 days to 6 virgin females of the genetic constitution Cy dp^2/Bl h^2. All surviving progeny were tested. About 20% were either sterile or died before they could be mated. The remainder could be divided into three approximately equal classes; homozygous lethal, homozygotes showing phenotypic anomalies, and apparently normal. The phenotypic anomalies were of two types; either a lightening of the vermilion eye color or an elbow (el) -like modification of the wings.

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Leigh, B. University of Leiden, The Netherlands. Induction of attached-X chromosomes in spermatozoa, by X-irradiation.

During discussions with F.H. Sobels, I.I. Oster and R. Falk it became clear that because autosomal isochromosomes can be induced in post-meiotic male germ cells it should, by analogy, be possible to induce attached-X chromosomes in these same germ cell stages. Neuhaus (Nature 1936, 137:996-997) reported the recovery of attached-X chromosomes from males carrying either an $X.Y^S$ or $X.Y^L$ chromosome but not from males carrying a single X chromosome. However, from this early paper it is not possible to determine either the germ cell stage which was treated or the radiation exposure.

One-day old males, either X/Y (ORK) or $X.Y^S/Y^{LC}$ were given an exposure of 1500 R and then individually mated for 3 days to 6 virgin females of the genetic constitution C(1)RM, y w f/Y. All wild type female progeny were tested. These were found either to result from a breakdown of the maternal attached-X chromosome or to carry newly induced attached-X chromosomes. The rates of attached-X induction were 0/14,500 in X/Y males and 11/5,000 in $X.Y^S/Y^{LC}$ males. No spontaneously attached-X chromosomes were recovered in simultaneous control experiments.

When these results are considered in relation to the models of isochromosome induction and recovery discussed by Leigh and Sobels (Mutation Res. 1970, 10:475-487) two conclusions can be drawn. Firstly, it is unlikely that centromere splitting is an operative model; otherwise attached X chromosomes should also have been recovered from the irradiated ORK males. Secondly, regulation must be operative during early embryogenesis in order to permit the recovery of the attached-X's which were found.

The rate of attached-X chromosome induction is low compared to the rates of recessive lethals or translocations. However, it is high when compared to the estimated rates of autosomal isochromosome induction. This probably reflects the greater capacity of the X chromosome to modification without causing lethality. The rates of attached-X induction may be high enough to determine the kinetics and this to find out whether one-hit or two-hit processes are involved.

This work received support from the J.A. Cohen Institute for Radiobiology and Radiation Protection and the Association between Euratom and the University of Leiden, contract no. 052-64-1 BIAN.

Elens, A. Facultés Universitaires N.D. de la Paix, Namur, Belgium. Influence of aging on behavior of D. melanogaster.

It has been previously reported (DIS 46:81) that the differences in positive phototactism found among flies of the strains "wild" (Canton S), "ebony" (e^{11}), and "white" seem to be much more marked for "old" (30 days) than for "young" (5 days) flies. But it was doubted if such differences were founded on characteristics only phototactic. The process of aging can, e.g., affect diversely the locomotor capacity of flies of the various strains and the weaker phototactism of the "ebony" and "white" in old age could be attributed purely to a lower aptitude to move towards the light.

Therefore "young" and "old" individuals of the strains "wild", "white", and "ebony" were submitted to various tests concerning: 1) positive and negative phototactic reactions of flies in groups (by the "countercurrent distribution method", as previously reported, but with 5 possibilities of choice in place of 15); 2) locomotor activity of flies in a group (in a series of six glass tubes connected by glass funnels); 3) locomotor activity of isolated flies (in a square "arena").

For isolated flies, the locomotor activity is significantly reduced in old age for the three strains, the "wild" flies remaining the most active and the "ebony" flies the least. For the flies in a group, the diminution of locomotor activity with age is evident for the "wild" ones; in the strains "ebony" and "white" the differences between old and young are less marked: the locomotor activity of young "white" and "ebony" flies in a group is already a very low one.

From these observations, it could be concluded that the differences previously reported in positive phototactism are a consequence of a lower locomotor activity of the "ebony" and " "white" flies: the "wild" flies are more "phototactic" only because they move faster towards the light. But the present tests concerning the negative phototactic reactions show that the greater differences between strains in old age could perhaps be attributed to a greater repulsion from light in some cases (especially for the old males "white") or to a lowered one in some other cases (e.g. the old "ebony" females).

The relatively uncomplicated behavior reported in the previous experiences concerning the positive phototactic reactions seems to result from complex interactions of various factors, not at the same level for the three strains.

Elens, A. Facultés Universitaires N.D. de la Paix, Namur, Belgium. Temperature, light intensity, and sexual isolation in function of frequency ratio of both genotypes for various strains of D. melanogaster

The object of this work was to study the effect of temperature and light intensity on mating activity and sexual isolation at various relative frequencies of both genotypes in presence ("white" and wild, or "ebony" and wild).

20 temperature-light intensity combinations were used (4 levels of temperature and 5 levels of light intensity), the relative humidity of the air being kept roughly constant. For each combination the sexual activity was measured according to our previously described method (DIS 39:118, 1964) by direct observation for a period of two and one half hours. Three chambers were in observation at the same time; the total number of flies was the same in the three cases, but the frequency ratio of both genotypes differed. 5 repetitions were done.

The major characteristics in sexual activity can be drawn from the Fig. 1 and 2 which give, for each genotype and sex, the ratio of flies having mated. In Fig. 1, the data concerning the 5 levels of light intensity at the same temperature have been grouped; in Fig. 2 the grouping concerns the data obtained for the same light intensity at 4 different temperatures.

The greater activity of the wild males is evident; it seems even that some can copulate more than once in two and one half hours (this is particularly manifest in the case where rare "wild" flies are in competition with many "white"ones). The activity of the "ebony" females can also be relatively high.

It seems that 20°C is the optimal temperature (25°C for the "ebony" males). The influence of light intensity is not a striking one. But the sexual activity is much more affected by the frequency ratio of both genotypes in presence; the wild males are much more active when rare; a same trend is evident for the "ebony" females (much less for the "white" ones). On the contrary, the "white" and "ebony" males are more active when numerous. Such general behavioural characteristics seem relatively independent from the physical environmental factors (30°C is not far from the critical limit).

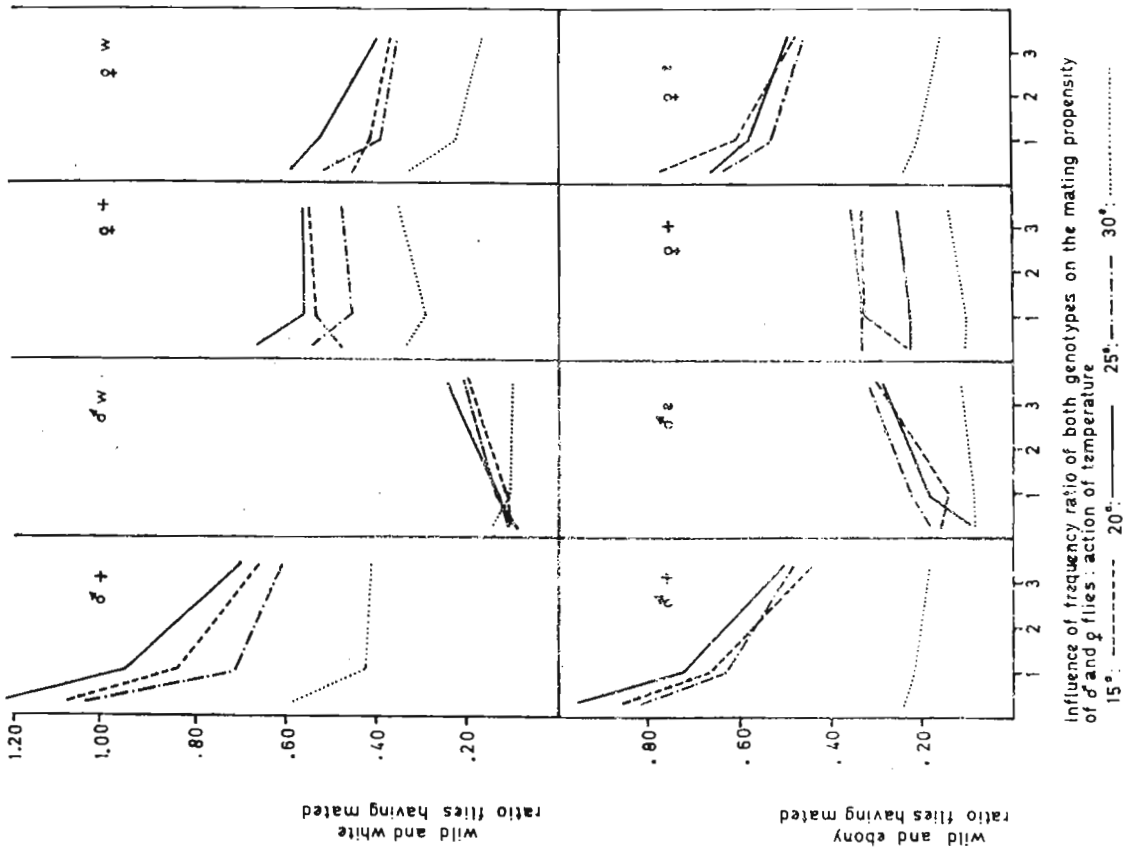

Figure 2

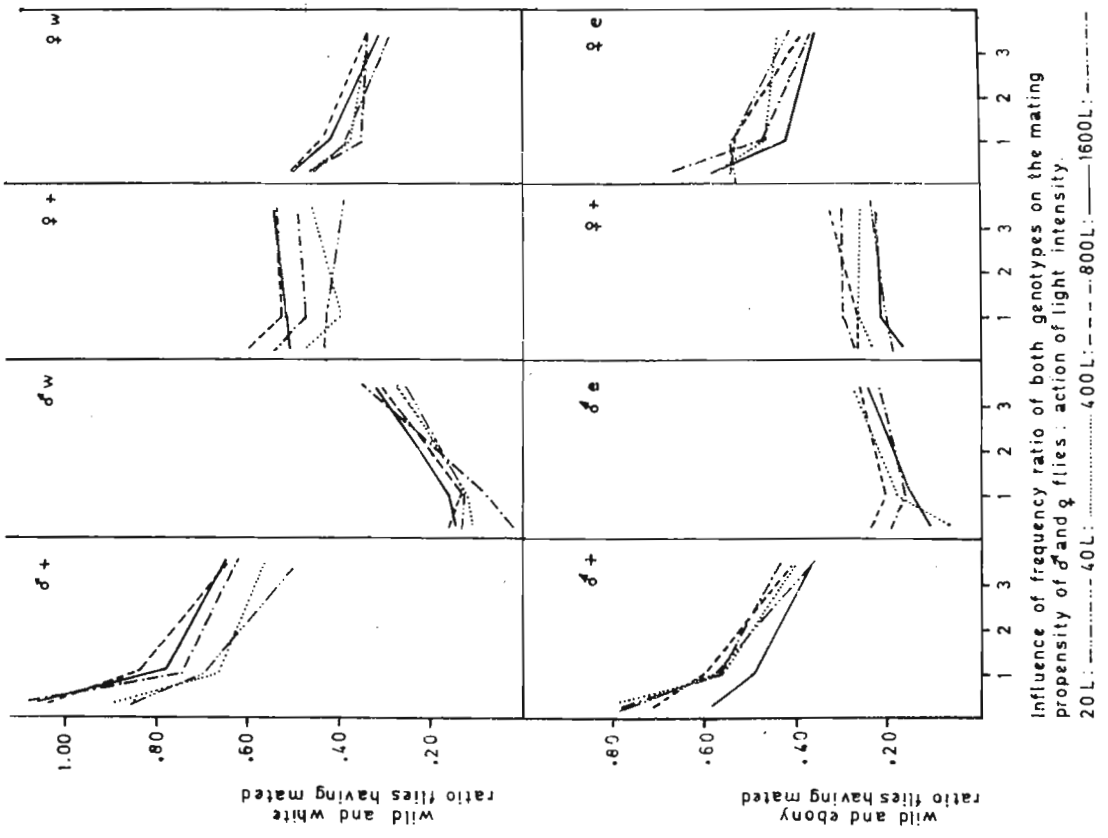

Figure 1

The sexual isolation is not purely a matter of sexual activity; the choice of a partner is of course of primary importance. A first survey, using the coefficients proposed by Petit and Ehrman (Bulletin biologique CII:433, 1968), shows that the "isolation coefficient" between "ebony" and wild is in general higher (approximately 2.0) than the "isolation coefficient" for "white" in competition with wild (roughly 1.0). The "male selection coefficient" is always highly in favour of the wild flies; from its variations it should be difficult to draw general conclusions (concerning e.g. a possible "advantage" for the "rare" males). But, from the variations of the "female selection coefficient" it seems very probable that the "ebony" females (but not the "white" ones) are "advantaged" when they are rarer, being preferred by the numerous wild males. Again, such a characteristic seems to be independent of the physical conditions.

Lakhotia, S.C. University of Calcutta and University of Burdwan, India.

Differential response of polytene X-chromosome of male D. melanogaster to dietary glutamic acid.

Earlier studies by Anders and Anders (1964) and Fahrig et al. (1967) have shown that feeding glutamic acid to developing D. melanogaster prolongs the larval life and the polytene chromosomes of these larvae appear larger. In an attempt to use this method to obtain polytene nuclei in other larval organs (e.g. Malpighian tubules, midgut, etc.) of D. melanogaster suitable for microscopic studies, an interesting effect of dietary glutamic acid was observed on the organization of the male X in salivary glands.

Glutamic acid was mixed with normal Drosophila food (1.5 g/100 g of food). Freshly hatched larvae were transferred and allowed to develop in glutamic acid supplemented food either at 24°C or at 12°-15°C. Salivary gland chromosomes were examined from late third instar larvae (approx. 105-110 hr after hatching at 24°C and 28-30 days after hatching at 12°-15°C). 3L/X chromosome width ratios were considered for comparing the relative width of the X in normal and glutamic acid-fed larvae (for details, see Mukherjee et al., 1968).

Table 1. Effect of dietary glutamic acid on the width of the male X-chromosome in D. melanogaster

	No. of nuclei	Mean 3L/X width ratio ± S.E.
Control male	60	1.10 ± 0.01
GLU male 24°C	31	1.29 ± 0.02*
GLU male 12°-15°C	20	1.04 ± 0.04*
Control female	59	1.00 ± 0.02
GLU female 24°C	30	0.98 ± 0.01

* Ratios significantly different from control male (P 0.01).

At both the developmental temperatures, the chromosomes are wider, condensed in length and better stained than in normal larvae, more so at the lower temperatures. At 24°C, the male X appears narrower than the paired autosomes, unlike the situation in normal male nuclei. At 12°-15°C, the male X shows a reverse effect: the X in male appears much swollen with the banding pattern largely obscured, while the autosomes show clear banding pattern, though much condensed in length. Female nuclei, which too have highly condensed chromosomes, do not show the appearance which male X often displays. The summarized data in Table 1 show the differential effect of dietary glutamic acid on the width of the male X at different developmental temperatures.

Significance of this behaviour of the male X is being analyzed and preliminary observations suggest that with the altered morphology of the X, there are also some changes in the replicative and presumably in the transcriptive activities of the same. It appears that this differential response of the male X is related to the normal hyperactivity of the male X in Drosophila to achieve dosage compensation (Lakhotia and Mukherjee, 1970). It may be noted that under certain other conditions too, as in ltl larvae, the male X assumes a very diffuse and ball-like appearance (Kobel and van Breugel, 1967).

References: Anders, F. and A. Anders 1964 DIS 39:87; Fahrig, R., M. Sieger and F. Anders 1967 Verh. Dtsch. Zool. Ges. in Heidelberg 565-578; Kobel, H.R. and F.M.S. van Breugel 1967 Genetica 38:305-327; Lakhotia, S.C. and A.S. Mukherjee 1970 J. Cell Biol. 47:18-33; Mukherjee, A.S., S.C. Lakhotia and S.N. Chatterjee 1968 The Nucleus, Suppl. 161-173.

Schalet, A. University of Leiden, The Netherlands. Crossing over in the major heterochromatic region of the X chromosome in normal and inverted sequences.

This note briefly summarizes the results of a number of experiments designed for various purposes in which the major heterochromatic region of the X chromosome in Drosophila melanogaster was delimited by the su(f) and y^+ markers.

EXPERIMENT 1: ♀♀ 1J1 y^{J1} sc^{J1} v f mal^{F1} 120 bb^+.Dp(sc^{V1} y^+)/1J1 y^{J1} sc^{J1} v f mal^1 su(f) bb^+ x ♂♂ Y/y ac In49 v f mal^1 su(f). Since all regularly produced ♂ offspring die except 1/2 of the crossovers between 120 and the duplication to the right of the centromere: a) crossing over between su(f) and y^+ is scored in two classes of ♀♀ but only 1 class of ♂♂. b) crossing over between 120 and su(f) is scored in only one class of ♂♂. Crossing over between mal and su(f) is scored only in ♀♀ (mal^{F1}/mal^1 = mal^+ under the conditions of this experiment). The % crossing over given in the table takes these factors into account.

EXPERIMENTS 2 & 3: ♀♀ y^+ sc^8 bb su(f)mal^{F1} f sc^8/v^{S1} sc^8 bb^+ mal^1 f sc^8 x ♂♂ Y/y ac In49 v f mal^1 su(f). In contrast to the other experiments flies were cultured on a potato based, rather than cornmeal, medium. During the collection of parental ♀♀ for parts of experiment 3, it was observed that the eye color of some mal^{F1}/mal^1 ♀♀ were mutant or intermediate rather than wild type. The temperature during the critical periods of development was sufficiently low as to have expected only wild type eyes (Schalet, 1971). Indeed, more than 800 ♀♀ observed during the collection for 3d were all wild type. Failure of the complementation reaction was seen again among the ♀♀ offspring of this experiment in which the temperature during their development did not exceed 25. For this reason crossing over between mal and su(f) could not be accurately measured. These difficulties were not encountered in experiments 1 and 2 where the equality of mal and mal^+ ♀♀ within both non-crossover and crossover classes testifies to the reliability of the data with respect to this point.

EXPERIMENT 4: ♀♀ y^+ sc^8 bb su(f) w^a sc^8/y^{31d} sc^8 bb^+ Tu w^a sc^8 x ♂♂ Y/y w^a f^5 su(f).

EXPERIMENT 5: ♀♀ y^+ sc^8 bb su(f) w^a sc^8/y sc^4 Tu w^a sc^8 x ♂♂ Y/y w^a f^5 su(f). In these experiments the nearly white eye color of the w^a su(f) combination was used to mark the presence of the mutant su(f) allele. In experiment 4, three possible crossovers between su(f) and y^+ failed to breed: 1 ♀ could have been produced by maternal non-disjunction or a triploid; 2 apparent ♂♂ could have been 2X;3A intersexes. Two additional flies showing intersex characteristics were noted. The 11% value for the Tu to su(f) interval does not include data from ♂♂ carrying the y^{31d} marker. Although inclusion of such data would only raise the overall value to 11.6%, the 13.7% found among y^{31d} ♂♂ was considered to be spuriously high in part because of a consistent deficit of non-crossover y w^a Tu ♂♂. In experiment 5 the expected deficit of progeny marked with y was realized. Again the numbers of non-crossover ♂♂ marked with y was consistently smaller than the ♀♀ marked with y, and this led to a spuriously high 10.9% value for the Tu to su(f) interval among y ♂♂ as compared to the 8.8% among y ♀♀. On the contrary, for equal numbers of y^+ marked ♂♂ and ♀♀ the values were 6.9% and 7.0% respectively.

The slight bb allele in the y^+ sc^8 chromosomes of experiments 2-5 probably arose as a consequence of the exchange by which su(f) was inserted into the sc^8 chromosome. The bb phenotype was first noticed in tests of the original y^+ sc^8 su(f) mal^1 f v sc^8 chromosome from which the chromosomes used here were derived. Although all experiments involved mass matings of 5-12 parental ♀♀/culture, the following features of the data may be noted:

Crossover related bb mutants can be generated in a chromosome of normal sequence (c.f. Atwood 1969). In experiment 1a among the 43 tested chromosomes recombinant for the su(f) to y^+ interval there were two cases of independent origin in which ♀♀ showed a bb phenotype over a sc^4 sc^8 chromosome. In one of these cases, from a single set of cultures derived from five parental ♀♀, there were at least 6 offspring marked with su(f) and y^+ which showed similar bb phenotypes. All 6 offspring belong to the complementary crossover class were bb^+.

Premeiotic origin of at least some crossovers in the su(f) to y^+ interval. The example just cited suggests that a single gonial exchange was responsible for the observed crossovers. Supporting evidence for gonial exchange comes from the kind of distribution seen in experiment 2b. Here 9 of 19 crossovers were found among offspring derived from 12 parental ♀♀ in a single set of cultures out of the 13 sets scored in this experiment. Additional support comes from experiment 3b. In a special case, not included in the table, there were 30 y ac ♀♀ offspring in a single set of cultures derived from 12 parental ♀♀. The appearance of these ♀♀ suggest that at least one of the parental ♀♀ had lost the distal tip of the y^{S1} sc^8 chromosome due to a prior X Y exchange in the germ line of her father. Subsequently, an apparent

Spontaneous crossing over in heterochromatic and adjacent euchromatic regions of X chromosome in normal and inverted sequences

Experiment	Sequence	Days of Oviposition	Total Offspring	Crossovers su(f)-y^+	Crossovers mal-su(f)	Crossovers 1(1)20-su(f)	Temperature range during Development of parental ♀♀
1a Nov. '69	normal	1-14	26,600 ♀♀	45 0.116	436 1.6	9 0.068	21-25; 17 (see text)
1b	normal	1-14	25,200 ♀♀	7 0.028	355 1.4	4 0.032	21-25
2a Feb. '71	sc^8/sc^8	1-12	7,400 ♂♂ & ♀♀	3 0.040	80 1.8		25
2b	sc^8/sc^8	1-12	17,500 ♂♂ & ♀♀	19 0.108	238 2.2		17 from just before puparium formation to at most 11 hrs. before eclosion; otherwise 25
3a June '71	sc^8/sc^8	1-6	15,800 ♂♂ & ♀♀	8 0.050			22-26; mostly 25
3b	sc^8/sc^8	1-8	20,000 ♂♂ & ♀♀	5 0.025			22-26
3c	sc^8/sc^8	1-6	10,000 ♂♂ & ♀♀	7 0.070			17 as larvae; otherwise 22-26
3d	sc^8/sc^8	1-6	29,400 ♂♂ & ♀♀	20 0.068			17 as larvae and pupae; otherwise 25
3e	sc^8/sc^8	1-4	7,100 ♂♂ & ♀♀	5 0.070			32-35 for 12 hrs. during first or second larval instar; otherwise 22-26
					Crossovers Tu-su(f)		
4 Jan. '72	sc^8/sc^8	1-8	38,800 ♂♂ & ♀♀	11 0.028 14 0.036	3296 11.0	(see text)	23-25
5 Jan. '72	sc^8/sc^4 sc^8	1-8	24,800 ♂♂ & ♀♀	6* 0.024	348 7.0 735 8.8	(see text)	23-25

* Subsequent tests have shown: 1 w^a Tu ♂ received from his mother an X chromosome carrying the markers y^+ su(f) Tu w^a and a segregating duplication with at least su(f)$^+$ present. 1 ♀ that was phenotypically y w failed to breed. 4 other flies were genuine crossovers between bb and su(f).

gonial exchange could have occurred to the left of su(f), since the phenotypes of the exceptional ♀♀ were: 2 y ac f^+ mal^+ and 28 y ac f mal. The 1 y ac f^+ mal^+ ♀ which was bred gave 11 y ac v mal ♂ offspring and 0 y ac f^+ mal^+ ♂♂.

Some crossovers in the su(f) to y^+ interval do not involve the bb locus. This is demonstrated by the 6 crossovers in experiment 5 in which the parental ♀♀ were heterozygous for the bb deficient sc^4 sc^8 chromosome. At least 1 of these crossovers appears to involve the region between bb and su(f) in the y^+ sc^8 bb su(f) w^a sc^8 chromosome. Whether the heterochromatic region to the left of the bb locus in this chromosome was involved in the other crossovers has not been tested yet.

Possible temperature influence on crossover frequency and changes in redundant sequences. Data presented in the table suggest the possibility that ♀♀ cultured at 17 during at least part of their pre-imaginal development may exhibit about twice the amount of crossing over in the su(f) to y^+ interval as ♀♀ cultured at the higher temperatures. The 0.116% crossing over in experiment 1a may be an example of this temperature enhancement, since parental ♀♀ were inadvertantly placed at 17 for 3 or 4 days prior to eclosion. Thus, the maintenance of stock cultures at around 17, in a manner which permits unrestricted crossing over to take place in the heterochromatic region, may serve to promote changes in redundancy not only within the bb locus, but also within repetitive sequences located on either side of the bb locus. The su(f) locus could be included among such structures. The crossover data discussed here has not taken into account the possibility that the wild type and mutant alleles of this locus represent different degrees of redundancy or complexity, and that some of the observed crossovers between su(f) and y^+ may have been exchanges within this locus. These conjectures concerning the organization of su(f) are based upon features previously enumerated (Schalet, Genen en Phaenen, 1970) which include suppression of lz^1 and intensification of lz^{37} by $su(f)^1$, and enhanced by the observations of Voss concerning the l^{3DES} allele of su(f) and $su(l^{3DES})$ reported in DIS 46 and 47.

Comparisons of crossover frequencies in normal and inverted sequences. Crossover frequencies between su(f) and y^+ in normal and inverted sequences under comparable temperature conditions appear to be similar, although the data are too scanty to preclude a 1.5-fold increase. (The 0.4% crossing over at the bb locus in a sc^8 chromosome reported by Schalet (1969) remains an unexplained anomaly.) A perusal of the literature reveals that, almost invariably, crossing over in the segment proximal to f-B in the normal chromosome is increased at least 1.5-fold in the sc^8 (type) chromosome (see also experiment 4 for Tu to su(f) interval), while data based on the segment proximal to car fails to show a consistent comparable increase. Yet, Braver (1956, 1957) reported that the region comparable to the car to y^+ interval in the sc^8 chromosome, namely, the car to w interval in the rst^3 inversion, showed a 3 to 4-fold increase in crossing over as compared to the normal chromosome.

X-ray induced crossing over in inverted sequences. Along with the untreated series of experiments 2, 4 and 5, other ♀♀ were exposed to 3,000 R and crossovers, especially between su(f) and y^+, were scored. For experiments 2 and 4 induced crossovers (2-5.7%) were found for all days of oviposition, except that days 5-6 were not scored. When allowance is made for the difference in X-ray exposure, frequencies and curves were roughly comparable to Roberts' (1969) c(3)G experiment. Induced crossing over did not generate detectable bb locus deficiencies. In experiment 2, when the total exposure was divided into two equal fractions, one hour apart, crossing over was reduced for all days of oviposition and reductions ranged from 14% to 22% below the unfractionated series. In experiment 5, induced crossovers were found only among eggs laid during the first two days of oviposition at a low frequency of about 0.2%.

(This work was carried out within the framework of the Association between Euratom and the University of Leiden, Contract 052-64/2 BIAN, and it also received support from the J.A. Cohen Institute for Radiopathology and Radiation Protection.)

Hanly, E.W. University of Utah, Salt Lake City, Utah. The effect of Actinomycin D on ommatidial bristle development. In a recent publication (Hanly and Hemmert 1967) the fact that Actinomycin D inhibits the development of D. melanogaster ommatidial bristles in vitro was reported. It was noted that when the developing eye (24-30 hr following puparium formation of Oregon-R at 26°C) attached to the optic lobe of the brain is dissected and cultured in Schneider's medium containing low concentrations of Actinomycin D, ommatidial bris-

tles will not develop, although when placed in medium without Actinomycin, these bristles will grow if done at the proper developmental time. Possible explanations of the very low concentrations needed for inhibition were also presented. Further experiments have given more information on this phenomenon.

Whole brain complexes (cerebral hemispheres, optic lobes and attached eyes) were dissected 25 1/2 hr after puparium formation and placed in approximately 1 ml Schneider's medium containing Actinomycin D (Merck, Sharp & Dohme) to 0.075 µg/ml. They were removed with a fine pipette after 5 min and washed twice in 2 ml each of Schneider's medium without the antibiotic. They were then placed in hanging drop cultures containing no inhibitor as described in Hanly, Fuller and Stanley (1967) and observed for a 72 hr period. Appropriate controls were also cultured.

Eyes with attached optic lobes, but without cerebral hemispheres, competent to form ommatidial bristles (27 1/2 hr after puparium formation) were also dissected and treated in like manner. Eyes alone were similarly tested by dissecting at 28 1/2 hr after puparium formation. Controls in these cases consisted of one side of a complex while experimentals were the opposite side.

In all cases examined, ommatidial bristles developed in the controls while none appeared in the treated eyes (approximately 100 cultures). Other developmental processes occurring in the eye and brain during this time (growth of the ommatidia, apparent deposition of pigment granules, extension of the outer optic glomerulus, and growth of the optic nerve) did not seem to be affected by the antibiotic treatment. Subsequent deposition of normal in vitro amounts of corneal material was also apparently not affected. These results indicate that RNA synthesis necessary for developmental functions other than ommatidial bristle synthesis has occurred prior to or occurs after the pulses of Actinomycin D; or that the DNA locus or loci responsible for bristle synthesis are particularly sensitive to low concentrations of the inhibitor.

Cultures were also established in order to determine the sensitivity of optic lobes with attached eyes over different time periods of development. These tissues were dissected, with appropriate controls, every half hour from 27 1/2 through 33 hr. Eye-optic lobe complexes dissected at 29 1/2 hr following puparium formation and treated with Actinomycin D developed very short, fine bristles. Those dissected and treated at 30 hr had slightly longer and larger bristles. Each subsequent half hour produced longer bristles until normal-sized bristles were produced in cultures of eyes dissected at 31 hr. Bristles normally appear in vivo between 32 and 33 hr at 26°C following puparium formation. These results indicate that at least some DNA-dependent RNA necessary for ommatidial bristle development is synthesized approximately 2 1/2 - 3 hr before its apparent function is seen. Fristrom (personal communication) and others have calculated a "half-life" of some messenger-type RNA molecules in Drosophila to be between 2 1/2 and 3 1/2 hr. Furthermore, it appears that for normal bristle development, continued RNA synthesis is necessary for approximately 1 1/2 hr. This could be a developmental "maintenance" process.

During the course of these experiments it was noted that if concentrations of Actinomycin D of 0.05 µg/ml were used, or if the exposure period used was less than 5 min, some ommatidial bristles would develop. They were, however, usually abnormal: irregular, short and stubby, multiple bristles from single sockets, or bent and crooked. Many of these appeared similar to those in the singed phenotype.

References: Hanly, E.W., C.W. Fuller and M.S. Stanley 1967, The morphology and development of Drosophila eye. I. In vivo and in vitro pigment deposition. J. Embryol. exp. Morpho 17:491-499; Hanly, E.W. and W.H. Hemmert 1967, Morphology and development of the Drosophila eye. II. In vitro development of ommatidial bristles. J. Embryol. exp. Morph. 17:501-511.

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Mitra, N. and A.S. Mukherjee. University of Calcutta, India. Continuous ^{3}H-TdR labeling pattern as the beginning of replication cycle: further evidence.

The results of the present experiment throw some light on the controversy regarding the type of labeling pattern at the initiation of the DNA replication cycle in the polytene chromosomes of Drosophila melanogaster. Ninety-hour old, late third instar larvae were fed for 2 hr on mitomycin C mixed in the medium at a conc. of 0.02 ml/gm of food (conc. 2 mg/ml). Excised salivary glands were subjected to autoradiography after a 20 min incubation in 200 uCi/ml of ^{3}H-

TdR (Sp. Act. 6000 mCi/mM; BARC; Trombay). DNA replication patterns were analysed from autoradiograms prepared after a 25 day exposure by categorizing the patterns into 2C (light continuous, 3C (heavy continuous), 3D (heavy discontinuous), 2D (medium discontinuous). 1D (light discontinuous) types after Rodman (1968). It was seen that in comparison with the control, the treatment series showed a significant reduction in the overall labeling frequency in both sexes. When a comparison of the absolute frequencies (amongst all nuclei examined, both labeled and unlabeled) of the continuous and discontinuous types is made, it is seen that though MC affects both types of patterns, the effect is more pronounced on the former. It has been shown earlier that inhibitory action of MC on DNA synthesis (Szybalski and Iyer, 1964) is restricted mainly to cells which are about to enter or have just entered into a new replication cycle (Doi et al., 1967). Our data, in the light of this action of MC, gives further proof of our earlier postulation (Lakhotia and Mukherjee, 1970) that the continuous type of pattern and not the discontinuous type is at the initiation of the DNA replication cycle.

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Paik, Y.K. and K.C. Sung. University of Hawaii, Honolulu, Hawaii. Chromosomal polymorphism in Hawaiian populations of D. immigrans.

In most cases, Drosophila flies adjust themselves to new habitats, where environmental stresses are different, through the formation of races or ecotypes by selection. This formulation, however, appears not to fit the populations of all species of Drosophila, especially those which are geographically very widespread or cosmopolitan. Drosophila immigrans represents the latter though displaying remarkable ability to colonize diverse natural habitats on the islands of Hawaii. Unfortunately, our ideas of what constitutes such a successful colonization of this species are much too vague and are purely speculative at present, despite the fact that solution of the problems posed is biologically very important.

As an initial step toward attacking the problems, we have analyzed the inversion polymorphisms of this species on the islands of Hawaii. Preliminary report of part of this work is presented in this communication.

The population samples presented here were taken from the islands of Oahu and Hawaii, Hawaii. The Oahu samples were from three different habitats: the first population sample (OT-70) was taken in late November, 1970, in Mt. Tantalus - moist forest - at 1500-1700 foot levels. A second collection (OT-71) was taken in mid-January, 1971. Another sample (OM-70) was collected in Mt. Mauna Kapu - dry forest - at 2100-2300 foot levels in late October, 1970 and a second collection (OM-71) in early January, 1971. The final sample (OP-71) was collected in mid-March, 1971, in Mt. Puu Keaau - cactus forest - at 100-1000 foot levels.

The Hawaii samples were taken in early April, 1971, in Hawaii Volcanoes National Park (HS-) and in Kilauea Forest Reserve (HK-) - a virgin rain forest. In the first collecting area samples were taken at six elevations along Mauna Loa Strip Road extending from 3000 to 6700 feet; in Kilauea Forest a sample was collected at an altitude of approximately 5300 feet. In Tables 1 and 2 are summarized the data on chromosomal polymorphisms obtained from these populations by "egg sample" technique.

Table 1. Frequencies (in per cent) of inversion heterozygotes in the Oahu populations (N, total number of larvae examined, one larva per line).

		Heterozygous Inversions						
Sample	N	A	B	C	A+B	A+C	B+C	Total Het. Inversions
OT-70	83	25.3	2.4	1.2	-	-	-	28.9
OT-71	120	18.3	3.3	0.8	0.8	-	-	23.3
OM-70	53	24.5	1.9	-	1.9	1.9	-	30.2
OM-71	158	22.8	6.3	1.3	2.5	1.3	1.3	35.4
OP-71	54	18.5	5.6	-	3.7	1.9	-	29.6
All samples	468	22.0	4.3	0.9	1.7	0.9	0.4	29.9

A, B, and C denote different inversions on the 2nd chromosome; and these are identical with or similar to those described by Brncic (1955).

The average frequency of the total heterozygous inversions in the Oahu populations was 29.9 per cent. Compilation of the total number of separate inversions showed that the distribution of the inversions is uniform for the three populations ($0.25 > P > 0.10$). The mean frequency of heterozygosity per larva in the Oahu populations was 0.33, based on the total examinations of 903 larvae, nearly the same as found in Maui populations, Hawaii, by Richmond and Dobzhansky (1968).

The chromosomal polymorphism in the Hawaii populations is, however, quantitatively quite unlike the Oahu populations (see Table 2). First, the incidence of the inversion heterozygotes is generally much higher in all the Hawaii populations as compared with the average frequency of the heterozygous inversions in the Oahu populations. It is particularly noticeable to find the exceptionally high frequencies of the inversion heterozygotes in the HS-4000' and HS-5100' populations where the greatest number of samples were actually examined. Secondly, it was found for the two populations that the distribution of separate inversions is significantly nonuniform ($0.05 > P > 0.025$). It is worth noting that the two collecting sites are separated by only four miles. In addition, the mean frequency of the inversion heterozygosity per larva in the HS-4000' and HS-5100' was found to be 0.66, based on the total examination of 334 larvae. This mean frequency is twice as high as those found in the Oahu and Maui populations and at least three times higher than those reported from the other geographical areas.

Table 2. Frequencies (in per cent) of inversion heterozygotes in the Hawaii populations. (N, total number of larvae examined, one larva per line)

		Heterozygous Inversions						
Sample	N	A	B	C	A+B	A+C	B+C	Total Het. Inversions
HS-4000'*	67	17.9	10.5	16.4	5.9	-	5.9	56.7
HS-4300'	12	25.0	-	8.3	-	-	-	33.3
HS-5100'*	101	31.7	9.9	6.9	5.9	2.9	2.9	60.4
HS-6100'	11	36.4	-	-	-	-	-	36.4
HS-6700'	15	26.7	-	6.7	6.7	-	-	40.0
HS-3000'	24	12.5	-	8.3	4.2	-	4.2	29.2
HK-5300'≠	10	10.0	10.0	10.0	-	10.0	-	40.0

* Statistical comparison for the distribution of the heterozygous inversions was possible only for these two samples (see text).

≠ A new pericentric inversion of the 2nd chromosome was detected in this po population.

In summary 1) comparison of the frequency of heterozygous inversions and distribution pattern of the separate heterozygous inversions in the Hawaii populations (particularly in those at HS-4000' and HS-5100') with those on Oahu suggests that the three common inversions respond in different ways to the potential ecological differences between the two islands; 2) the striking similarity of all the Oahu populations studied (both in time and areas) i.e., the lower frequency and the comparatively uniform distribution of the inversions, both suggest that the populations of this species on Oahu are not differentiated; and 3) the striking difference in the distribution of separate inversions between the HS-4000' and HS-5100' suggests that the two populations on Hawaii are differentiated. This finding is reinforced by our more recent unpublished data.

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References: Brncic, D. 1955 Jour. Heredity 46(2):59-63; Richmond, R. and Th. Dobzhansky 1968 Studies in Genetics 4:381-386.

Sobels, F.H. University of Leiden, The Netherlands. The viability of II-III translocations in homozygous condition.

For insect irradication programs, the possible advantage of partial sterility resulting from translocations (over complete sterility, as achieved by the sterile male technique) are now being considered. Since in these species, inversions for balancing translocations are not readily available, large scale breeding of individuals with translocations depends on their homozygous viability. With the exception of Ytterborn's (DIS 45:158, 1970) data, little is known about the viability of translocations in homozygous condition.

For that reason homozygous viability of a number of translocations that had been obtained in experiments on the interaction of breaks induced in different stages of spermatogenesis was determined. Males heterozygous for a II-III translocation and the markers bw and st p^p were mated to females of the genotype yw^- spl sn^2;Lyu/TM3 Sb Ser. The presence of p^p in TM3 enabled recognition of the desired genotypes, so that flies heterozygous for the translocations and the third-chromosome balancer could be mated to each other. In total 256 different translocations were tested, out of which only 135 could be bred through the successive generations required for the test. Out of these, 84, that is 62.2%, were lethal when homozygous. The weighted mean for the induced translocation frequency in these experiments was 7.0%. On the basis of earlier results (Sobels, Mutation Res. 8:111, 1969) this translocation frequency would correspond to 7% recessive sex-linked lethals, and it is assumed that about four times as many lethals are induced in the major autosomes. This would mean then that about 28% of the lethality can be attributed to recessive lethals in the second and third chromosomes and little over one half of the total lethality observed, results from the translocations per se. This observation suggests that either deletions, or breaking up the contiguity of gene clusters or linked genes and relocating them to different sites, results in some kind of recessive lethal position effects (Muller and Altenburg, Genetics 15:28, 1930). These findings correspond remarkably well to those obtained by Ytterborn after an exposure of sperm to 2000 R, which induced a comparable frequency of translocations as observed in our experiments. Ytterborn noted that out of 35 translocations, 66% were lethal in homozygous condition. Assuming that 27% results from recessive lethals, 53% of the total lethality can be ascribed to that of translocation per se.

For the possible applications of induced translocations it is of interest to conclude that at doses inducing 6.5 - 7% II-III translocations, about 53% are sufficiently fertile to be of further use and that out of these roughly 36%, or about one fifth of the total number of induced translocations, are viable in homozygous conditions.

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Miklos, G.L.G.* University of California, San Diego, La Jolla, California. Properties of males homozygous for Segregation-Distorter.

There are a number of potentially interesting problems associated with SD/SD males which have not been reported on in the past. They are presented here in case they merit sufficient interest for further pursuit by others.

1. Segregation ratios from X/y^+Y;SD-72/SD bw males. It has been found on two separate occasions that this genotype yields high recoveries of the y^+Y chromosome. The SD-72 chromosome is a standard highly distorting element used routinely, and SD bw is a highly distorting derivative of SD-72 obtained by recombination between SD-72 and cn bw. The y^+Y is also a standardly used chromosome which possesses L(L)J1$^+$ y^+ac^+ and In(1)sc^8 heterochromatin. The X's used here were structurally normal run of the mill chromosomes from shelf stocks.

The recovered gametic arrays obtained from X/y^+Y;SD-72/SD bw, X/Y;SD-72/SD bw and X/y^+Y; SD-72/In(2LR)Cy males raised at 25 and 18 degrees are shown in Table 1. At 25 degrees, the recoveries of the y^+Y in two different experiments were 0.68 and 0.72. These findings could perhaps be dismissed without much introspection were it not for the following: the original experiment was repeatable; the X chromosomes used in the two experiments were from different laboratory stocks; the same genotype was constructed using different crossing programmes; the tester females in the second experiment were of a different genotype to those in the first;

the abnormally high recoveries of the y^+Y were abolished at 18 degrees, and a high recovery of the Y was not observed in X/Y;SD-72/SD bw males.

From Table 1 it can be seen that a non-distorting X/y^+Y;SD-72/In(2LR)Cy genotype does not produce abnormal gametic arrays at 25 or 18 degrees, the recoveries of the y^+Y being 0.53 and

Table 1. Gametic arrays from homozygous SD males.

Genotype	X;SD-72	X;SD bw	y^+Y;SD-72	y^+Y;SD bw	Total progeny	Temperature
X/y^+Y;SD-72/SD bw	0.16	0.16	0.31	0.37	1573	25°
X/y^+Y;SD-72/SD bw	0.15	0.13	0.37	0.35	1377	25°
X/Y;SD-72/SD bw	0.24	0.21	0.29	0.26	916	25°
X/Y;SD-72/SD bw	0.22	0.24	0.27	0.27	6273	25°
X/y^+Y;SD-72/DS bw	0.25	0.30	0.23	0.22	3083	18°
X/Y;SD-72/SD bw	0.31	0.28	0.20	0.21	3256	18°
Genotype	**X;SD-72**	**X;Cy**	**y^+Y;SD-72**	**y^+Y;Cy**	**Total**	**Temperature**
X/y^+Y;SD-72/Cy	0.22	0.25	0.25	0.28	5012	25°
X/y^+Y;SD-72/Cy	0.24	0.28	0.24	0.24	6246	18°

0.48. Similarly, in the X/Y;SD-72/SD bw case, the recoveries of the Y are 0.55 and 0.54. At 18 degrees, the recoveries of the y^+Y and the Y are slightly depressed, and are at 0.45 and 0.41 respectively.

The combined results of these experiments indicate that it is quite possible to produce abnormal gametic recoveries by combining two bivalents each of which alone yields gametic recovery ratios near one to one. Furthermore, whatever causes the observed perturbations, utilises in some way the genetic material from the X chromosome which is present on the tip of the y^+Y. The y^+Y element in certain situations, thus possesses properties not expected from an inocuous marked Y. Whether this phenomenon occurs with other marked Y derivatives remains for future investigations.

2. Progeny to sperm ratios from SD bw/SD bw males. Progeny to sperm ratios from SD/SD^+ males have been extensively treated in the literature and arguments concerning the efficiency of sperm usage by the female, selection of sperm by the female and the presence or absence of different sperm types in an ejaculate has provided the basis for much discussion.

These experiments were designed to answer the question of whether dysfunctional sperm were present in an ejaculate. SD bw/In(2LR)Cy individuals were mated to each other, and SD bw /SD bw and SD bw/In(2LR)Cy sibs were produced and kept as virgins for 3 days and then mated singly to a y female. All matings were monitored and upon separation of partners the males were removed by suction and most were discarded. Some were retained and dissected to check for their residual sperm content. Half the females were dissected after 3 hours or so and the sperm heads stained and counted under phase optics. The remainder were allowed to lay eggs with several accompanying changes of food in order to minimise larval crowding.

The results are shown in Table 2. Experiment 1 depicts the results of a small pilot experiment in which SD bw/SD bw males were mated to cn bw/cn bw females. Although the average

Table 2. Progeny to sperm ratios from SD bw/SD bw and SD bw/In(2LR)Cy males.

	Genotype	Sperm/ Female	No of Females Dissected	Progeny/ Female	No of Females Tested	Progeny/ Sperm	Genotype of Female
Exp 1	SD bw/SD bw	144	9	4.5	8	0.03	cn bw/cn bw
Exp 2	Sd bw/SD bw	120	49	1.4	54	0.01	y/y
	SD bw/In(2LR)Cy	365	47	263	43	0.72	y/y

number of sperm transferred and stored was large, the number of resultant progeny was very low by comparison. An over-whelming proportion of the ejaculate consisted of dysfunctional sperm. The females were dissected at the end of their egg laying period and less than 5 percent of originally transferred sperm had been retained. Dissection of the males revealed that they too contained sperm.

Experiment 2 shows that the progeny to sperm ratio from SD bw/In(2LR)Cy males mated to

y/y females is 0.72. Hence the female could be utilising sperm with an efficiency near 70 percent. However, the ratio from homozygous SD bw fathers is 0.01, and if the efficiency of sperm usage remains unchanged, then most of the ejaculated sperm are dysfunctional.

This is in contrast to the results from SD/SD$^+$males for the following reasons. It is known that the lifetime productivity of SD/SD$^+$ males is about half that of SD$^+$/SD$^+$ controls and that the progeny to sperm ratios from these two genotypes are similar. If it is assumed that the efficiency of sperm usage is female determined and is constant between SD/SD$^+$ and SD$^+$/SD$^+$ males (as indeed seems to be the case), and if females use sperm of different genotypes at random, or nearly so, then an SD/SD$^+$ male must transmit mainly SD sperm, in order to satisfy the above experimental data. That this is in fact the case is known from the work of Tokuyasu, Peacock and Hardy (in prep) who have demonstrated that much sperm breakdown (of the SD$^+$ class presumably) occurs within the male, and consequently most ejaculated sperm are SD bearing.

The results that most ejaculated sperm from SD/SD$^+$ males are nondysfunctional, whereas most sperm from SD bw/SD bw are dysfunctional need not necessarily be at variance with each other. A probable explanation may be that when the proportion of dysfunctional sperm in a male is very high, as is the case in SD/SD males where almost all sperm are destined to be dysfunctional, the mechanisms for sperm retention become inefficient, and dysfunctional sperm become included in the ejaculatory contents. The males are literally unable to contain themselves.

* Now at Department of Genetics, Research School of Biological Sciences, Australian National University, Canberra, A.C.T., Australia.

Gill, K.S., Punjab Agricultural University, Ludhiana, Punjab, India.

Morphological differences between a pair of sibling species - melanogaster and simulans.

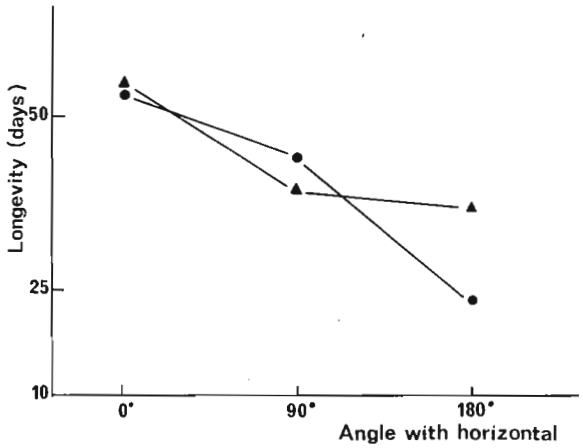
Adults of these two species are morphologically very similar, adult females cannot be distinguished from each other while adult males may be differentiated on the basis of external male genitalia. The posterior process of the genital tergite is rounded in simulans and hook-shaped in melanogaster (Sturtevant, 1920, Genetics 5: 488). Current investigations reveal that pupae and third instar larvae of both the sexes in these two sibling species can be distinguished from each other in several respects. (1) Pupal pigmentation: The pupae of simulans are more heavily pigmented than those of melanogaster. Pupae of simulans appear moderately brown while those of melanogaster only lightly brown. (2) Setae: The two species can be differentiated both on the basis of distribution and size of the setae. Setae were examined on the dorsal side of the pupae. As the outer pupal case is identical with the cuticle of the last larval instar, the following description holds for the third instar larvae. Each segment is incompletely divisible into an anterior part and a posterior part by a system of ridges that run across each segment. The partition separating the anterior and posterior parts shifts posteriorly as it approaches the mid-dorsal line. This posterior shift is in general more pronounced in melanogaster than in simulans. Most of the setae are present in the posterior part and all are pointed posteriorly. The setal band is broader laterally and narrower medially. The narrowing of the setal band is more pronounced in melanogaster. Few setae are present in the anterior part and they appear to be directed randomnly. More setae are present in the anterior part of the simulans than in that of melanogaster. Regarding size, setae in simulans are distinctly larger than those in melanogaster. (3) Intersegmental groove: This also was examined in the pupae. The walls of the groove are thicker in simulans, while the space in the middle is wider in melanogaster.

F_1 pupae (both males and females) obtained in crosses between the two species are more like simulans pupae. To see if mutations affecting bristle morphology in the adult also affect setae in the larva, spineless (ss) pupae were examined. The setae are rudimentary. Setal morphology is now being examined in other groups of sibling species and in other bristle mutants. Setal patterns in melanica and robusta are different from each other and from that in melanogaster. Setal morphology can, therefore, be a useful character in systematics.

David, J. and Y. Cohet. University Claude Bernard, Lyon, France. Accessibility of food and life span of Drosophila adults.

Although longevity of Drosophila adults has been studied in many publications, little attention has generally been paid to the influence of experimental conditions. In an attempt to get more reproducible results for Drosophila life span, we studied the importance of food accessibility, expressed by the position of food in cages, and the inclination of its surface.

Groups of 10 females and 10 males of highly vigorous F_1 heterozygote adults were placed in plastic cages (5 x 5, 5 x 8, 5 cm) of the model used for measuring egg production (David and Clavel 1968). Food (killed yeast, axenic medium) was placed in small round containers and changed every other day. Three experimental conditions were used:



1 - food in normal position at the bottom of the cage (horizontal position); 2 - food vertical on a side of the cage (angle of 90° with horizontal); 3 - food inverted at the top of the cage (angle of 180° with horizontal).

Four or five repetitions were made for each treatment.

The results are summarized in the table and figure. It appears that, when food is not in the normal position, and thus less accessible, the life span is reduced. Moreover, this reduction is roughly proportional to the difficulty of getting food, expressed by the angle made by the surface with horizontal (see figure). For the two first treatments, longevity of males and females is approximately identical. But a clear sex difference is observed when food is placed at the top of cages, the survival of males then being definitely higher.

It is concluded that food accessibility interfers with the ageing process. Young adults can feed in any position. But, as the flies age, their activity diminishes and old flies are less able to get food when it is poorly accessible. Then they die prematurely. Male activity is not so greatly affected, so that they live longer.

For the theoretical interpretation of the data, it may be said that, when food is difficult to get, there is a lowering of the threshold of a "dying process", different from the

FOOD	FEMALES				MALES			
Position	Mean (days)	Variance	Variation Coefficient	n	Mean (days)	Variance	Variation Coefficient	n
normal	53.45 ± 1.85	136.35	21.9	40	55.25 ± 1.29	53.35	13.2	32
vertical	44.44 ± 1.22	61.50	17.7	41	39.45 ± 0.97	39.18	15.9	42
reversed	24.18 ± 0.88	33.78	24.0	44	37.14 ± 1.38	78.07	23.8	41

"aging process", as this has been considered by Maynard Smith. But it is also possible to explain the results in terms of "wear and tear" or "rate of living" theory: the excessive activity imposed on the flies in adverse conditions resulting in an acceleration of the aging process.

It is supposed that new experiments will allow a choice between the two conceptions. Anyway, the great importance of the experimental conditions in longevity studies must be underlined.

Reference: David, J. and M.F. Clavel 1968, A new method for measuring egg production without disturbing the flies. DIS 43:122-123.

Aknowledgements: We thank Professor J.H. Sang for helpful discussion of our data.

Helmsing, P.J. and O. van Eupen.
University of Nijmegen, The Netherlands.

Gene activity and histone patterns in salivary gland nuclei and chromatin of Drosophila hydei.

In many instances (1), it was reported that histones are involved in the specific response of the genome on various gene activating treatments. Incubation of Drosophila salivary glands in a medium containing the insect molting hormone ecdysone results in a specific quantitative decrease in one of the major histone fractions (2). It is well established that application of ecdysone to Dipteran salivary glands in vitro results in a characteristic pattern of local changes in genome activity. The aim of this study was to establish whether or not the change found in the histone pattern of Drosophila melanogaster is a specific effect of ecdysone or can be brought about by other treatments influencing genome activity as well. Histones were extracted with 0.2 N sulphuric acid (30 min at 4°C) or with 0.5 N sulphuric acid (15 min at 4°C) (3) from salivary gland nuclei of Drosophila hydei in which a specific change in genome activity was induced in the intact gland by either a temperature treatment (4) or by incubation of the glands with β-ecdysone (1mg/ml). Control glands were incubated in Ringer's solution for identical periods at room temperature. Electrophoresis of the sulphuric acid extracts from control glands on 15% polyacrylamide gels (5) reveals a pattern of histone fractions which is essentially the same as the pattern from Drosophila melanogaster fly histones obtained by extraction with 2 M NaCl (6).

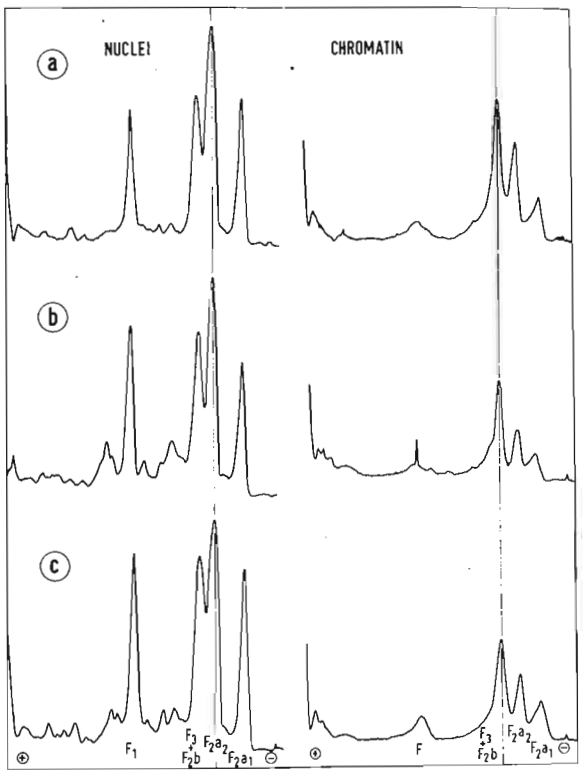


Fig. 1. Densitometric analysis of polyacrylamide gels containing histone fractions extracted from whole nuclei (left) and chromatin (right). (a) control, (b) after applying a temperature treatment to isolated salivary glands, which resulted in the formation of temperature puffs; (c) after incubation of isolated salivary glands with ecdysone. The measurements were performed at 550 nm.

For comparison of the histone fractions from nuclei in which specific changes in the puffing pattern were induced, a batch of 500-600 mg of isolated salivary glands was divided into three equal portions. One portion served as a control, another portion was submitted to a temperature treatment and the third portion was incubated with ecdysone. Following these different treatments some of the glands were squashed and stained to determine the presence of temperature- or ecdysone-specific puffs. From the rest of the glands nuclei were isolated. After repeated extractions of the isolated nuclei with sulphuric acid and electrophoresis it was found that all gels displayed 4 major components and 16-18 minor bands. Densitometric analysis showed that neither qualitative nor quantitative differences could be found in the major histone fractions of nuclei from temperature- or ecdysone-treated glands as compared with nuclei from control glands (Fig. 1, left side). Differences in the minor fractions do occur. However, these differences seem to be unrelated to the treatments applied.

Extraction and subsequent electrophoresis of histones from chromatin prepared from polytene nuclei resulted in a histone pattern with consistently different characteristics, if compared with extracts from whole nuclei. All major fractions present in extracts from whole nuclei are present in the extracts from chromatin (Fig. 1, right side), but the number of minor basic protein fractions was reduced to 5-6. Despite these general differences in the pattern of basic proteins between nuclei and chromatin extracts, no indication was obtained for specific differences in the patterns derived from treated and untreated samples. This indicates

that the activation of particular groups of genes in the polytene chromosomes of Drosophila hydei does not involve a change in the electrophoretic pattern of major histone fractions.

References: (1) MacGillivray, A.J., J. Paul and G. Threlfall, Adv. Cancer Res., in press (2) Cohen, L.H. and B.V. Gotchel 1969 Fed. Proc. 28:600; (3) Asao, T. 1970 Exptl. Cell Res. 61:255; (4) Berendes, H.D., P.M.A. van Breugel and Th.K.H. Holt 1965 Chromosoma 16:35; (5) Panyim, S. and R. Chalkley 1969 Arch. Biochem. Biophys. 130:337; (6) Dick, G. and E.W. Johns 1969 Comp. Biochem. Physiol. 31:529.

Benner, D.B. East Tennessee State University, Johnson City, Tennessee. Some properties of Y-fourth chromosome translocations.

In addition to the Y-autosome translocations reported in DIS 47 Special Supplement, the Seattle-La Jolla Drosophila Laboratories recovered 24 presumed Y-4 translocations which were sent to Dean Parker's laboratory in Riverside for study. The following is a preliminary report on some of the properties of these translocations.

Five of the original 24 translocations have been lost, and two have lost one of the elements. Three other translocations prove to lack 4R markers because on a ci ey^R spa^{pol} background y^+ B^S ci ey^R spa^{pol} progeny are recovered. Two additional cases (H162 and G51) may prove to be of special interest because they are y^+ ci^+ ey^R spa^{pol}. B^S individuals are ci and appear to be ey^R spa^{pol}. These 5 stocks are listed under the heading "Appear to Lack 4R" in Table 1 below.

Table 1. Summary of tests to determine position of nucleolus organizer, segregation properties, and fertility in Y-4 translocations. See text for explanation of tests.

Stock	Rescue C(1)DX, y f: y^+	Rescue C(1)DX, y f: B^S	Recovery of y^+ and B^S males: y^+	y^+B^S	y^2B^S	y^2	N	Proportion recovered: y^+	Proportion recovered: B^S	$X/y^+/B^S$ fertile
A 27		+	0	.478	.522	0	92	.47	.53	+
L 59	+		.292	.357	.399	.012	168	.50	.50	?
R 90	+		.143	.476	.333	.048	21	.50	.50	-
B 23		+	.034	.337	.600	.027	110	.38	.62	+
A 94[1].	+		.969	0	0	.031	128	-	-	
J113		+	.250	.448	.302	0	96	.43	.57	+
D 2	+		.482	.453	.036	.029	137	.55	.45	+
B126	+		.297	.398	.068	.237	118	.62	.38	-
R110	+		.091	.409	.487	.012	164	.47	.53	-
B 79	+		.223	.457	.255	.065	94	.50	.50	+
H112	+		.521	.438	.027	.014	146	.56	.44	-
B118[2].	+		-	-	-	-	-	-	-	+
Appear to Lack 4R										
R107	+		.022	.555	.423	0	137	.50	.50	-
P 54	+		.406	.311	0	.283	106	.67	.33	-
B244	+		.718	.266	.008	.008	124	.77	.23	+
H162		+	0	1.000	0	0	108	.50	.50	-
G 51		+	.218	.366	.416	0	101	.58	.42	+
One marker lost										
B147, B^S		-								
H119, y^+	-									

1. Only y^+ males tested. 2. No accurate count of progeny obtained.

Attached-XY/B^S/y^+ males were mated to C(1)DX, y f females in order to determine the relation of y^+ and B^S to the nucleolus organizer region. C(1)DX females are NO deficient so should be rescued only by the fragment which has retained the NO region. As a first approximation this gives some indication of which marker may have retained the Y centromere. In 12 cases y^+ rescues C(1)DX, and in 5 cases the recovered marker is B^S. In both of the cases where one marker has been lost the remaining element does not rescue the y f females. These

results are summarized in Table 1. In all but two cases 4R is associated with the element containing the NO region. In translocation D2 y^+ is recovered but the 4R markers are associated with B^S. In A27 B^S rescues y f and has ey^+ spa^{pol+} associated with it, but ci^+ appears to be associated with y^+. H119 y^+ also appears to have only ci^+ associated with it. In this case the B^S marked element has been lost.

The segregational properties of the translocation elements have been examined in attached XY, $y^2/B^S/y^+$ ♂♂ x y^2 cv wy car ♀♀ crosses. Table 1 shows only the proportions of progeny recovered as males. H162 shows only y^+ B^S males recovered. The female class was all y^2. These factors have been observed to segregate so this represents preferential segregation, or recovery, not linkage. The total recovery of y^+ and B^S is also given in Table 1. This was determined by using both male and female progeny. There are four cases (B23, B126, P54, and B244) in which there is preferential recovery of one marker. In other cases there are excesses which might not prove to be significant. In all cases where an excess is clearly shown, or indicated, the excess class is the class containing the NO region.

Finally, y^2 cv wy car/B^S/y^+ males were tested for fertility. Eight of the 16 X/T(Y;4) stocks tested were fertile. One stock is listed as questionable because two separate tests were done and only one offspring was produced.

Supported in part by an AEC contract to the University of California at Riverside.

Das, A. University of Calcutta, India.

Studies on penetrance, expressivity, viability etc. of the mutant px in Drosophila ananassae.

The mutant plexus (px) causes network of venation in the distal region between the second and third longitudinal veins of the wing in Drosophila ananassae. It was obtained by X-irradiation in 1955 in the laboratory, was located in the third linkage group by Ray-Chaudhuri et al. (1962), and was placed in the 3R by Hinton (1970). Previous workers (Mukherjee, 1957; Kale, 1969; Hinton, 1970) have attributed the abnormal behaviour of this mutant to lack of penetrance, pseudo-dominance, low viability etc. Since it was realized that this mutant was intimately associated with a system of segregation distortion (Mukherjee and Das, 1971), a detailed analysis was taken up to establish it as non-overlapping Mendelian gene and to rule out the trivial causes, viz., zygotic mortality, viability, penetrance and pseudo-dominance.

Morphological and genetic analysis of the mutant expression of px have shown that px shows a wide range of variation in expressivity, from a simple dot-like expression to extreme network. However, an individual with both wings "dotted" or one wing "dotted", the other without any dot or spot, has always proved to be px/+ in progeny tests. Thus all expressions of px except the "spot" character (one or both wings) are the result of homozygosity of px. Progeny tests for the transmission of px obtained either from px/px or pxpc/pxpc with any one kind of expressions have shown nearly 99.5% penetrance. Furthermore, segregation ratios of px to px or px to pxpc in appropriate crosses have also shown to be within expectations (tested by homogeneity as well as 2 x 2 contingency chi-square analysis).

Interestingly, among the progeny of px x + crosses as well as px/+ x px/+ the proportion of both wings spotted, or one wing spotted and the other normal, is within 13 to 20%. Considering these spotted winged flies as px/+ and not px/px, the proportions of px/px homozygotes among the progeny of px/+ x px/+ and px/+ x px/px crosses are within the range of expected values of around 25% and 50%, respectively.

The mean rating of wing expression (arbitrarily rated as 1 to 6, for extreme expression to wild type expression) of the px flies is about 5.6 in the px stock, and 10.5 in the progeny px/+ x px/+ cross. Heterozygous px/+ (with or without spot) when crossed to px/px yielded an average rating of about 9.0. These ratings are not affected markedly either by temperature, X-ray or by aging.

Analysis of the pre-adult development time, using E_{50} (i.e. days after first emergence of flies when 50% of all flies emerge) shows that the px as well as the wild type (a^{66+}) of D. ananassae have the E_{50} value of 1.

These observations, therefore, clearly establish this mutant to be of fairly good category and may be placed in Rank 1 without any over-lapping with the wild type. Details of studies on its role in segregation distortion are in progress (see also Mukherjee and Das, 1971).

References: Hinton, C.W. 1970 Genetics 66:663-676; Kale, P.G. 1969 Genetics 62:123-133; Mukherjee, A.S. 1957 M.Sc. Thesis, Calcutta Univ; Mukherjee, A.S. and A.K. Das 1971 Genetics 67:521-532; Ray-Chaudhuri, S.P. et al. 1962 Proc. 1st. All India Cong. Zool. i-xi.

Tung, P.S. Pennsylvania State University, University Park, Pennsylvania. Radioautographic study of RNA and histone syntheses in the testicular cyst cells of Drosophila.

In insects, the germ cells derived from one primary spermatogonium are surrounded by a testicular cyst (Fig. 1 A-B) - a closed envelope of polyvalent cell/cells (Cantacuzene, 1968). Within the cyst, the germ cells develop and differentiate synchronously (Virkki, 1965; Bairati, 1967). As the spermatids elongate, their anterior tips are usually embedded in the cytoplasm of the cyst cells (Fig. 1C). The speculation that the latter are "nutrituve" cells was tentatively based on the morphological association between these two cell types.

In our current studies on the incorporation and interconversion of pyrimidines and of amino acids in Drosophila sperm cells, the testicular cyst cells were found incorporating tritiated uracil throughout the course of spermatogenesis until the time when elongation of the sperm cells is completed (Fig. 1D). This strongly suggests that they are actively involved in RNA and protein syntheses and that their "nutritive" role in the development of the sperm cells surrounded is likely.

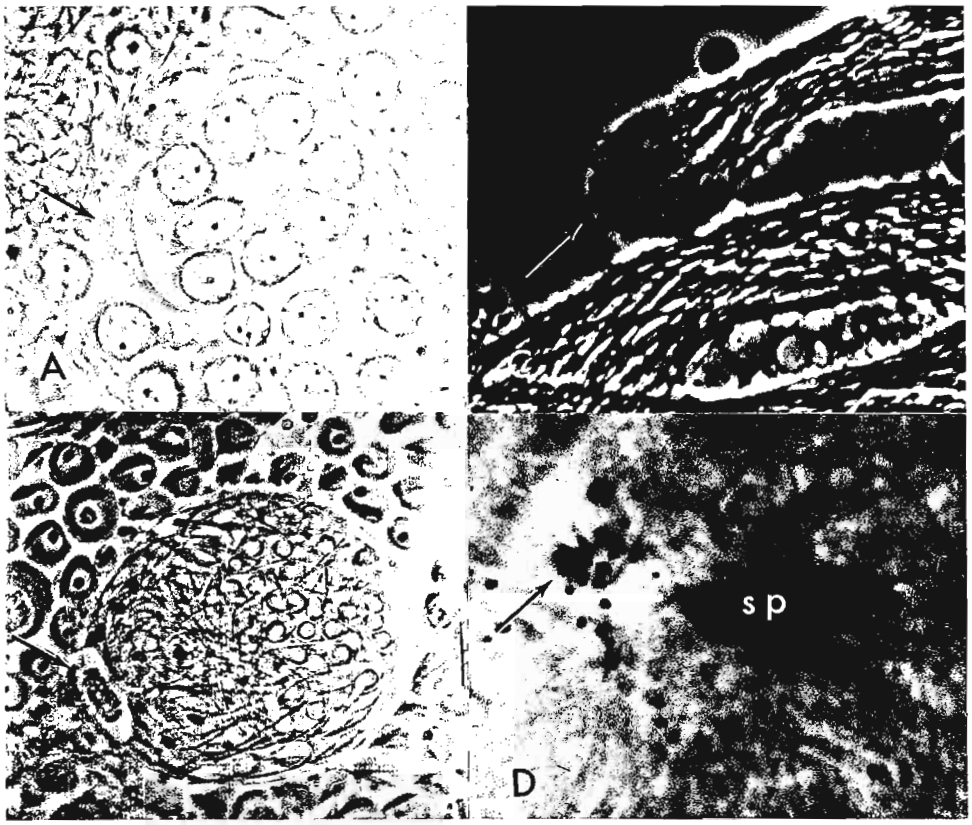


Fig. 1. Testicular cysts at: (A) 8 secondary spermatogonial stage, note cell body of cyst (arrow); (B) early elongation; (C) late elongation, note anterior tips of sperm cells embedded in cyst cell. (D) Radioautograph of cyst cell incorporated with uracil-6-^{3}H, elongation completed. Note bundle of sperm heads (s p).

On the other hand, no significant incorporation of tritiated lysine was evidenced in the cyst cells after elongation of the spermatids began. However, it has been documented that "new" additions of proteins in late spermatids are mainly protamine or arginine-rich histones (Bloch, 1966). One might expect that labeled lysine be actively incorporated during spermiogenesis. The reverse of such an expectation as revealed in the present study supports the hypothesis that histone transition (from somatic-type to gamete-type) during spermiogenesis represents reorganization and re-location of sloughed nuclear proteins (Chevallier, 1966; Vaughn and Thomson, 1972).

However, synthesis of other proteins (e.g. non-basic acrosomal protein and some enzymes) also occurs during spermiogenesis. Since the genome is not transcribing for RNA synthesis as was evidenced in lack of tritiated uracil uptake (unpublished material), the incorporation of tritiated uracil in the cyst cells suggests a possible site of synthesis for these proteins.

In the present study, Drosophila cultures of Oregon R wild type were used. Testes were dissected from 2-day old males in a large drop of Schneider's Drosophila medium (Grand Island Biol. New York). These were rinsed with fresh medium and incubated with isotopically labeled medium. Tritiated uracil used was Uracil-6-^{3}H (sp. act. 26.2 Ci/mM, New England Nuclear, Boston) which was diluted with Schneider's medium to a final activity of 100 μCi/ml and final concentration of 1 x 10^{-6}M. Tritiated lysine used was L-lysine-^{3}H (G) (sp. act. 1.85 Ci/mM, New England Nuclear, Boston) and diluted to a final activity of 10 μCi/ml and a total L-lysine of 2.3 x 10^{-4}M. For each 20 testis pairs, 1 ml of labeled medium was used. After incubation at 25°C for 4 hours, the testes were transferred to unlabeled medium and incubated for another 4 hours. The testes were then rinsed in Shen's saline fixed with aceto-alcohol, and squashed in lacto-carmine. Radioautographes were prepared using NTB-2 photographic emulsion (Kodak, Rochester) and exposed for 4 weeks.

References: Bairati, A. 1967 Z. Zellforsch, Mikrosk. Anat. 79:65; Bloch, D.P. 1966 Protoplasmaforsch 5:1; Cantacuzene, A.M. 1968 Z. Zellforsch, Mikrosk. Anat. 90:133; Chevallier, P. 1966 J. Micros. 5:739; Virkki, N. 1965 Agri. Exp. Rev. Coop. State Res. Serv. USDA.

Tung, P.S. Pennsylvania State University, University Park, Pennsylvania. Dosimetry of Drosophila sperm labeled with tritiated thymidine.

Since the discovery of ^{32}P cell suicide some 20 years ago, interest has increased in the genetic effects produced by radio-isotopes incorporated in animal sperm cells. Unlike procaryotes and cultured cells, the radioactivity of labeled spermatozoa in Drosophila is usually considered difficult to assay due to the complexity of the cell-type and cell-stage conditions of the imaginal testis, and to the extremely small quantity per ejaculation. Without having the rate of disintegration per unit of time per cell (e.g. DPM/cell) specified, to correlate experimental results on a quantitative basis is very difficult.

In the present study, two different approaches of radio-assay for Drosophila sperm incorporated with tritiated thymidine were compared: (1) based on the radioactivity per fertilized egg; and (2) on direct quantitation of mature sperm in seminal vesicles. The former appraoch was based on the findings of Hildreth and Lucchesi (1963) that fertilized eggs of Drosophila are 95% monospermic and 5% dispermic.

In the experiments discussed in this report, Drosophila cultures of Oregon R wild type were used. One-day old males were fed continuously for 48 hours with thymidine-methyl-^{3}H (specific activity 25.2 Ci/mM, New England Nuclear, Boston). The diluent used was a medium similar to Hunt's (1970) except that agar was omitted and the concentration of uridine reduced to 1 x 10^{-5}M. These were mixed to a final activity per unit volume of 0.252 mCi/ml and a concentration of 1 x 10^{-5}M. 0.5 ml of the tritiated medium was given to a group of 10 males according to the feeding technique of Felix (1971). After feeding, the males were allowed to mate to virgin females at a ratio of 1 male to 4 females every 2 days according to the brood technique. Radio-assay was based exclusively on analyses of brood D females and males 6 days after the treating period.

In assay 1, eggs were separated from the regular cornmeal medium on which they were laid with 20% sucrose solution, rinsed with distilled water, and dechorionated with 2.5% sodium hypochlorite. For each sample, about 1,000 eggs were transferred onto 3 x 3 cm sections of filter paper and air-dried in a desiccator. Part of these preparations were extracted with cold (4°C) 2% perchloric acid for 30 minutes to remove any labile, acid soluble precursor materials. Such preparations did not differ markedly from untreated ones in their labelling properties. The egg samples were then burned in an oxygen atmosphere using a tritium oxidizer (Packard Instrument C., Illinois). The vapor thus generated was condensed into water and mixed with a scintillation fluid. Radioactivity thus recovered was counted with a liquid scintillation counter (LS-230, Beckman). The latter was calibrated for every experiment by use of standard tritiated water obtained from the National Bureau of Standards.

In assay 2, an approach based on the seminal vesicles of treated males was undertaken. Seminal vesicles were excised from the adjacent tissues and squashed in Shen's saline. The numbers of sperm in the seminal vesicles were recorded based on quantitation under the phase

Sample no.	No. of sperm	No. of eggs	DPM	DPM/cell	^{3}HTdR/cell**
1	3868		9050	2.60	
2	3216		8640	2.68	
3	11643		26848	2.31	
4	3084		8750	2.84	
X	21811		53288	10.43	
$\overline{X}$	-		-	2.61	2.61×10^7
5		1000	2898	2.76*	
6		1000	3528	3.36*	
7		1000	3076	2.93*	
8		1000	3172	3.02*	
X		4000	12674	12.07	
$\overline{X}$		-	-	3.02	3.02×10^7

The difference between the 2 means is not significant at 5% level.

* Since the probability of tritium disintegration = 1.02×10^{-7}; disintegration/min-tritium, therefore, 1 disintegration - 1×10^7 ^{3}H

** Modified with a coefficient of 0.957, based on the presumption that 5% of the eggs are dispermic

contrast microscope. The coverslips were removed after freezing on dry ice. Cells attached to the slides and coverslips were rinsed into a graduated test tube with 4% sodium lauryl sulfate and homogenized. Samples of the homogenates were counted with the foregoing scintillation counting technique. The results of these comparisons are in the table.

These results clearly show: (1) that the two techniques are reasonably consistent among samples; and (2) that the fertilized eggs in these experiments gave slightly higher radioactivity counts. However, statistic analyses indicate that such difference is non-significant. This implies that fertilized eggs can be used in the radio-assay of the sperm cells. Since eggs are much easier to manipulate than sperm, the advantage of such an approach is apparent. Further, it may be noted that the wall of the seminal vesicle is comprised of somatic cells. Nevertheless, results from parallel observations on radioautography indicate that these cells do not actively incorporate tritiated thymidine during the treating period. Hence, the presence of these somatic cells in the sample should be acceptable as far as the accuracy of scintillation counting is concerned.

References: Felix, R. 1971 DIS 47:129; Hildreth, P.E. and J.C. Lucchesi 1963 Develop. Biol. 6:262; Hunt, V. 1970 DIS 45:179.

Lefevre, G., Jr. and K. Peterson. San Fernando Valley State College, Northridge California. An unusual Notch mimic: glossy-like (g-1).

In examining an F_2 culture from an EMS-treated + male, we observed viable males that display many of the characteristics of mutations at the Notch (N) locus: strongly notched wings, thickened Confluens-like wing veins, prominent "deltas" at the junctions of the longitudinal veins with the wing margins, extra hairs on the thorax and legs, shortened tarsal joints, and roughened, shiny bright somewhat mottled eyes closely resembling those of facet-glossy (fa^g). In addition, all macrochaetes are thin and delicate. The mutant, however, is not allelic with Notch or any of its alleles; it is, in fact, located less than a map unit to the left of wavy (wy) in Section 11D of the salivary chromosome. Nonetheless, in the presence of Dp w^{+51b7}, which extends from 3C2 through 3D6 and includes the N^+ locus, the phenotypic expression of the mutant, which we have named glossy-like (g-1), becomes virtually normal: small deltas remain, there is some thoracic hairiness, and the eyes are not completely smooth. When raised at 29°, g-1 fails to emerge from the pupal case, and the presence of Dp w^{+51b7} does not protect it from this temperature sensitivity. No chromosomal aberration is present and recombination appears to be normal. When g-1 is in heterozygous combination with a long, male-lethal euchromatic insertional translocation, T(1→3R)C92, having breaks at 6E1-2 and at (or immediately adjacent to) band 11D9-10, the g-1 phenotype is expressed. Both g-1 and wy are uncovered by

a short deficiency, Df(1)N12, that extends from 11D1-2 to 11F1-2.

By crossing over, N alleles, including fa^g and sp1, were combined with g-1. Males carrying both fa^g and g-1 show an exaggerated phenotype, have difficulty in eclosion, and usually survive only briefly. The combination with sp1 has a somewhat less drastic effect. Males with N^{264-40} (cytologically normal), g-1, and Dp w^{+51b7} exhibit simply the g-1 phenotype. Two other euchromatically located N^+ duplications interact with g-1 exactly as does Dp w^{+51b7}; however, three heterochromatically located N^+ duplications, including w^+Y, produce a noticeably less effective suppression of the g-1 phenotype.

Although we can rule out the origin of g-1 as resulting from the transposition of part or all of the N^+ locus from 3C7 to 11D9-10, we can not yet decide whether the g-1 locus is a persisting duplicate locus once identical with N, or is an unrelated locus whose altered product now interacts or competes with the product of the N locus. If regulatory genes in Drosophila can occur at a distance from their subject loci, in contradiction to the Crick (1971) model, then the g-1 locus might be a regulator of the N locus, or vice versa.

To the best of our knowledge, this is the only case, except for zeste and white, in which the presence of an extra dose of one locus modifies the expression of a mutant at another, distantly located locus.

Valentin, J. University of Stockholm, Sweden. Effect of maternal age on recombination in X in D. melanogaster.

This effect is usually described, following Bridges, as a decrease of recombination with increasing age during the first ten or so days of a female's egglaying (later on followed by an increase and another decrease). Deviations from this pattern are of course known to all recombination workers. One such deviation, which has never been expressly described in the literature, concerns the X chromosome. One sometimes sees authors express surprise that maternal age does not influence recombination frequency in the region around vermilion (v: 1 - 33.0) which is in the middle of both genetical and cytological maps. However, maternal age effect in X consists of two components: an increase of recombination with increasing age distally and a decrease with increasing age proximally. The v region lies where these counteracting effects take out each other so that no maternal age effect is observed. This phenomenon is illustrated in Figure 1, where the linear regressions of recombination on maternal age for different X chromosome regions are shown.

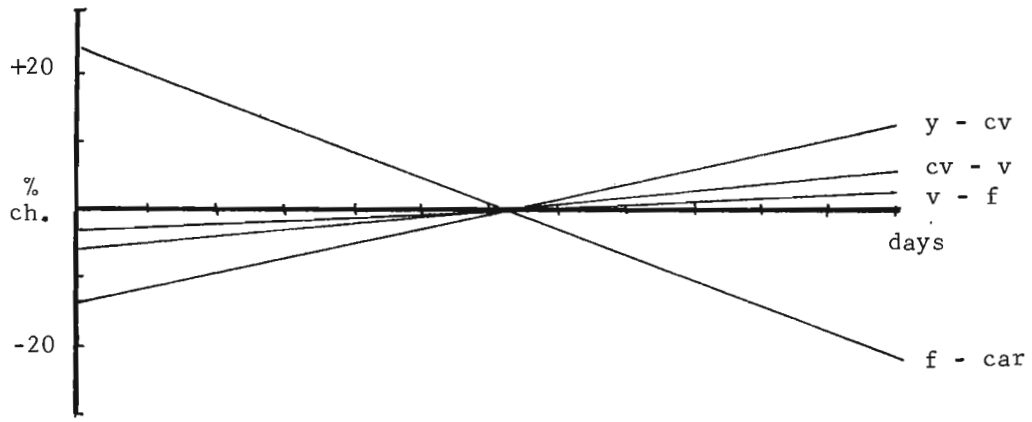


Figure 1. Linear regressions of the entity [(observed rec. in one brood-mean rec.)/ mean rec.] on maternal age for different regions of X. Material from Bateman and Chandley (1965), Roberts (1962), Ting and Walker (1969) and Valentin (1969). Y axis 100 $[(\text{Obs.} - \bar{x})/\bar{x}]$; X axis, maternal age in days.

Recombination is expressed as percentual difference from overall mean, i.e., $100[(\text{Obs.} - \bar{x})/\bar{x}]$ in order to make results from different experiments compatible, and the correct calculation of variance for this unit would be difficult. If we however for purposes of demonstration only regard it as normally distributed, we obtain the following regressions and P-values for regressions being unreal: y - cv, b = 2.20, P = 0.06; cv - v, 0.89, 8.06; v - f, 0.34, 0.52; f - car, -3.72, 0.01.

Wright, C.P. Western Carolina University, Cullowhee, North Carolina.

Development of phenfultyrless-1, 1(1)EN11, a lethal mutant of Drosophila melanogaster.

Phenfultyrless-1, 1(1)EN11, is a sex-linked, lethal mutant of Drosophila melanogaster which was induced by Novitski (1963). Death in this mutant occurs in either the late larval or prepupal stage. Both weight and oxygen consumption measurements were made on individual larvae from the first-instar larval stage until the time at which oxygen uptake ceased. Oxygen consumption measurements were made with small respirometers in a 25°C water bath. A 20% NaOH solution was used to remove CO_2 from the respirometers which caused movement of the NaOH drop. By measuring the volume of the droplet displacement the oxygen consumption of a larva was determined.

Neither weights nor rates of oxygen consumption in phenfultyrless-1 larvae were significantly different from those in controls until 96 hours after oviposition. Beginning at 96 hours, weights of phenfultyrless-1 larvae began to decrease gradually, and rates of oxygen consumption began to decrease sharply. Control larvae formed puparia at about 110 hours. Most phenfultyrless-1 larvae failed to form puparia, remaining in the larval stage and showing increasing deterioration until death of all larvae had occurred by 240 hours. A few phenfultyrless-1 larvae did form puparia, but pupation never occurred. Phenfultyrless-1 individuals in this stage will be called pseudopupae. Oxygen consumption of these pseudopupae decreased until 40 hours after puparium formation, after which it increased sharply, reaching a peak at 80 hours which was even higher than that at the highest point of the control U-shaped curve. Then oxygen consumption dropped sharply, until at 128 hours none could be detected. Dry weights of pseudopupae dropped sharply, until at 128 hours they were less than half those at puparium formation.

Since they showed no signs of metamorphosis, it seems unlikely that the sharp rise in oxygen consumption was caused by metabolic activity of the pseudopupae themselves. It appeared that the pseudopupae died soon after puparium formation. The sharp rise in oxygen consumption was probably caused by rapid growth of microorganisms within the dead pseudopupae.

Reference: Novitski, E. 1963, List of biochemical mutants. DIS 37:51-53.

Hedrick, P.W. University of Kansas, Lawrence, Kansas.

Possible stable equilibrium for D. melanogaster and D. simulans.

Ayala (1971) described a case of interspecific competition where D. pseudoobscura and D. willistoni were maintained in a stable equilibrium for a period of six months. The maintenance of the equilibrium was attributed to frequency-dependent progeny production observed in a one generation test. In this study one generation tests have indicated that under certain conditions D. melanogaster and D. simulans might also be maintained in a stable equilibrium because of frequency-dependent progeny production.

Table 1. Mean percentage of melanogaster and mean number of flies emerging per vial. Simulans was given a two day head start and counts were made through 18 days. Values are based on six replicates.

	% melanogaster parents	% melanogaster progeny	No. progeny mel.	No. progeny sim.	Total
16 pairs of parents	100.0	-	101.7	-	101.7 ± 11.9
	87.5	72.7	90.8	30.5	121.3 ± 11.5
	50.5	42.0	46.3	61.3	107.6 ± 4.9
	12.5	26.7	23.3	69.0	92.3 ± 5.4
	0.0	-	-	80.7	80.7 ± 4.2
32 pairs of parents	100.0	-	141.0	-	141.0 ± 11.8
	87.5	80.0	98.0	23.3	121.3 ± 12.8
	50.0	60.2	63.0	35.8	98.8 ± 11.2
	12.5	26.3	19.5	55.2	74.7 ± 2.5
	0.0	-	-	93.7	93.7 ± 9.5

The strains used were a yw strain of melanogaster and a v strain of simulans, both obtained from J.S.F. Barker. When equal numbers of young adults (1-3 days old) were introduced simultaneously to half pint bottles, 90.4% of the progeny were melanogaster. But if simulans was given a two-day head start, 50.8% of the progeny were melanogaster. As a result an extensive experiment using vials was set up giving simulans a two-day head start at three different parental proportions and two parental densities. The results are summarized in Table 1 and show a strong degree of frequency dependence. When there was a high percentage of melanogaster parents (87.5%), the percentage of melanogaster progeny was reduced to 72.7 and 80.0% at the low and high parental densities, respectively. At a low percentage of melanogaster parents (12.5%), the percentage of melanogaster progeny increased to 26.7 and 26.3%. With equal numbers of parents from both species, there was a decrease in melanogaster (to 42.0%) at the low parental density and an increase (to 60.2% at the high parental density.

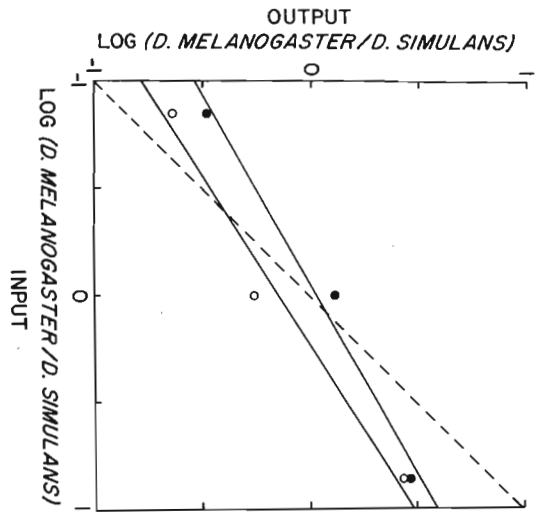


Fig. 1. The linear regression of the log input ratio on the log output ratio for 16 pairs of parents (closed circles) and 32 pairs (open circles). The broken line indicates a regression coefficient of one.

Another interesting aspect of these results was the increase in the number of progeny in pure cultures and the decrease or maintenance of numbers in the mixed cultures from the low to high parental density. As a result, a de Wit diagram analysis indicated facilitation at the low density and interference at the high density between the two species.

The data can also be examined using a ratio diagram (Fig. 1). The linear regressions of both parental densities are significantly less than one (.56 and .64), the condition indicative of a stable equilibrium. The percentage of melanogaster at equilibrium calculated from the ratio diagram is 44.8% at the low density and 60.3% at the high density, indicating that the equilibrium may be density dependent.

Reference: Ayala, F.J. 1971 Science 171:820-824.

Fleming, C. and F. DeMarinis. Cleveland State University, Cleveland, Ohio. A comparative study of electrophoretic protein patterns of the hemolymph of Bar series.

Amides in general, $-CONH_2$, and glutaramide specifically, $NH_2CO(CH_2)_3CONH_2$, when added to the media modify Bar to wild type eye (S. Kaji 1954, DeMarinis and Sheibley 1963). Later it was proposed that this effect could be explained best on the basis of the operon hypothesis, a modified form of Jacob and Monod model (DeMarinis and Sheibley 1965). In this case the amides act as derepressing agents during the sensitive period of Bar, thus permitting the double operon of Bar (wild type having a single operon) to operate as a wild type. This hypothesis gives us much promise in that it explains many facts of Bar that could not be explained before. Therefore, in line with this operon concept of Bar we have initiated a series of investigations in effort to test the validity of this hypothesis.

The present line of investigation describes the protein bands of the larvae hemolymph of Bar (B), double Bar (BB), double infra Bar (BiBi) and reverted Bar (wild type). The larval period investigated was between 60-74 hours. Test samples were taken at two-hour intervals, at 62, 64, 66, 68, 70, 72, 74-hour. This range includes the pre-sensitive and sensitive period of Bar (DeMarinis and Sheibley 1965). The age of the larvae were determined from the initial hatching period. Twelve male larvae were used for each test sample. The larvae were ruptured gently and the hemolymph collected was immediately stored at -60°C until ready for

use. The electrophoretic procedure was carried out with a Bionix Microelectrophoresis apparatus described by Pun and Lombroso, 1964. 80 microgram sample was used in each test. The resulting acrylamide gel patterns were observed and measured against an illuminated yellow gelatin filter (#15 G. Kodak). The pattern of the bands were followed during the developmental period between 60-74 hours. Some 21 different protein bands were identified. Fourteen of these were major bands which we designated as A through N. Bands A, C, J, K, L, M, N developed a complex of subbands at different times of development. Tables 1 and 2 summarize some of the main differences found in bands D and G. Table 3 shows some of the main differences observed in C-band complex. See Figure 1.

These preliminary observations show that a number of proteins change continuously during the larval developmental period. Distinctive protein difference can also be observed between members of the Bar series and wild type. Further differences are observed between control larvae and those treated with glutaramide. The disappearance of bands D and G in the treated larvae and the appearance of new bands in the C-complex of the experimental group during the Bar sensitive period may be related to the multiple effect of turning on the double operon of Bar, as hypothesized by DeMarinis and Sheibley (C.S.AV, Czech. Acad. Sci., 1966, p. 303).

Table 1. Occurrence of protein band D in the hemolymph of the male larvae during the period between 60-74 hours.

Genotypes	Number of larvae used	Control	Experimental
+	12	strong thin band	light thin band
B	12	strong thin band	missing
BB	12	strong thin band	missing
BiBi	12	strong thin band	missing

Table 2. Occurrence of protein band G in the hemolymph of the male larvae during the period between 60-74 hours.

Genotypes	Number of larvae used	Control	Experimental
+	12	heavy band	light band
B	12	light band	missing
BB	12	light band	missing
BiBi	12	heavy band fades out by the 68th hour	missing

(Table 3 on next page)

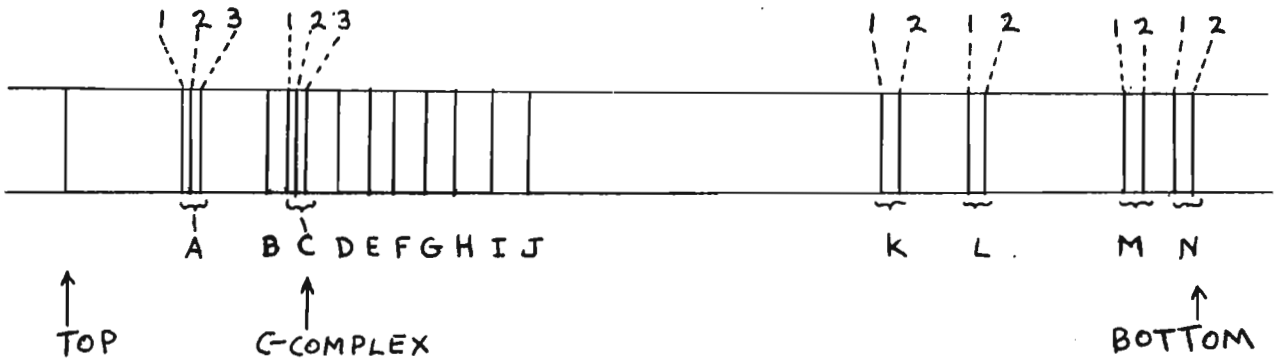


Figure 1. Protein bands identified in hemolymph of male larvae of the Bar series and wild type between ages 60-74 hours.

Table 3. Protein band changes in the hemolymph of male larvae between 60-74 hour period in band C-complex. Exp. = treated with 2.5% glutaramide for one hour.

Ages	Genotypes: +						B						BB						BiBi					
	Contr.			Exp.			Contr.			Exp.			Contr.			Exp.			Contr.			Exp.		
	C_1	C_2	C_3	C_1	C_2	C_3	C_1	C_2	C_3	C_1	C_2	C_3	C_1	C_2	C_3	C_1	C_2	C_3	C_1	C_2	C_3	C_1	C_2	C_3
60	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	±	+	+	-	-	d	-	-	d
62	single diffuse band			-	-	-	+	-	+	-	+	+	-	-	-	±	+	+	-	-	d	-	-	+
64	single diffuse band			-	-	-	-	-	+	-	+	+	+	+	+	±	+	+	-	-	+	-	+	+
66	single diffuse band			+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	-	-	+	-	-	d
68	single diffuse band			+	+	+	-	-	-	-	-	+	+	+	+	+	+	+	-	-	+	-	-	-
70	single diffuse band			-	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+	-	-	-
72	single diffuse band			-	-	-	-	-	+	-	+	+	-	-	±	-	+	+	-	-	+	-	-	-
74	single diffuse band			+	+	+	-	-	+	-	+	+	-	-	±	-	+	+	-	-	+	-	-	d

+ Denotes distinct band
± Denotes less distinct band
- Denotes absence of band
d Denotes diffuse band

Minamori, S. and K. Sugimoto. Hiroshima University, Hiroshima, Japan. Production of delta-retaining sensitive chromosomes by EMS in D. melanogaster.

The extrachromosomal element denoted by delta has a virus-like nature in killing host and damaging host chromosomes, and is retained steadily by a specific second chromosome line symbolized by S^b, S^r or ID^b (S^b, sensitive to killing action of delta b, but not to delta r; S^r, sensitive to delta b and r; ID^b, insensitive to delta b and r). The association between the chromosomes and delta is inseparable. In earlier reports (Minamori 1969, 1971), it was assumed that delta may be a copy of a chromosomal gene or of a certain agent integrating inseparably into the chromosome. These alternative hypotheses were examined by the following experiment.

Cy-heterozygous males for an insensitive second chromosome, I-521, which retains no delta were fed with 0.025M solution of ethyl methane sulfonate (EMS, alkylating mutagen; cf. Lewis and Bacher 1968) for 24 hours, and then crossed with Cy/Pm females for two days. Single Cy/I-521 sons of this mating were crossed with Cy/bw^D females (bw^D-chromosome is S^b, retains delta b), and the mortality of the I-521/bw^D progeny was checked. Five out of 1970 chromosomes (I-521) tested were sensitive, although no sensitive chromosome was obtained in the control (0/1733). Among the five, four chromosomes were S^b and one was S^r. These lines were maintained in the heterozygous condition for Cy-chromosome at 25°C. At the tenth generation after establishment, each line was tested for delta - retention by mating females with Cy/S^r-20 males. All the four S^b lines carried delta b, and the S^r line carried delta r. These findings indicate that delta-retaining sensitive chromosomes are inducible by mutation, and lead to the interpretation that delta may be a product of a chromosomal gene, but not a copy of integrating agent.

References: Lewis, E.B. and F. Bacher 1968 DIS 43:193; Minamori, S. 1969 Japan. J. Genet. 44:347-354; _____1971 Japan. J. Genet. 46:169-180.

Ranganath, H.A. and N.B. Krishnamurthy.
University of Mysore, Manasagangotri, India. Differential rate of development in Drosophila nasuta.

The rate of development in any organism is an outcome of several causes, both genetic and environmental. Environmental factors such as crowding, food and several others are known to influence the rate of development. The present communication deals with the differential rate of development and the effect of crowding on the rate of development in Drosophila nasuta. The strain of D. nasuta from Biligirirangana Hills has been used for these studies. The eggs of the same age were observed to exhibit differential rate of development in the same environment. In order to assess the effect of crowding on the rate of development the eggs of the same age were collected (± 4 hours) following the procedure of Delcour (1969). The eggs were then placed in 3" x 1" vials with yeast sprayed wheat cream agar media and permitted to develop at a constant temperature of 20°C (± 1°C). The eggs in different vials were distributed and divided into three groups - A, B and C. In the group A each vial has 10 eggs, B group has 50 and C has 100 eggs. The flies were scored each day right from the time of their emergence up to one month. The eclosion of the flies began from 13th day and continued even after 27th day. The effect of crowding has been measured by the number of flies emerged in each group. Thus the number of flies obtained in group A is 98%, while in B and C the number of flies emerged are just 50%. This is due to severe competition that existed in B and C groups. The percentage of flies emerged each day is graphically depicted in the figure 1. Survey of this graph reveals that in the group A the maximum eclosion of flies occurred on the third day followed by a sudden decline while in B and C there is approximately even distribution of emergence followed by a gradual decline.

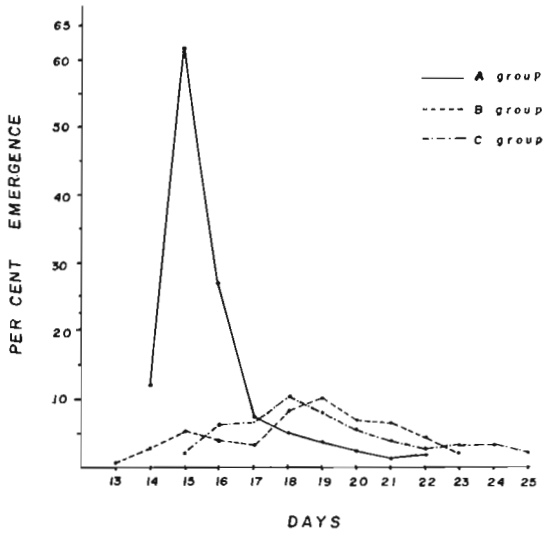


Fig. 1. Graph showing the percentages of flies emerged in the groups A, B and C of Drosophila nasuta.

It is probable that this difference in the pattern of emergence is under the influence of overcrowding.

Acknowledgements: The authors are highly grateful to Dr. M.R. Rajasekarasetty, Professor and Head of the Department of Zoology, University of Mysore, for all his help. One of us (H.A. Ranganath) acknowledge with thanks the award of Mysore University Research Fellowship.

References: Delcour, J. 1969 DIS 44:133.

Ranganath, H.A. and N.B. Krishnamurthy.
University of Mysore, Manasagangotri, India. Preliminary survey of Drosophila in Biligirirangana Hills (Mysore, India).

Biligirirangana Hills lie to the east of Mysore at a distance of 60 miles. The altitude from the base of the hills to the top ranges from 2525 feet to 4500 feet and has provided the cool and pleasant climate for the growth and existance of luxuriant and vast array of flora and fauna. This prompted the authors to undertake a preliminary survey of Drosophila in this terrain. The results of this survey are listed in the Table 1. Of the eleven spots selected for collection, the spot at 4165 feet yielded the richest haul of Drosophila both in number of species and density. Irrespective of the height the whole range is marooned with Drosophila nasuta and Drosophila melarkotliana. However Drosophila rajasekari is restricted to the lower altitudes while D. immigrans, D. mysorensis and D. varietas are maintained only at higher altitudes. It is an interesting fact that the density of Drosophila immigrans gradually ascends with the increase in height. D. nigra and D. jambulina are recorded at only one spot. Peculiarly enough D. melarkotliana alone was found in the traps tied at 3270 feet.

Table 1. A record of Drosophila species collected in Biligirirangana Hills

Species	Altitude in feet 2526	2985	3016	3270	3498	3838	3894	3968	4000	4165	4493	Total
nasuta	54	39	51	-	18	39	180	201	75	135	101	893
brindavani	87	12	-	-	-	-	6	-	8	9	6	128
immigrans	-	-	-	-	-	3	6	-	24	99	189	321
melarkotliana	138	128	28	84	63	66	18	8	51	21	33	638
rajasekari	45	72	30	-	-	-	-	-	-	-	-	147
nigra	-	-	-	-	3	-	-	-	-	-	-	3
mysorensis	-	-	-	-	-	27	33	6	12	87	10	175
jambulina	-	-	-	-	9	-	-	-	-	-	-	9
varietas	-	-	-	-	-	-	-	-	-	10	26	36
* neotruncata	-	-	-	-	14	-	-	-	-	16	-	30
takahashii	-	42	-	-	3	-	-	-	-	-	-	45
Total	324	293	109	84	110	135	243	215	170	377	365	2415

* A new species (G. Sreerama Reddy and N.B. Krishnamurthy, unpublished)

Acknowledgements: Please see previous note.

Alexandrov, I.D. Research Institute of Medical Radiology, Academy of Medical Sciences of U.S.S.R., Obninsk, U.S.S.R.

Functional w^+ isoalles and genetic background.

Quantitative differences in the content of red eye pigments in heterozygous females for some w mutations had been used to distinguish w^+ isoalleles in D. melanogaster (DIS 46:72). However, the observed differences may be somewhat conditioned by the genotypic variability of heterozygous females. To test this possibility more carefully, w^{+C} and w^{+O} isoalleles (from Canton-S and Oregon-R lines, respectively) were placed in genetic backgrounds of w^{10gA} and w^{69gA} lines by a chromosome substitution procedure. For this purpose w^+/w^{10gA} females were backcrossed to w^{10gA} males for twelve generations (backcross A). The same procedure was applied also for the introduction of both isoalleles into the genetic background of w^{69gA} line (backcross B). The quantities of red eye pigments in FB females of each generation were estimated by a spectrophotometric method (see DIS loc. cit.). The results show that the significant difference in phenotypic action of w^{+C} and w^{+O} isoalleles remained during the substitution procedure in two different backgrounds. The data from FB_{10} heterozygous females are, as an example, listed in Table 1.

	Backcross A		Backcross B	
	w^{+C}/w^{10gA}	w^{+O}/w^{10gA}	w^{+C}/w^{69gA}	w^{+O}/w^{69gA}
E*	0.710	0.628	0.503	0.427
Conf. limits at $P_{0.05}$	0.730-0.690	0.650-0.606	0.531-0.475	0.436-0.418

*Means of three independent experiments

FB_{12} w^{+C}/w^{10gA} females were further crossed to w^{69gA} males from FB_{12} of backcross B. The reciprocal cross (FB_{12} w^{+C}/w^{69gA} ♀♀ x FB_{12} w^{10gA}/Y♂♂) was made. The same crosses for w^{+O} were carried out. Four types of heterozygous females (w^{+C}/w^{10gA}; w^{+C}/w^{69gA}; w^{+O}/w^{10gA}, and w^{+O}/w^{69gA}) with similar genetic backgrounds were obtained. The quantitative determinations of red eye pigments of these females were made. The results of analyses are listed in Table 2.

	w^{+C}/w^{10gA}	w^{+O}/w^{10gA}	w^{+C}/w^{69gA}	w^{+O}/w^{69gA}
E*	0.585	0.523	0.540	0.462
Conf. limits at $P_{0.05}$	0.603-0.567	0.531-0.515	0.557-0.523	0.482-0.440

*Means of three independent experiments

These data provide further evidence for w^+ isoalleles and locus-specific action of w mutations in D. melanogaster. Comparison of Tables 1 and 2 shows that the phenotypic action of isoalleles in question is somewhat influenced by the genetic background. This influence, however, is not sufficient to cancel out the differences in the action of the w^+ isoalleles themselves and of the w mutations studied.

Jenssen, D. and J. Ahlberg. University of Stockholm, Sweden. The effect of an electric field on somatic chromosomes in Drosophila melanogaster.

The present investigation was performed in order to study the effect of an electric field to somatic recombination and/or chromosome loss in larvae of Drosophila melanogaster. Previous observations on root tip cells of Allium have shown that the segregation of the chromosomes was disturbed by electric shocks.

The treatment was given to female larvae, heterozygous for yellow. The larvae were collected at random to all groups. The abdomen of hatched females was mounted on a slide in a drop of Euparal. The slides were coded and the bristles inspected under microscope. The size of the yellow spots was also recorded. In a preliminary test the females were also heterozygous for singed. As the classification of the singed character turned out to be unreliable, however, only the yellow character could be scored.

The electric treatment involved 250 volts, given to third instar larvae as a one second shock between two titan-electrodes in a bath of aq. dest. As a control that the larval age used was sensitive to the induction of somatic recombination and/or chromosome loss, one group of larvae received 1800r of X-ray at an intensity of 90r/min. A third group consisted of a control without any treatment.

In Fig. 1, the number of spots per fly is presented. The irradiated group (R) shows a significantly higher number of yellow spots than the control (C), indicating that the treated

Fig.1

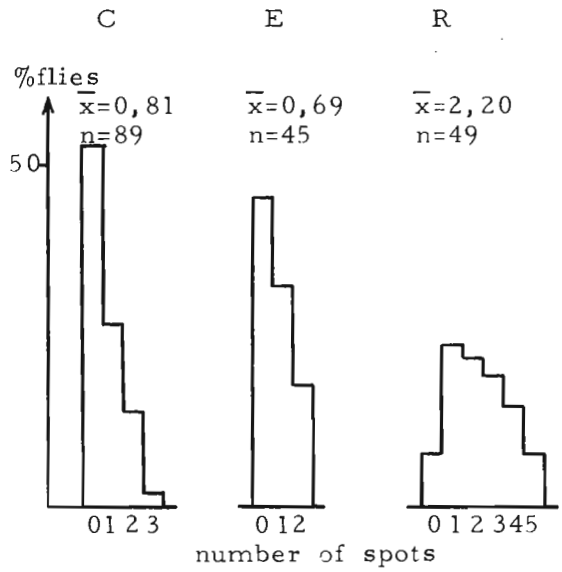
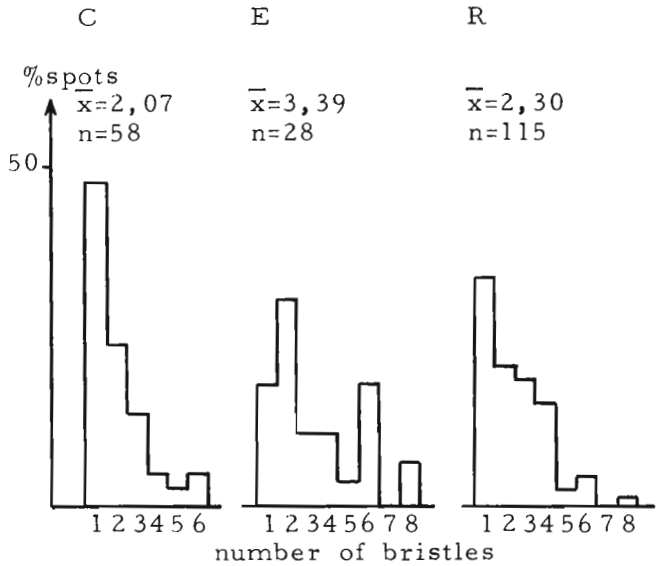


Fig.2



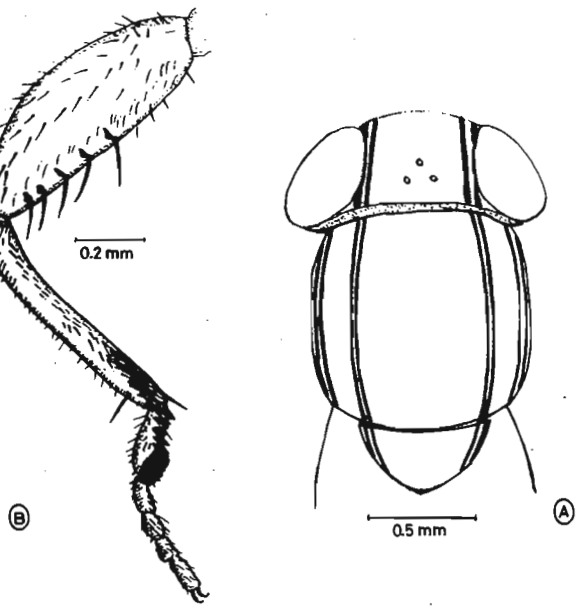
stage of the larvae was sensitive for induction of yellow spots. There is no difference between the control and the group receiving the electric shock (E).

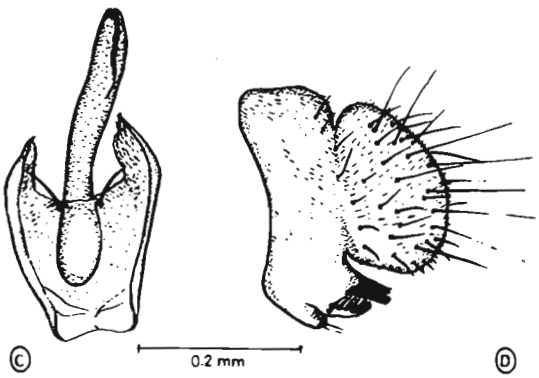
An effect by the electric treatment is indicated, however, by the larger size of the yellow spots as compared to the control, as shown in Fig. 2, showing the number of bristles per yellow spot. The difference between groups C and E is highly significant both concerning the distribution ($X^2_5 = 22.4$, $P < 0.0005$) and the mean ($F_{1,84} = 11.7$, $P < 0.001$). A slight tendency in the same direction occurs for the irradiated group, the difference versus the control being at the border of significance ($P = 0.05$). Further investigations are being performed in order to reveal the biological significance of these observations.

Godbole, N.N. and V.G. Vaidya. University of Poona, India. A new species of Drosophilidae from Poona (India): Zaprionus (Zaprionus) paravittiger sp. nov.

DESCRIPTION OF THE MALE IMAGO: General features and Head: Body about 2.8 mm in length. Eyes red with thick pile. Ocellar triangle small and pale. The three orbitals almost equally distant from the margin of the eye. First orbital (reclinate) slightly smaller than the third (proclinate). Second orbital (reclinate) about 3/4 of the first. Antenna yellowish brown, third segment darker and longer than broad. Arista with about 5 dorsal and 3 ventral rays including the terminal fork. Front dark brown. Carina pale, exceedingly swollen, broad ventrally and touching the oral margin. One prominent oral bristle. Palpus yellowish with a few prominent bristles. Two longitudinal silvery white stripes between orbital bristles and eye margins, reaching anteriorly the outer distal part of the second antennal joint. The stripes lined by black borders.

Thorax: Thorax dark brown. Humerals 2 unequal. Acrostichal hairs in 6 rows. Anterior dorsocentrals nearly parallel to each other and shorter than the posterior convergent ones. Anterior scutellars convergent. Sterno-index about 0.43. Four longitudinal silvery white stripes with black borders on thorax. Dorsal stripes arise just outside the base of the posterior scutellars and the lateral stripes from the bases of the wings.





Zaprionus paravittiger:
A. Dorsal view of head and thorax
B. Foreleg of male
C. Phallic organs
D. Periphallic organs

Legs: Legs yellowish. Apicals on first and second, that on second prominent. Preapicals on first and third. Femur of first leg with about 4-5 tubercles each with 2 stout unequal spines. Metatarsus of first leg distally with a dense tuft of short hairs and proximally with 5 oblique rows of spines. All but the ultimate segments of second and third tarsi with lateral row of small cuneiform bristles.

Wings: Wings clear, about 2.7 mm in length. Costal index about 2.46. 4th vein index about 1.42. 4C-index about 0.9. 5X-index about 0.97. C-1 bristle one. C-3 bristles on about basal 1/2.

Abdomen: Tergites yellowish, unicolourous.

Periphallic organs: Genital arch yellowish and pubescent, with 3-4 bristles on the posterior margin. Heel rounded. Toe low, rounded apically, directed ventrally with about 4 terminal setae. Clasper 1, large, apically truncate, with about 5 strong black teeth and ventrally with about 8 setae. Anal plate fused with the genital arch, pubescent and with many long evenly distributed bristles.

Phallic organs: Phallic organs pale yellow. Aedeagus long, arched dorsally and bearing fine serrations apically. Apodeme of aedeagus paler, laterally compressed. Novasternum roughly triangular, each with a long submedian spine. Anterior and posterior parameres

absent. Ventral fragma oblong. Phallosomal index about 2.2.

DESCRIPTION OF THE FEMALE IMAGO: Similar to male except in the slightly larger size and absence of a dense tuft of short hairs on the metatarsus of first leg.

Egg guide: Lobe yellowish, narrow apically, with about 14 marginal and 3 discal teeth and a long subterminal hair. Basal isthmus narrow.

MATERIAL: Holotype: Male; Poona (India); July 1969 (Vaidya & Godbole). Deposited with the Department of Zoology, University of Poona, Poona 7 (India).

Paratypes: 8 males, 5 females collected together with holotype. 4 males deposited with Prof. T. Okada, Department of Biology, Tokyo Metropolitan University, Tokyo (Japan).

HABITAT: The flies were collected on decomposing leaves in garden by sweeping with net. They appear only in the rainy season and are difficult to rear in the laboratory.

RELATIONSHIP: The cuneiform bristles on the second and the third tarsi confirm the generic position and the femoral tubercles of the foreleg show that it belongs to subgenus Zaprionus. The only other species of genus Zaprionus reported from India is Z. indiana (Gupta, 1970), which however, belongs to subgenus Phorticella.

Acknowledgement: The authors are grateful to Prof. Dr. T. Okada of the Tokyo Metropolitan University for confirming the identification and for checking the description.

Godbole, N.N., R.M. Kothari and V.G. Vaidya. University of Poona, Poona, India. Study of free amino acids in eggs of five species of Drosophila.

Our knowledge of the free amino acids occurring in eggs of Drosophila seems to be limited to species melanogaster only (Chen et al. 1967). It was therefore intended to undertake similar studies on some other species of Drosophila. For this comparative work, the following species were selected: D. ananassae, D. jambulina, D. malerkotliana, D. melanogaster and D. nasuta.

The cultures of the above species were maintained at 22 ± 1°C on the standard agar-cornmeal medium. Paper chromatographic technique was employed for the separation and identification of the free amino acids in the eggs.

For this purpose, freshly laid eggs of a particular species were collected and were washed with glass distilled water. About ten eggs were directly spotted on Whatman No. 1 paper (36 X 5 cm) by crushing them on it with a blunt glass rod. Two such chromatograms were run separately in glacial acetic acid : n-butanol : water (1:4:5) phase and phenol : water (8:2) phase for 4-6 h at 22°C by ascending chromatographic method. The chambers were saturated with respective phases prior to the chromatographic runs. The chromatograms were dried in air after which they were developed by spraying with 0.5% ninhydrin in acetone in order to detect the free amino acids. Rf values for the spots thus developed were calculated. The amino acids were identified by comparison of the obtained Rf values with the standard values for authentic samples. The findings were confirmed by two dimensional paper chromatography using glacial acetic acid : n-butanol : water (1:4:5) and phenol : water (8:2) phases. Similar procedure was adopted for the eggs of all the five species.

The amino acids identified in the five species of Drosophila are presented in Table 1. Methionine sulfone and serine are found to be present exclusively in D. malerkotliana. α-alanine and glutamine are present in all the species studied except D. nasuta, in which these

Table 1. Free amino acids in the eggs of five species of Drosophila.

Amino acid	D. ananassae	D. jambulina	D. malerkotliana	D. melanogaster	D. nasuta
α-alanine	+	+	+	+	-
β-alanine	-	-	-	-	+
Aspartic acid	-	+	+	+	-
Cysteine	+	+	-	+	+
Cysteic acid	+	-	+	+	-
Cystine	+	+	+	-	+
Glutamic acid	-	-	-	-	+
Glutamine	+	+	+	+	-
Methionine sulfone	-	-	+	-	-
Serine	-	-	+	-	-
Taurine	-	-	+	-	+

two amino acids seem to be replaced by β-alanine and glutamic acid respectively.

It is reported by Chen et al. (1967) that in the eggs of D. melanogaster glutamic acid, α-alanine, glycine and aspartic acid are highly concentrated. In the present studies however, it is interesting to note that glycine is not detected either in D. melanogaster or in any other species studied. This may be due to very low concentration of this amino acid in freshly laid eggs. Chen et al. (1967) have further indicated the probable presence of methionine sulfoxide in the fertilized eggs of D. melanogaster. However in the present studies methionine sulfoxide is not detected in any of the species.

Reference: Chen, P.S., F. Hanimann and H. Briegel 1967, Rev. Suisse Zool. 74:570.

Godbole, N.N. and V.G. Vaidya. University of Poona, India. A quantitative survey of Drosophilidae from Poona (India).

A survey of Drosophilidae was undertaken in Poona and neighbouring areas in the wet season, viz. from 15th of June to 15th of October in the year 1969. This survey was carried out in order to determine the composition of the drosophilid population in this season.

Poona (lat. 18°13' N and long. 73°51' E) is located at the confluence of the rivers Mula and Mutha in the shadows of the mountain ranges of the Western Ghats. It is surrounded by low hills and is at a height of 564 m from the mean sea level. It is about 105 km from the Arabian Sea. The average annual rainfall is about 62.5 cm.

Table 1. Numerical data on different species collected

Species	Total number collected	Percentage
D. biarmipes	51	1.75
D. takahashii	112	3.85
D. melanogaster	356	12.23
D. ananassae	1141	39.21
D. malerkotliana	192	6.60
D. kikkawai	114	3.92
D. jambulina	218	7.49
D. nasuta	305	10.48
D. repleta	221	7.60
D. paratriangulata	73	2.51
Zaprionus paravittiger sp. nov.	127	4.36

Flies were collected from fermenting fruits, garbage and vegetation by sweeping with net. Banana baits were also used. A total number of 2910 flies were collected, comprising eleven species as shown in Table 1.

Stoddard, A.E. University of Pittsburgh Pennsylvania. Interaction between two dominant bristle mutants.

A series of experiments has been undertaken to characterize the highly variable expression of a dominant bristle mutant, Ocellarless (Oce; 1-5.7) in D. melanogaster, and to gain information as to its mode of action during development. As a part of the study, Oce was crossed to another mutant, Hairy-wing-49c, which appears, at least superficially, to have an effect opposite to that of Oce. The F_1 females from these crosses showed an unexpected phenotype - a differential interaction on the head bristle sites as compared with thoracic sites.

Fahmy and Fahmy described Ocellarless (DIS 32:72, 1958) as being responsible for the absence of ocellar macrochaetae, plus the occasional absence of other macrochaetae, especially the postverticals and scutellars. In the current studies, populations of Oce/Oce females are seen to have approximately 90% of ocellar and postvertical macrochaetae missing and 10-40% of anterior dorsocentrals also absent. In Oce/+ flies, 60-80% of the ocellars and 90-95% of the postverticals are missing, but very few flies lack any dorsocentrals. Hairy-wing-49c (Hw^{49c}; 1-0.0), notable for its strong dominant manifestations, causes flies to differentiate extra

macrochaetae on the thorax, especially in the dorsocentral and scutellar regions. Homozygous Hw^{49c} females have 3-4 extra dorsocentrals per side, in addition to having microchaetae on the wing cells and bristles along wing veins. However, many Hw^{49c} homozygotes are missing one or more ocellar or postvertical macrochaetae. Flies heterozygous for Hw^{49c} and the ClB chromosome or a wild-type X-chromosome show 1-2 extra dorsocentrals per side and the absence of 75% of ocellar and 25% of postvertical macrochaetae.

The female progeny of crosses of Oce/Oce females with Hw^{49c} males, and the non-Bar female progeny of crosses of Hw^{49c}/ClB with Oce males, are heterozygous for these two mutants in the trans configuration. On the thorax, the effects of Oce appear to be completely epistatic to those of Hw^{49c}, in that the flies show about 10% of the dorsocentrals missing; that is, there is virtually no sign of the typical Hairy-wing appearance of extra dorsocentrals. However, the interaction of the two mutants in the mediation of formation of macrochaetae on the head appears to be synergistic - 95% of the ocellars and almost 100% of the postverticals are absent. Thus, the phenotypic expression is not only more extreme in these heterozygotes than that of either Hw/+ (or Hw/ClB) or Oce/+ alone; it is more extreme than that of either homozygote alone. This interaction represents an interesting example of autonomous pleiotropy, in which two dominant mutations, each of which has diverse effects on the entire organism, show different interaction phenotypes in different body regions.

Experiments are in progress to analyze the regional specificity of the Hairy-wing-49c - Ocellarless interaction and in the presence of homozygosity of one or both mutants.

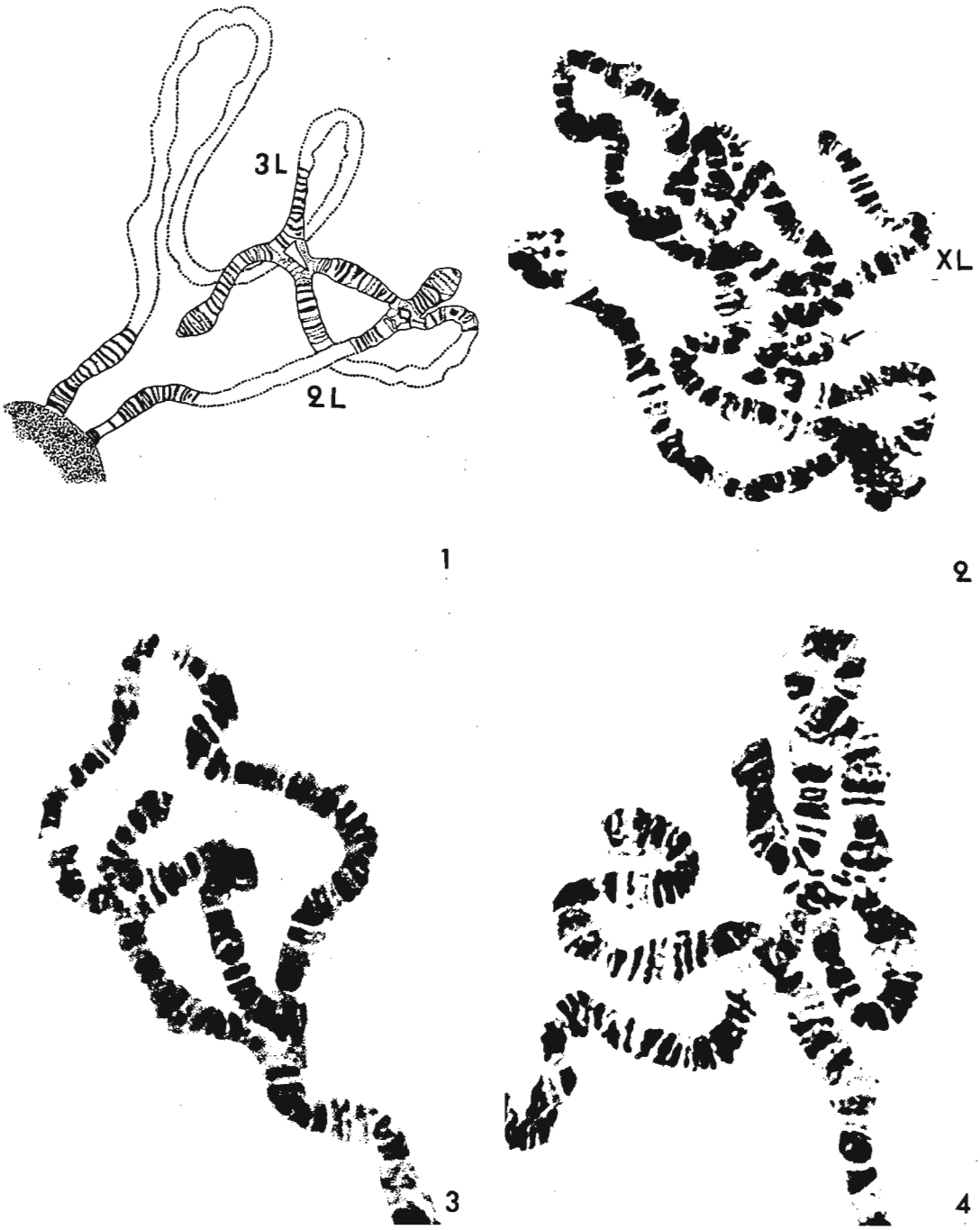
Khovanova, E.M. Research Institute of Medical Radiology, Academy of Medical Sciences, Obninsk, U.S.S.R. The influence of the content of live yeast in the medium on the frequency of somatic mosaicism in Drosophila simulans.

The influence of the content of live yeast Saccharomyces cerevisiae in the medium on the frequency of somatic recombination in the cells of the dorsal prothoracal disc was analyzed in heterozygous y/y^+ females of simulans. Virgin ♀♀ y w/y w were mated with ♂♂ y^+ w^+/Y from the laboratory stock 2. In this type of mating the frequency of yellow mosaic spots in the area callus humeralis was approximately 10 times greater than in the case of mating with ♂♂ from stock 1. Mosaic females eclosed almost completely in the first 2-3 days from the beginning of the emergence in the culture bottles. In the following days (from the 3-4th to the 9th) the frequency of humeral yellow spots sharply decreased and approached that in the case of mating with stock 1. Propionic acid was added to the medium for preservation against the fungi infection. The surface of the medium was covered with a suspension of live yeast Saccharomyces cerevisiae at 1-2 hours before putting in flies. In the experiments with medium containing 10 ml of propionic acid per 1000 ml medium, 5430 females y w/y^+ w^+ were obtained, 175 of them having mosaic spots in the humeral area (3.22%). In the experiments with the medium containing 1 ml propionic acid (per 1000 ml of the medium) the frequency of humeral mosaicism was increased to 4.28% (379 mosaics among 8837 heterozygous females). The differences are statistically significant: $\chi^2 = 11.38$, $p < 0.001$.

Two hypotheses were proposed: 1 - propionic acid is an inhibitor of somatic recombination in the cells of dorsal prothoracal disc; 2 - the frequency of somatic recombination depends on the quantity of live yeast in the medium; propionic acid acts as an inhibitor for growth of yeast colonies. To test these hypotheses, matings were made on the medium containing 10 ml (the first variant) and 1 ml (the second variant) of propionic acid (per 1000 ml of medium), but the yeast suspension was not put on the medium surface. Mosaicism frequencies decreased under these conditions: 2.69% (3932 females, 106 mosaic ones among them) in the first variant, and 2.83% (5090 females, 144 mosaics) in the second one. The differences between the variants are statistically insignificant: $\chi^2 = 0.222$, $0.5 < p < 0.75$, d.f. = 1. So different concentrations of propionic acid did not change mosaicism frequency by themselves. Finally, another series of experiments was made: yeast suspension was put on the surface of the medium containing 1 ml propionic acid (per 1000 ml of the medium), and after that culture bottles with the medium were put in the incubator at 24°C for a day. Flies were put into bottles with the medium, the surface of which was overgrown by yeast colonies. From 1965 heterozygous females, 125 were mosaics, i.e., the mosaic frequency increased under such conditions to as much as 6.36%. Even a single day in the incubator, on the medium with 10 ml propionic acid (on which yeast colonies grew poorly), the frequency of mosaic females was 3.60% (23 out of 626). Further investigations on the mechanisms of influence of live yeast on the frequency of somatic recombination are in progress now.

Sreerama Reddy, G. and N.B. Krishnamurthy
University of Mysore, Manasagangotri, India. Aberrant gene sequences in D. ananassae from South India.

It is well known that the natural populations of Drosophila ananassae exhibit a high degree of chromosomal polymorphism. This is evidenced by the occurrence of coextensive inversions 2LA, 3LA and 3RA in varied frequencies in various populations and the presence of certain unique aberrations in low frequencies of 1 to 2%. Several such aberrant gene arrangements have been reported by several workers.



Aberrant gene sequences in D. ananassae: Fig. 1. Translocation (2L-3L)9; Fig. 2. Inversion XLb; Fig. 3. Inversion 2Le; Fig. 4. Inversion 2Lf.

The present note records four new arrangements in D. ananassae. Of these one is a translocation and the other three are heterozygous paracentric inversions. The translocation (Fig. 1) named here (2L-3L)9 is a heterozygous reciprocal translocation involving the left arm of the second chromosome and the left arm of the third chromosome. It is associated with the coextensive inversion 2LA and is found in a low frequency of 1% in the Merupalyam population (Niligiri Range). Its break points are located in 19A of the left arm of the second chromosome and 55 D of the left arm of the third chromosome (chromosome map by Rajeshwari, 1971). 19A lies within the inversion loop of the inversion 2LA.

Of the three paracentric inversions one is a simple inversion located in the left arm of the X-chromosome, and is found in a low frequency of 1% in Gudalur population. Its proximal break point is located in 6B and distal one in 4D. This has been called XLb (Fig. 2) and is different from XLA of Futch (1966). The second inversion called 2Le (Fig. 3) is an overlapping inversion discovered in 1% individuals of Merupalyam (Nilgiri Range). The extreme break points of this are located in 16F and 31E. The first inversion has its break points in 16F and 26F which are similar to those of the coextensive inversion 2LA. The second inversion overlapping the first has its break points at 20D and 31E. It is thus possible that the latter is of more recent origin and has not thus far been found separately. The third paracentric inversion is an included type wherein a new inversion has been included inside the coextensive inversion 2LA. This gene sequence is called 2Lf (Fig. 4) and found in Perumalmalai population (Kodaikanal Range) in a low frequency of 1%. The break points are located at 23C-26D. The new inversion found within the inversion 2LA has not been recovered independently.

The above mentioned new gene arrangements have added to our knowledge on the peculiar pattern of polymorphism exhibited by D. ananassae. Further the participation of the inversion 2LA in three of the four arrangements presented here needs a special mention. In addition to other avenues of gene rearrangements, it is possible that this species is utilizing one more avenue through the coextensive inversion 2LA in order to incorporate more novelties into the polymorphic pattern.

Acknowledgements: The authors gratefully acknowledge the help and encouragement given by Dr. M.R. Rajasekarasetty, Professor and Head of the Department of Zoology, University of Mysore. The authors are also thankful to Sri Ramakrishna Raju for his help in the preparation of microphotographs.

Sreerama Reddy, G. and N.B. Krishnamurthy
University of Mysore, Mysore, India. Two new gene arrangements in Drosophila ananassae from South India.

The rarity of translocations and pericentric inversions in the natural populations of various species of Drosophila is attributed to the production of aneuploid gametes which reduce the fecundity and fertility. Although these rearrangements are forbidden by natural selection and per se disadvantageous, that these rearrangements have played a significant role during the past in the phylogeny of several species of the genus Drosophila cannot be denied. Drosophila ananassae, a domestic cosmopolitan species is a favourable material for the analysis of gene arrangements as it harbours a wealth of chromosomal rearrangements. In addition to several paracentric inversions, certain translocations and pericentric inversions have also been reported for this species. The number of pericentric inversions and translocations found in this species out-number similar rearrangements in all the other Drosophila species so far studied.

The two new gene arrangements reported here were observed in two populations out of seven populations collected from Ooty (Niligiris) and Kodaikanal (Palani Hills) ranges. Of the two new gene rearrangements, one is a heterozygous pericentric inversion found in Gundlupet population and the other is a heterozygous translocation found in Perumalmalai population of Drosophila ananassae. The pericentric inversion (Fig. 1) is found in the second chromosome and has been named (2L-2R)9, as it is the ninth pericentric inversion reported for this species. It is a long inversion found associated with the co-extensive heterozygous paracentric inversion 2LA. Its break points are located in 26F of the left arm and 45A in the right arm of the second chromosome (chromosome map by Rajeshwari 1971). It was found in a frequency of 0.07%. The heterozygous translocation reported here involves the right arm of the X chromosome and the left arm of the second chromosome (Fig. 2) called here (XR-2L)8 as it is the eighth translocation reported in this species. The breakage points are located in 14D of the right arm of the X chromosome and 22E of the left arm of the second chromosome (chromosome map by Rajeshwari 1971). It is an asymmetrical reciprocal translocation detected, also

in a frequency of 0.07%. Further it is quite interesting to note that the Perumalmalai population in which the translocation has been found is devoid of any of the known or new heterozygous paracentric inversions.

Drosophila ananassae is a unique species where including the two new gene arrangements reported here, a total of nine pericentric inversions and eight translocations are known (Table 1). Of the nine pericentric inversions, five of them, IIa, IIIa, IIIb, IIIc and IIId, were reported by Freire-Maia (1961) in Brazilian populations and three (2L-2R)A, (3L-3R)A and (3L-3R)B were reported by Futch (1966) in some of the Pacific island populations. Except (2L-2R)A and (3L-3R)B, which are symmetrical, all the other pericentric inversions reported are known to be asymmetrical. The pericentric inversion (2L-2R)9 reported here is slightly asymmetrical. Alexander (1952) in Drosophila melanogaster and Futch (1966) in Drosophila ananassae have shown that symmetrical pericentrics are at a lesser disadvantage than asymmetrical ones. The (2L-2R)9 being asymmetrical probably is at a higher disadvantage and hence not incorporated into the karyotype. Of the eight translocations reported for this species, one was shown to be karyotypically fixed involving the translocation of basal region of the X chromosome to the fourth chromosome (Kaufmann 1936b and Kikkawa 1938). The other seven translocations are of floating types. Of these one has been reported between 2L and 3L in a Brazilian population by Dobzhansky and Dreyfus (1943), one between 3R and 2R found in Uberlandia, Minas Gerais population of Brazil by Freire-Maia (1961), one between 3L and 4 in Mughalsarai population of North India by Ray-Chaudhuri and Jha (1965), one between XL and 2R in one individual of Niue island population by Futch (1966), two translocations between XR and 2R, and 2R and 3R found together have been reported by Sajjan and Krishnamurthy (1970) in Hiriyur population of South India and the new one between XR and 2L reported here.

Both these gene arrangements reported here are so rare that at this stage we cannot attribute any evolutionary significance except to say that these are two more unsuccessful attempts made by this species for a change in its karyotype.

Acknowledgements: We are highly indebted to Dr. M.R. Rajasekarasetty, Professor and Head of the Department of Zoology, University of Mysore, for his help and encouragement. Our

Table 1. List of pericentric inversions and translocations recorded in various natural populations of Drosophila ananassae all over the world.

X Chromosome	Second Chromosome	Third Chromosome
	Pericentric inversions	
	IIa (Inversion in second chromosome) FM	(3L-3R)A (18.3-8)F
	(2L-2R)A (35.2-28.9)F	(3L-3R)B (5-5.5)F
	(2L-2R)9 (26F-45F)RK	IIIa (Inversion a in third chromosome)FM
		IIIb (Inversion b in third chromosome)FM
		IIIc (Inversion c in third chromosome)FM
		IIId (Inversion d in third chromosome)FM
	Translocations	
XL-IV$^{Ka; Ki}$	(2L-3L)^{DD}	(IIIL-IV)^{RJ}
(XL-2R)A^{F}	(IIR-IIIR)^{FM}	
(XR-2R-3R)^{SK}		
(XR-2L)8^{RK}		

Ka = Kaufmann (1936); Ki = Kikkawa (1938); DD = Dobzhansky and Dreyfus (1943); FM = Freire-Maia (1961); RJ = Ray-Chaudhuri and Jha (1965); F = Futch (1966); SK = Sajjan and Krishnamurthy (1970); RK = Reddy and Krishnamurthy.

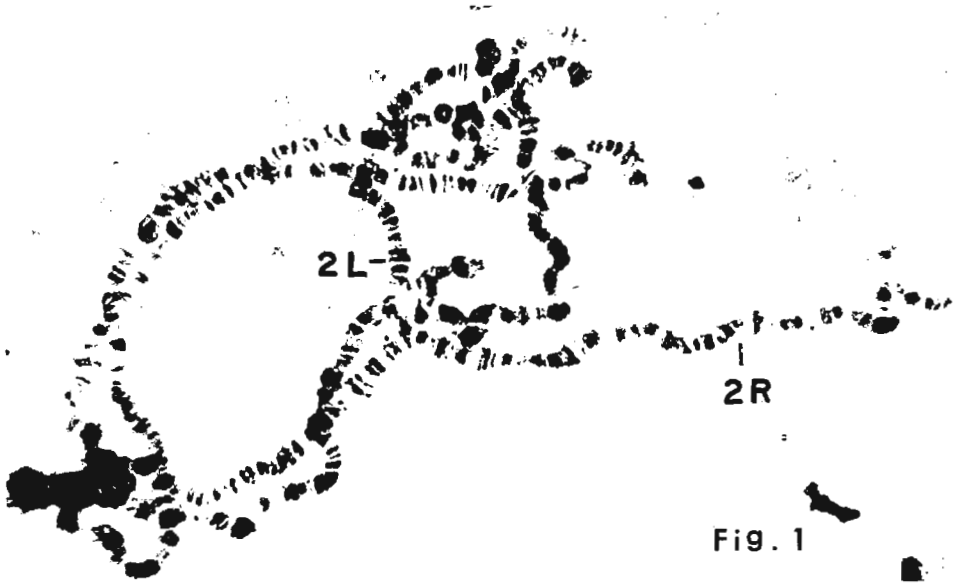


Fig. 1

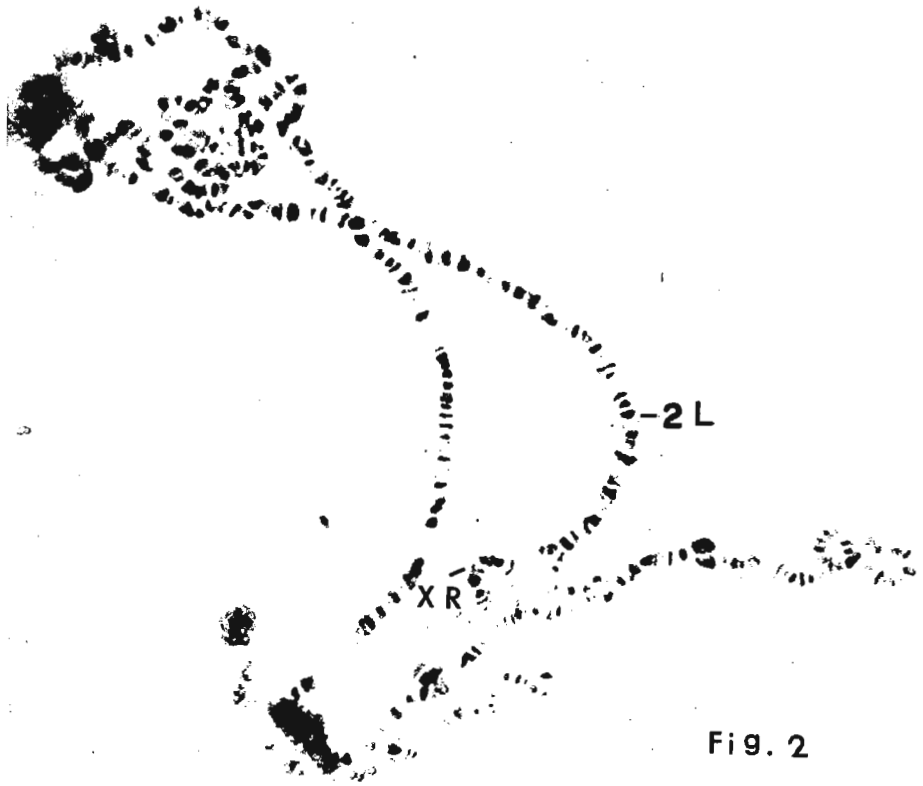


Fig. 2

Fig. 1. Pericentric inversion (2L-2R)9

Fig. 2. Translocation (XR-2L)8

thanks are due to Mr. Ramakrishna Raju for preparing the photomicrographs. One of us (G. Sreerama Reddy) is thankful to University Grants Commission for the award of personal grants to support our work.

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Alonso, C. University of Nijmegen, The Netherlands. In situ hybridization of RNA synthesized in larval salivary glands of D. hydei under in vitro conditions.

The hybridization (RNA-DNA) experiments reported here were designed to test a) the capacity for RNA synthesis in isolated salivary glands of Drosophila maintained for three days in a medium described by Poels et al. (1972); b) the possibility that RNA produced by certain puffs is transcribed from repetitive sequences.

Autoradiographs of pulse labeled glands at three days after the onset of incubation revealed a pattern of uridine incorporation into the chromosomes and nucleolus which was essentially the same as seen after in vivo incorporation (Poels et al., 1972). Puff 97A, a puff which becomes active in all cells after explantation of the glands was heavily labeled.

RNA was extracted for hybridization from 70 glands after three days incubation with 50 uCi/150 ul ^{3}H-5T-uridine (spec. act. 27 Ci/mM). The RNA which had a specific activity of 1.1 x 10^{6} dpm/ug, revealed after electrophoresis on SDS-polyacrylamid gels various molecular weight fractions, the major fractions being located at the 28S, 18S and 4-5S positions of the gels. Hybridization experiments were performed with the total RNA extract according to the method of Pardue et al. (1970). Salivary gland squashes were incubated for 16 hrs with the RNA and exposed for 65 days. The autoradiographs consistently revealed labeling of the nucleolus (Fig. 1) and variable labeling of other chromosome areas. Puffed regions, including the puff 97A, did not show consistent labeling.

Fig. 1. Autoradiograph of a salivary gland nucleolus and a part of a chromosome after in situ hybridization of total in vitro synthesized RNA. Exposure time 65 days.

References: Poels, C.L.M., C. Alonso and S.B. de Boer 1972 DIS 48 (this issue); Pardue M.L., S.A. Gerbi, R.A. Eckhardt and J.B. Gall 1970 Chromosoma 29:268-290.

Gavin, J.A. and D.G. Holm. University of British Columbia, Vancouver, Canada. Gamma ray induced nondisjunction of chromosome 2 in females.

Estimating the relative frequency of autosomal nondisjunction (or autosome loss) has been made possible through the construction of compound autosomes (Rasmussen, DIS 34:53). We find, for example, that disomic-2 and nullosomic-2 sperm are regular and frequent products of compound-2 males. Therefore, when these males are crossed with females bearing standard chromosomes, the resultant, but infrequent, progeny are products of exceptional meiotic events during oogenesis. The frequency of nondisjunction increases considerably, however, when crossing-over, in more than one pair of homologous chromosomes, is suppressed by either structural rearrangements or genetic means, or when females are exposed to ionizing radiation. The results of a preliminary study on radiation induced chromosome 2 nondisjunction (and chromosome 2 loss) during oogenesis are recorded in Table 1.

In each of the five tests, the treated (or control) females, whose genotypes are described in Table 1, were divided into groups of 25 and placed in half-pint creamers with 25 C(2L)P, b;C(2R)P, px males. The crosses were carried through five successive broods of three days duration for a total of 15 days. To estimate the overall reproductive potential of the females in each test, a number of bottles involved matings of 25 treated (or untreated) females to males bearing standard second chromosomes. The expected number of progeny listed in Table 1 is an estimate of the total expected progeny if compound males had been replaced by standard males. This value serves as a relative denominator for comparing nondisjunctional frequencies.

Two basically different genetic types of females are being considered: 1) structural

Table 1

Female Parent	Radiation Dose (rads)	Expected No. of progeny	Exceptional Progeny		Nondisjunction	Chromosome loss
			Matro	Patro		
lt stw^3/b pr cn	0	86,000	2	26	4	24
lt stw^3/b pr cn	3500	72,000	17	153	34	136
lt stw^3/SM1	0	84,000	12	26	24	14
lt stw^3/SM1	1000	63,000	208	230	416	22
lt stw^3/SM1	3500	40,000	120	325	240	205

homozygotes for chromosome 2, and 2) structural heterozygotes involving the multiple-break inversion, SM1, Cy. Comparing the results recorded on lines 1 and 3 of the table, we note little difference in the frequency of exceptional progeny from either class of untreated females. The primary contrast is in the ratio of matro/patro progeny. The exceptional progeny produced by structurally homozygous females appear to arise mainly as a function of chromosome loss. In comparing the relative frequencies of exceptional progeny recovered from the different genotypic classes following radiation (from a Co^{60} source at a rate of 65 rads/sec.) we find two quite contrasting results. First, assuming the method of estimating progeny number is reliable, the frequency of induced exceptional meiotic events is considerably greater in structurally heterozygous females than in homozygous females (compare lines 2 and 5 in the Table). The second contrast concerns chromosome loss. Although treated structural homozygotes produce increased numbers of exceptional gametes, we find (as noted on line 2) that most of the progeny are patroclinous. This clearly indicates that chromosome loss is responsible for the majority of the exceptional gametes. The structural heterozygotes, on the other hand, produced more nondisjunctional gametes, although chromosomal loss is significant at 3500 rads. At the lower radiation dose of 1000 rads, all the progeny appear to be products of nondisdunction (i.e., the matro/patro is approximately equal to one). It is also of interest to note that in all but the last experiment (line 5 of the table) the matro/patro ratio remained relatively constant. At 3500 rads (line 5), the matro/patro ratio was quite low in brood 1, indicating high chromosome loss, whereas by brood 5 the ratio increased to approximate unity. We should also note that, since the assortment of the compound-2 chromosomes used in this study approaches randomness in males, the frequency of disomic-2 and nullosomic-2 eggs should be approximately four times the frequency of exceptional progeny.

Mosna, G. and S. Dolfini. University of Milan, Italy. New continuous cell lines of Drosophila melanogaster. Morphological characteristics and karyotypes.

Several continuous cell lines of Drosophila melanogaster have been recently established (Kakpakov et al. 1969; Echalier and Ohanessian 1970; Schneider 1971). We report now on the successful growth of three additional cell lines deriving from embryonic tissues of Drosophila. Two hundred cultures were started from embryos of the wild stock Varese 12-15 hours old, following the technique devised by Echalier and Ohanessian (1970) and using the same D 225 medium. The development of the cultures was similar to that described by Echalier and Ohanessian (1970). The only three cultures, after 8, 10 and 6 months respectively, a new wave of cell multiplication gave rise, by subsequent subcultures, to the three cell lines, called GM_1, GM_2 and GM_3 (Genetics, Milan). Nearly all cells are roundish, only a few are spindle-shaped; the degree of homogeneity in the three lines varies according to the percentage of polyploid cells present in each line.

Karyotypic analysis provided characteristics for distinguishing each line. The preliminary cytological observations are in fact the following:

GM_1 line (16th and 17th passage): A high percentage of cells (75%) are marked by a normal X and a centric heteropycnotic fragment, 10% are XO and the rest are tetraploid. Nearly all cells have only one IV chromosome, the major autosomes being normal (Fig. 1a). Quinacrine staining showed in the short fragment two sections of bright fluorescence, which correspond to the two sections of the normal Y chromosome proximal to the centromere (Zuffardi et al. 1971).

GM_2 line (17th and 21st passage): a peculiar marker has been found in this line. 50% of these cells are XO and have two IV chromosomes; moreover, one chromosome of the II pair is missing and two "new" telocentric chromosomes are present resulting probably from a misdivision of the centromere of the original metacentric autosome (Fig. 1b). The other cells show tetraploidy or higher ploidy degrees; the characteristic telocentric chromosomes are always present (Fig. 1 .)

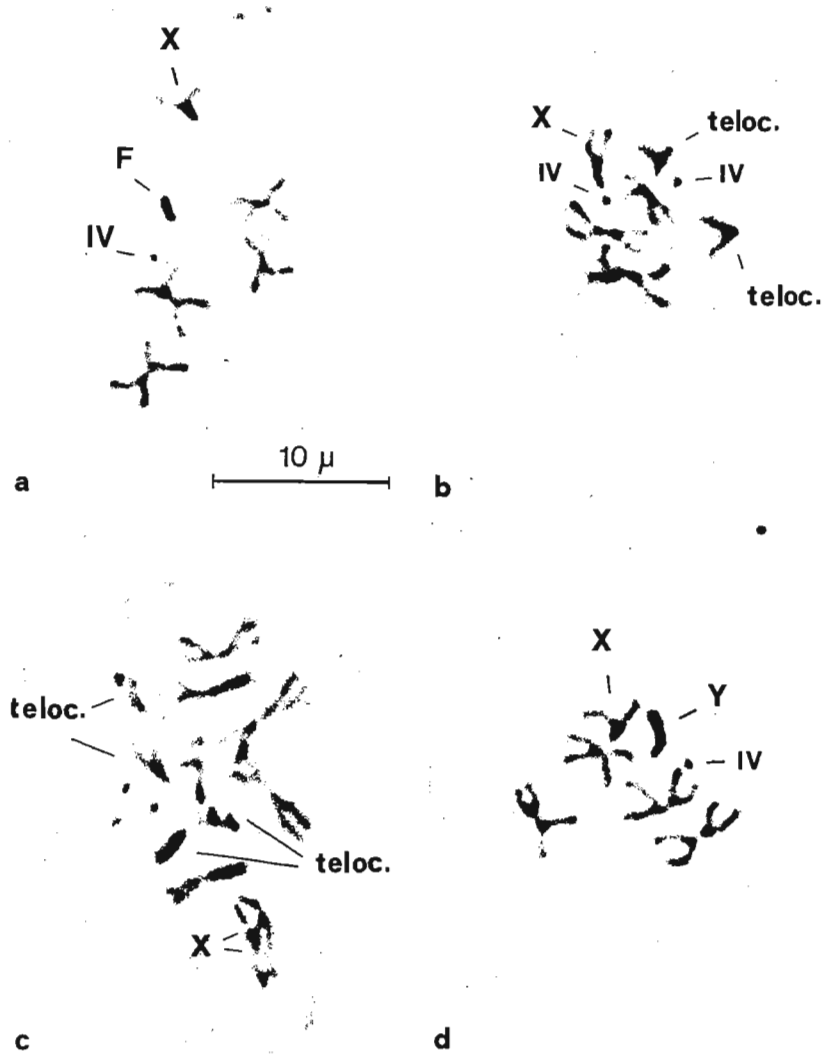

Fig. 1. Karyotypes of the different cell lines. a GM_1 line: X + fragment cell having one IV chromosome (F fragment); b GM_2 line: XO cell having two "new" telocentric chromosomes and two IV chromosomes; c GM_2 line: tetraploid cell; d GM_3 line: XY cell having one IV chromosome.

GM_3 line (9th, 10th and 12th passage): a high percentage of these cells (70%) are XY and have normal large autosomes. Only one IV chromosome is present (Fig. 1d). Many cells exhibit tetraploidy, octoploidy or higher ploidy degrees (30%).

No differences between different passages have been found in each line.

These findings emphasize the importance of these Drosophila cell lines: the easily recognizable chromosomal markers allow one to distinguish the different lines, making them useful for several research purposes. We are willing to send our cell lines to anybody interested.

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Ouweneel, W.J. Hubrecht Laboratory, Utrecht, Netherlands. Effect of colchicine on the development of homoeotic wing tissue.

Because it is known that homoeosis and transdetermination strongly depend on altered proliferation dynamics, experiments to alter proliferation and to study the consequent effects on these phenomena may be useful. In the present study the homoeotic mutant ld-opht was used, which produces wing outgrowths in the eyes.[1,2] Late 2nd-instar eye discs of this strain were bathed for 30 min in 9 - 100 ug/ml colchicine solutions made up in Ringer (control discs were bathed in Ringer only), then transplanted into larvae of the same age. Higher concentrations proved to be toxic. At the lower concentrations used (17 - 9 ug/ml) 124 (61%) of the transplanted discs were recovered (controls: 52%), 93% of which had undergone complete differentiation (controls: 97%) with an average incidence of all normal eye-antennal disc derivatives of 80% (controls: 82%).

At a concentration of 17 ug/ml fewer facets, but sometimes more bristles (often arranged in a confusing, crowded pattern) were formed. The occiput region often was much more extensively developed than in untreated implants and strikingly approached that of the normal fly, both in spatial relationships and in number of occipital bristles. This suggests that in these implants colchicine induced the process of growing-out which normally occurs in situ but fails to take place in untreated implants (cf. ref. 2). Interestingly, the long period between transplantation and pupation both in the treated and untreated discs often led to a partial or complete reduplication of the antenna and palps. The distal segments of the antenna always reduplicated first. Many antennal segments and palps were strongly enlarged and apparently trapped in the process of splitting-up (cf. ref. 3).

Homoeotic wing outgrowths were encountered in 10 (34%) of the implants treated with 17 ug/ml, in 25 (35%) of those treated with 11 ug/ml, and in 10 (67%) of those treated with 9 ug/ml. In the controls the penetrance was 33% (out of 72 implants). Therefore, a strong increase of penetrance was only observed at the lowest concentration tested; the X^2 for the difference was 5.68 (significant at the one-sided 2.50% level). The expressivity of the wing-like outgrowths is markedly increased by the colchicine treatment, but here also most strongly at 9 ug/ml, the surface of the outgrowths being 2.1 times as large as in the controls; this difference is significant (p=1.80, Wilcoxon test). At a concentration of 11 ug/ml the outgrowths were 1.9 times as large (p=2.74). At 9 ug/ml the total amount of wing tissue produced was more than 4 1/4 times as much as that produced in the controls; at 11 ug/ml twice; at 17 ug/ml 1 1/2 times as much. Colchicine given in the food in low concentrations during the larval period also significantly increased the expressivity of the wing-like outgrowths. We may therefore conclude that treatment with lower colchicine concentrations increases the production of homoeotic wing tissue in the eye of ld-opht, which is direct evidence for my earlier view[1] that the homoeotic effect is a consequence of changed proliferation dynamics.

Colchicine, which is best known for its ability to arrest mitosis, may thus, under certain circumstances, exert mitosis-enhancing effects, as found by many other authors (see ref. 4 and 5 for further literature). It seems to be capable of enhancing prophase progression and the cells' entrance into metaphase if they are in a state of "high mitotic tendency" (Lüscher), as is the case in proliferating imaginal discs. It is interesting that proliferation-enhancing effects could also be suggested for other colchicine experiments on imaginal discs. Treatment of genital discs often produced many more spermathecae than normally.[6] Tobler[7] adduced several arguments (particularly a markedly increased transdetermination frequency) for a stimulation of proliferation in treated foreleg discs; he assumed a similar effect in the experiments of Vogt[8] on aristapedia eye-antennal discs.

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Lefevre, G., Jr. and J. Kelley. San Fernando Valley State College, Northridge California. Strawberry vs. facet-glossy, a locus correction.

In 1958, Fahmy (DIS 34:49) reported a chemically induced mutant with roughened, glazed, bright red but "patchy" eyes, which, because of their remarkable resemblance to overripe strawberries, he named strawberry (swb), and which he localized at 1-2.2 (between w and N). An X-ray induced allele, swb^{62b}, was obtained from Amherst. P.T. Ives (personal communication) informed

me that swb^{62b} had been tested for allelism with Fahmy's original swb allele.

The swb^{62b} phenotype is not expressed when made heterozygous with a deficiency, Df(1) w^{67k30}, that lacks bands 3C2 through 3C6. However, when made heterozygous with either cytologically normal or deficient Notch mutants or with facet-glossy (fa^g), the swb phenotype is exhibited. In fact, the eyes of swb^{62b} cannot be distinguished from those of fa^g. In heterozygous combination with fa, swb^{62b} produces a fa phenotype; with spl, the eyes are completely +. A new X-ray induced allele, swb^{71b}, behaves exactly like swb^{62b}, although its eyes are rougher and appear mottled, but with a more nearly normal color.

It is clear the "swb" was the incorrect symbol. The mutant should have been symbolized fa^{swb} as a male-viable member of the N locus complex of mutants located at 1-3.0. As a symbol fa^{swb} perhaps deserves priority over fa^g, the symbol given to the allele found in 1962. In appearance, the eyes of both swb^{62b} and fa^g are much more aptly described by the term "strawberry" than by "glossy".

Mittler, S. Northern Illinois University, DeKalb, Ill. Failure of Dimethyl sulfoxide to protect against radiation-induced sex-linked lethals.

Dimethyl sulfoxide (DMSO) has been found to protect mice[1], tissue culture[2], pseudomonas[3], and catalase[4] from radiation. In an attempt to protect cells in spermatogenesis from radiation-induced recessive sex-linked lethals, 0.1 µl of 3.5% DMSO was injected into one-day-old adult Oregon R males. These males were irradiated with 2000 R γ rays from Cs^{137} Gammator 50 at 500 R/min. and mated to M-5 females at a ratio of one male to two females. The males were presented with new harems every two days until six days after irradiation. The control males were injected with saline solution and irradiated at the same time and were also transferred to new females every two days.

Brood	Injection	Lethals	Total Chromosomes Tested	% Lethals
0-2 day	Control	26	517	5.03
0-2	DMSO	24	414	5.8
2-4	Control	26	591	4.4
2-4	DMSO	23	469	4.9
4-6	Control	21	328	6.4
4-6	DMSO	19	290	6.55

DMSO did not protect post-meiotic cells in spermatogenesis from radiation-induced recessive sex-linked lethals.

References: 1. Ashwood-Smith, M.J. 1961, Int. J. Radiat. Biol. 3:41; 2. Vos, O. and M.C.A. Kallen 1966, Int. J. Radiat. Biol. 5:609; 3. Bridges, B.A. 1962, Int. J. Radiat. Biol. 5:101; 4. Lohmann, W., A.J. Moss, Dr. and W.H. Perkins 1965, J. Nuclear Med. 6:519.

Charlesworth, B. and D. Charlesworth. University of Liverpool, England. Linkage disequilibrium in populations of Drosophila melanogaster.

We have carried out an experiment to detect possible linkage disequilibrium between five polymorphic loci located in the middle of chromosome 3 of D. melanogaster. The loci studied, their map positions, and the alleles present in sufficiently high frequency to be useful in this study, are shown in the first table.

Locus	Map Position	Alleles (Relative electrophoretic mobilities)
1. Esterase-6	36.8	1.00, 1.10
2. Phosphoglucomutase	43.4	1.00, 1.20, 1.30*
3. Larval alkaline phosphatase	46.3	1.00, 1.30
4. Xanthine dehydrogenase	52.0	1.00, 1.04
5. Aldehyde oxidase	56.6	1.00, 1.04

* This allele was present only in population S.

For references, see O'Brien, S.J. and R.J. MacIntyre 1971 DIS 46:89-93.

Sets of chromosomes were extracted from male flies by a balancer technique, and maintained either homozygous or as balanced stocks. We studied flies from three population

samples. M69 and M70 were supplied to us by Dr. P.T. Ives, and were trapped from his Amherst population in 1969 and 1970. The M69 sample comprised 98 lines and the M70, 102 lines. The S sample consisted of 265 lines derived from an artificial population descended from several hundred flies collected at Rochester, N.Y., and maintained for several years by Dr. S. Saul. Electrophoresis on starch and acrylamide gels was used to score each line for its genotype with respect to the five loci. Lethal-bearing chromosomes were scored as well as quasi-normals.

Of the thirty tests for linkage disequilibrium between pairs of loci, four significant results were obtained, as shown in the table below.

Population	Loci	Significance level	Map distance
M69	2 and 4	.05	8.6
M70	1 and 4	.05	15.2
S	2 and 3	.01	2.9
S	3 and 5	.01	10.3

Every locus is involved in at least one significant disequilibrium. There is no sign that disequilibrium is confined to the closest pairs of loci: 2.9 is the smallest map distance in our set of loci, 8.6 is the 5th smallest (out of 10), 10.3 is the 7th and 15.2 is the 9th. There is no significant decrease of the correlation values as map distance increases.

For the pairs of loci that had a significant correlation in one population, the absolute values of the correlation coefficients for the other populations are also strikingly high. We tested these values against those for pairs of loci that had no significant correlations in any population, using the Mann-Whitney U-test, and the difference is significant at the .01 level. This is not due to high correlation between the M69 and the M70 data, since a significant result is still found when these are pooled, and the test repeated. In other words, a high correlation coefficient in the S data tends to be associated with high values in the M69 and M70 data, and vice-versa, despite the fact that these are independent populations. Furthermore, we have evidence that the M69 and M70 populations can be regarded as essentially independent, since they differ significantly both in gene frequencies at loci 2 and 5 and in the linkage disequilibrium between loci 2 and 4. This strengthens the evidence that high correlations between certain pairs of loci tend to occur in all three separate populations, although the direction of the association may vary, and suggests that these correlations may be caused by specific selective interactions between the alleles at these loci rather than by chance events occuring in the history of the populations.

Using the gene frequency estimates that we obtained, we have also calculated the expected numbers of chromosomes of each genotype, and compared them with the observed numbers. The X^2 was not significant for the M69 and M70 data, but was significant at the .05 level for S. The discrepancy in the S data could all be ascribed to the significant pairwise associations. These results, therefore, show no evidence for correlations of higher order. There is no indication of the extreme non-random association between linked genes proposed by I. Franklin and R.C. Lewontin (Genetics 65:707-734).

Inversions are not segregating at appreciable frequencies in these populations, so that the significant correlations reported cannot be ascribed to associations with inversions.

Ramanamma, Y.V. and M. Sanjeeva Rao.
Osmania University, Hyderabad, India.

The alteration of Di-ethyl-sulphate induced genetic damage by penicillin in D. malenogaster.

The genetic damage induced by X-rays could be increased or decreased by pre- or post-treatment with chemicals, various gases and antibiotics in Drosophila (Sobels, 1961, 1963, 1964, 1965, Burdette 1961, Clark 1963 and M.S. Rao 1965). Very few experiments were conducted to assess the possibility of altering the chemically-induced genetic damage. (Sobels 1956; Sobels and Simons 1956; Brink 1963). With a view to find out the feasibility of reducing the genetic damage induced by chemicals experiments were undertaken. Di-ethyl-sulphate known for its high mutagenic activity has been used to induce genetic damage and penicillin is tested so as to screen any alteration.

Oregon-K males of D. melanogaster were injected with 8 international units of penicillin. The treated flies were allowed to feed on a medium containing 0.4% of Di-ethyl-sulphate for 24 hours; the feeding technique was adopted from Pelecanos and Alderson (1964).

The mutagenicity was screened by the incidence of sex-linked recessive lethals. Since

Di-ethyl-sulphate cannot induce chromosomal breaks (Pelecanos and Alderson 1964) no attempt was made to score translocations. A brood pattern of 3 days interval was used (Auerbach and Sonbati 1960) and 3 broods were studied. Treated Oregon-K males were mated individually with 3 virgin females of Y sc^{Sl} In-49 sc^{8};bw:st. The virgin F_1 females were mated individually with Y sc^{Sl} In-49 sc^{8} males. In F_2, the absence of a wild type body colour male is an indication that a sex linked recessive lethal has been induced.

A series of experiments were conducted as follows: (1) control, (2) penicillin treated, (3) Di-ethyl-sulphate treated, (4) penicillin injection + Di-ethyl-sulphate, and (5) penicillin injection + 24 hours rest + Di-ethyl-sulphate.

The chi-square test has been done to compare the following groups: (1) control versus penicillin treatment, (2) Di-ethyl-sulphate versus penicillin + Di-ethyl-sulphate, (3) Di-ethyl-sulphate versus penicillin + 24 hours rest + Di-ethyl-sulphate, (4) penicillin + DES versus penicillin + 24 hours rest + DES.

If the calculated values exceed the chi-square values at 5% level for one degree of freedom, the groups compared are taken to be significantly different from each other. The results are presented in Table 1.

Table 1

Treatment	Brood A			Brood B			Brood C			Total		
	N	l	%	N	l	%	N	l	%	N	l	%
1. Control	1366	3	0.22	1716	8	0.46	1894	5	0.26	4986	16	0.32
2. Penicillin by injection	541	-	-	373	4	1.07	316	8	2.53	1230	12	0.97
3. DES feeding for 24 hr	300	39	13.00	673	84	12.84	279	25	8.96	1252	148	11.83
4. Penicillin + DES feeding for 24 hr	591	26	4.39	669	27	4.03	738	33	4.47	1998	86	4.30
5. Penicillin + 24 hr rest + DES feeding for 24 hr	338	35	10.35	346	27	7.77	510	22	4.31	1194	84	7.03

N = Total number of X-chromosomes scored l = Lethals recorded

Table 2. Chi-square values for the difference in sex linked recessive lethal frequency for the groups compared.

Sl No	Group	Brood A	Brood B	Brood C	Total
1.	Control vs penicillin	-	1.89	20.09	10.74
2.	DES vs penicillin + DES feeding for 24 hr	21.79	31.55	7.57	65.12
3.	DES vs penicillin + 24 hr rest + DES feeding for 24 hr	1.07	5.15	6.95	16.32
4.	penicillin + DES feeding vs penicillin + 24 hr rest + DES feeding	11.4	6.4	0.017	11.4

The results of statistical analysis are presented in Table 2. Analysis of the data in Table 2 clearly indicates that penicillin reduces the genetic damage induced by chemicals similar to the reduction observed with X-rays. The rest of 24 hours between penicillin and DES treatments also showed a significant reduction in the spermatid and spermatocyte stages of the male germ plasm, while the data on the penicillin + DES and penicillin + 24 hours showed a significant deviation in spermatozoa and spermatid stages. This is probably due to the elimination of penicillin from the system.

Majumdar, S.K. and D.S. Novy. Lafayette College, Easton, Pennsylvania. A very simple device for the collection of large numbers of eggs of D. melanogaster.

The controversial reports on the toxicological, teratological and cytogenetical effects of 2,4, 5-trichlorophenoxyacetic acid on mice (Courtney et al., 1970), rats and rabbits (Emerson et al. 1971; Sterling, 1971), and on D. melanogaster (Dävring and Sunner, 1971) have prompted us to study the effects of this chemical on egg-laying capacity and egg-hatchability in some genetic strains of D. melanogaster.

In this laboratory we are using with success a simple egg collection apparatus which is much simpler than the one designed by Würgler et al. (1968). The apparatus is a small plastic container approximately seven inches in length, five inches wide and four inches deep with fitted cover. Two holes are cut in the bottom to fit open screw-caps (2 inches diameter) and their jars and two more holes are bored in the top which are plugged with foam

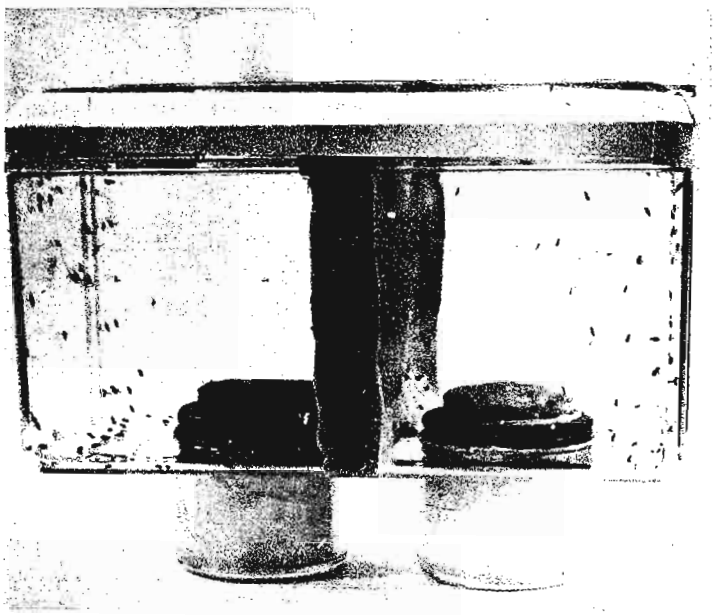

Fig. The egg collection cage with two jars screwed into the bottom.

stoppers (see Figure) for ventilation and introduction of flies. For our purpose, the container is partitioned between the holes; this allows us to study two strains of flies or two treated groups at one time in the same environmental conditions. Each jar was filled more than three-quarters with paraffin or modeling clay upon which was placed a small plastic petri dish (25 mm in diameter) containing moist instant Drosophila medium (Carolina Biological Supply Company). A round piece of blue or black paper (25 mm in diameter) is soaked in a specially prepared solution (2% acetic acid and 15% sucrose) and laid on the surface of the medium. Once the flies are placed in the container the females are found to lay eggs exclusively on the moist surface of the paper. The paper and food may be exchanged at will without loss of flies, by temporarily inserting an aluminum covered blank jar into the bottom hole. If the environment remains dark and the apparatus is kept at 24 ± 1°C, flies will deposit large numbers of eggs over a short period of time. The eggs may be brushed together on the paper to permit easy counting and chemical treatments.

This system proved to be a highly successful method for collecting eggs; for example, well fed 100 to 150 females often layed 30-40 eggs at 30 min intervals. In addition, accurate measurements as to the age of the eggs are readily available using this device.

References: Courtney, K.D., D.W. Gaylor, M.D. Hogen, H.L. Falk, R.R. Bates, and I. Mitchell, 1970 Science 168:864-866; Dävring, L. and M. Sunner, 1971 Hereditas 68:115-122; Emerson, J.L., D.J. Thompson, R.J. Sterbing, C.G. Gerbig, and V.B. Robinson, 1971 Fd Cosmet. Toxicol. 9:395-404; Sterbing, T.D. 1971 Science 174:1358-1359; Würgler, F.E., H. Ulrich, and H.W. Spring, 1968 Experientia 24:1082-1083.

QUOTABILITY OF NOTES

Bocquet, C. 44:192
Mather, W.B. and P. Thongmeearkom 48:40
Ouweneel, W.J. 46:86; 47:84
Scheid, W., H. Traut and M. Pfautsch 48:39
Tsacas, L. 37:135; 42:73; 42:83; 45:90

For previous listings see DIS 38, 42, 43, 44, 45 and 47

Klug, W.S. and M.H. Tan Wabash College, Crawfordsville, Indiana. Sexing and transplantation of gonads from Drosophila virilis larvae.

The in vivo culture of Drosophila imaginal discs has become a frequently used technique in developmental genetic studies. The sexing of larval donors and hosts and transplantation of excised discs is a delicate manipulative technique. We describe such manipulations of larval gonadal discs from Drosophila virilis which may be applied to other Drosophila organotransplantations with minor modification. The use of an inexpensive glass applicator for sexing and a method for the preparation of microneedles that requires no expensive equipment are described.

SEX IDENTIFICATION. As the adipose tissue becomes abundant, the larval gonads may be observed through the abdominal wall at about one-third of the body length from the posterior end. Each gonad remains comparatively transparent in the monolayer of adipose tissue. Sex may be distinguished on the basis of the larger gonadal size of the male throughout larval development (Figure 1). A larva should be washed free of food and placed in a drop of water in a petri dish which is placed on a blackened stereomicroscope stage. The gonads may be

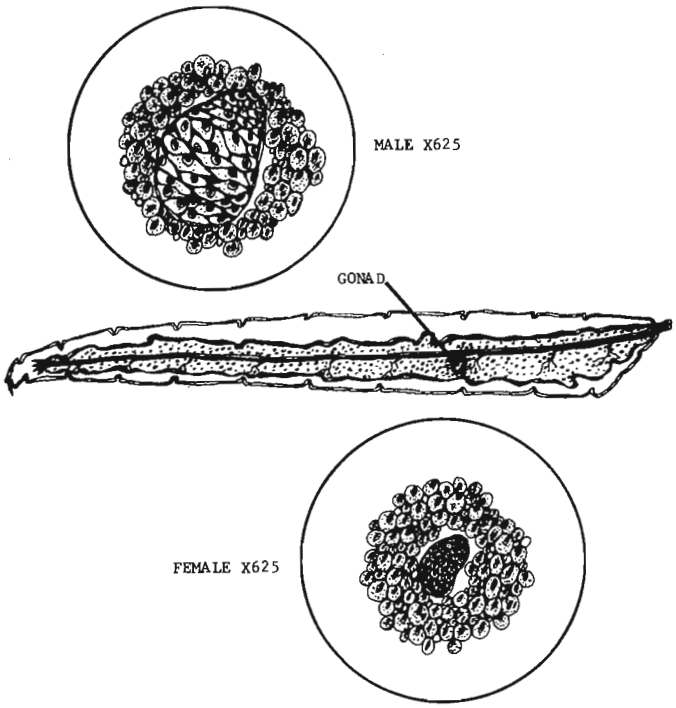

FIGURE 1. LATERAL VIEW OF THIRD INSTAR LARVA

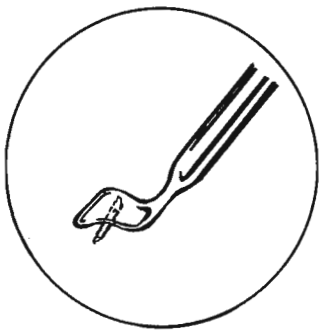

FIGURE 2. SEXING WITH GLASS APPLICATOR

observed as the larva is held in place and manipulated by a glass applicator. Using a slight rolling pressure on the larva with this applicator will allow the gonads to be viewed through it while using a stereomicroscope. After sexing is accomplished, larvae should be grouped and returned to food medium or moistened Kimwipes.

The glass applicator (Figure 2) is very helpful and may be prepared as follows: 1. A piece of #1 coverslip is broken into several triangular shaped pieces and one of them is joined by heating to a thin end of drawn out glass rod (5 x 150 mm). 2. The sharp edge of the coverslip is then introduced into the edge of a small flame to firepolish and shape it.

GONADAL TRANSPLANTATION. The dissection utilizes Drosophila Ringer's solution prepared as follows: Solution A: 7.5 g NaCl, 0.2 g $CaCl_2$, 0.1 g KCl in 500 ml distilled H_2O; Solution B: 0.2 g $NaHCO_3$ in 500 ml distilled H_2O prepared fresh (Butterworth, Bodenstein and King, 1965). Equal parts of A and B are mixed and 1 drop (0.05 ml) Antibiotic-Actinmycotic solution (Gibco, #524L) is added per 5 ml of Ringers.

Following sexing, larval donors and hosts are dipped in 70% ethanol and etherized lightly until motion ceases. The selected host can now be transferred to a drop of Ringers on a clean slide and the excess Ringers removed with filter paper. When the thin film between the larva and slide dries, the host is reversibly but securely held to the slide.

A donor larva is placed in Ringers on the end of a second slide under a dissecting microscope. The abdominal wall is teased apart at about one-fourth of the way from the posterior end. The two lateral monolayers of adipose tissue are now stretched and the gonads are readily observable. After the adipose tissue has been trimmed to one or two cells in thick-

ness surrounding the gonads, this piece is transferred to a second drop of Ringers on the other end of the slide. The gonads are never exposed to the air.

Each gonad is then sucked into the lumen of a micropipette which has been lubricated with adipose tissue and filled with Ringers. With the help of forceps, the bevel of the loaded micropipette is gently pushed into the abdomen of the host larva as shown in Figure 3. The gonad is transferred and the needle withdrawn leaving a wound no larger than 150 μ. It is usually necessary to moisten the abdominal wall before puncturing and withdrawing the micropipette. Following recovery by the larva, it is transferred to fresh food and allowed to develop.

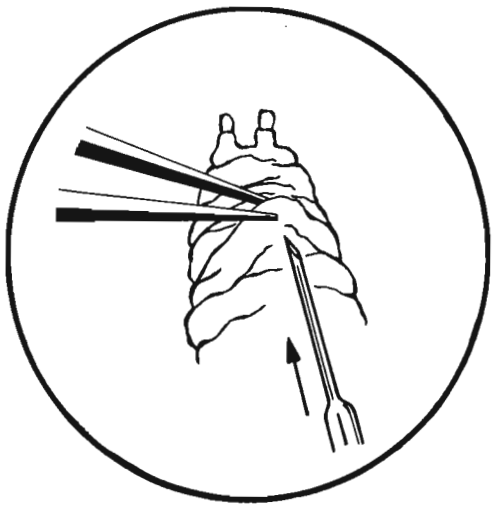

FIGURE 3. TECHNIQUE OF MICROINJECTION

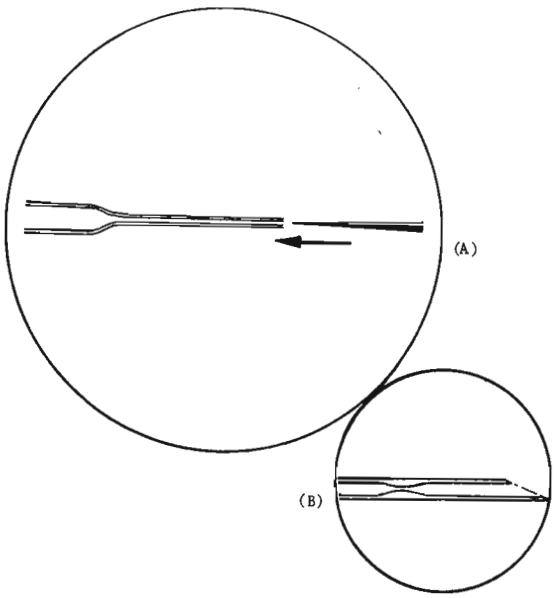

FIGURE 4. (A) PREPARATION OF BEVEL
(B) FINISHED MICROPIPETTE GAUGE

Preparation of the micropipette: 1. A 20 lambda capillary (#8206-X10, A.H. Thomas) is held in the blue flame of a horizontal microburner made from a B-D needle holder with a double-ended needle. When a red flame is observed, the capillary is withdrawn and pulled into halves. With a lumen of about 120 μ. the gauge is broken to about 2 cm in length.

2. A sharp bevel can now be made on the end of the gauge by inserting and withdrawing a sharp steel needle in the direction as illustrated in Figure 4A. This manipulation is done in a gentle and continuous motion.

3. The center of the gauge is now introduced vertically to the edge of the microflame until it again becomes red. The micropipette is withdrawn and this step repeated following a 90, 180 and 270° rotation. This will result in a constriction of the lumen of about 30-50 mμ. Such a constriction will prevent the tissue from being sucked too far up into the micropipette. The finished micropipette is illustrated in Figure 4B.

The above procedure may be mastered by any interested investigator. We have been 100% efficient in sexing procedures and had a high percentage of host larvae develop normally to eclosion. Examination of the mature adult has always revealed the presence of the developing implant as well as the host's normal reproductive system. Several references are listed below which give other insights into these processes.

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Research supported by NIH Grant GM-17716 to WSK.

Baird, M.B., H.V. Samis, H.R. Massie and R.J. Nicolosi. Masonic Medical Research Laboratory, Utica, New York. A method for the determination of catalase activity in individual Drosophila.

We have recently begun to study the regulation of catalase activity in Drosophila melanogaster. The assay procedure used for these studies[1] was essentially a slight modification of the spectrophotometric assay method which had been developed for homogenates derived from mammalian organs[2]. Because of the relatively low catalase activity in single flies, it was necessary to assay fly homogenates which contained large numbers (1000-150) of individual organisms in order to obtain reproducible data. However, it is advantageous to know enzyme levels of individual flies, especially in aging studies, where one may be interested in enzyme activity in the individual organism rather than mean values for a population. The purpose of this note is to describe a method for the assay of catalase activity in individual Drosophila.

Individual flies are collected on cold plates and placed in glass homogenizers containing 0.5 ml of a solution containing 0.1% Triton-X, which insures solubilization of all catalase activity[3], and 0.1% ethanol, which prevents formation of inactive catalase complex-II[4]. The flies are then homogenized with glass beads and rendered devoid of chitin as described elsewhere[5].

Fly whole homogenates were assayed for catalase activity by a slight modification of the polarographic technique described by Goldstein[6]. In this assay method, catalase activity is measured by determining the rate of oxygen production during the enzymatic decomposition of either sodium perborate or hydrogen peroxide. All assays were performed at 30°C with a YSI Model 53 Biological Oxygen Monitor, equipped with an externally thermostated circulation bath and Bausch and Lomb VOM 8 linear-log recorder. Three (3.0) ml of degassed substrate (0.033M sodium perborate in 0.05M sodium phosphate buffer, pH 7.0) were pipetted into each of the incubation chambers of the oxygen monitor. The chamber contents were allowed to equilibrate for 3 minutes with constant magnetic stirring. The Clark-type oxygen probes were then inserted into the chambers and the reaction was initiated by adding a suitable volume (25-50 µl) of a homogenate into the chambers through PE50 intramedic tubing (Adams) inserted into the overflow groove of the Lucite probe plunger. Oxygen production was recorded for 30 seconds. One unit of catalase activity is defined as that amount of catalase activity which releases 1.0 µM of O_2 per minute under these conditions[6]. Protein was determined on fly homogenates according to the method of Lowry et al.[7].

The results of assays of at least four individual flies on three separate occasions are shown in Table 1. There were no significant differences in mean enzyme activity in single Drosophila when assayed in three separate experiments. The results in Table 1 show that catalase activity per fly is about 13.4 units, and that there are approximately 90 units/mg protein in individual flies.

Table 1. Catalase activity in individual three-week old Drosophila males. One unit of activity is defined as that amount of catalase which releases one µM of O_2 per minute from 0.033M sodium perborate at 30°C.

Experiment #	units/fly $\bar{X}$ ± 1S.E.	units/mg protein $\bar{X}$ ± 1S.E.
1	13.599 ± 0.968	93.5 ± 2.4
2	13.553 ± 0.664	----------
3	13.210 ± 1.131	87.6 ± 3.7

These results indicate that the polarographic determination of catalase activity is applicable to the determination of activity in individual Drosophila. The results obtained indicate high reproducibility of catalase assays both with samples from single flies and between samples of different flies.

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Wheeler, M.R. University of Texas, Austin, Texas. The remarkable status of Drosophila pseudoneohydei.

Hennig, Hennig and Stein (1970) published an article describing differences in the DNA of Drosophila hydei, D. neohydei and D. pseudoneohydei, pointing out that the latter had not been officially named or described. They detailed a number of differences in the DNA of these three species. Thus, they appear to have "named" this new species of Drosophila, although unintentionally, since the International Code of Zoological Nomenclature states that a proposed new name is valid if "accompanied by a statement that purports to give characters differentiating the taxon..."

This must surely be the first time that a new species of Drosophila, or a new species of any sort of animal or plant for that matter, has been "described" solely on the basis of its primary genetic material - the specific composition of its DNA!

Reference: Hennig, W., I. Hennig and H. Stein,1970. Repeated sequences in the DNA of Drosophila and their localization in giant chromosomes. Chromosoma (Berlin) 32:31-63.

Hochman, B. University of Tennessee, Knoxville, Tennessee. Ecologically-sound laboratory practices.

As most drosophilists who occasionally venture outside their laboratories realize, the air, water and land on the earth are deteriorating at an alarming rate. While it is doubtful that any fly geneticist is a major polluter, it is true that some of our common laboratory practices are ecologically unsound. Surely, we should be able to replace these actions by ones which are gentler to our beleaguered environment. The table below contains a list of "do's" and "don'ts" which I respectfully submit for your earnest consideration. The feasibility of the "do's" has been verified in my lab.

Item	Do	Don't	Reasons
Bottles, vials, dishes, beakers etc.	Use glass	Use "disposable" plastic	Broken glass can be recycled. Plastic is a major land and water pollutant and when it is incinerated pollutes the air
Washing products	Use soap or non-phosphate liquid detergents	Use high phosphate detergents	Phosphates are major factors in the eutrophication of rivers and lakes.
Washing soiled glassware	Employ students or other part-time help	Use electric-powered dishwashers	Fossil fuels are not renewable. People do a better job and save water too. Besides, you will be helping a student financially
Chemical mutagens, acrylamide & other poisons	Render them harmless before disposal. Bury if possible	Pour them down the drain	They are toxic and mutagenic to aquatic organisms and they may contaminate municipal drinking water
Used fly food	Compost this organic matter	Pour it down the drain	It can enrich the soil. Municipal sewage systems are already overworked
Paper products	Limit their use. Buy only white paper. Recycle all paper that is not excessively dirty	Use colored paper. Discard paper with other trash	Each ton of recycled paper saves some 15 trees. Certain dyes in colored paper contaminate water ways if the paper enters the sewage system

The above list is by no means exhaustive. You can probably add to it. Also, try to convince your colleagues in other laboratories to eschew environmentally-harmful acts.

Spieth, H.T. University of California, Davis, California. Rearing techniques for the Hawaiian species Drosophila grimshawi and Drosophila crucigera.

The species of endemic Hawaiian Drosophila are notoriously difficult to rear under laboratory conditions. Modification of standard rearing procedures and food media (Wheeler and Clayton 1965) has enabled several laboratories to maintain stocks of a number of species but an inordinate amount of attention and time must be given the flies. Furthermore, pair matings have been difficult to achieve and typically only mass matings are successful. The following procedures have, however, been developed for rearing both D. grimshawi and D. crucigera in large numbers with relatively small time, energy and cost expenditures. Pair matings can be successfully achieved with adult mortality reduced to a minimum.

REARING UNITS. Square-shaped pint milk bottles with standard cotton or other type plugs are used as rearing containers.

FOOD STICKS. Cut rectangular strips (115 mm x 13 mm) from 3 mm (1/8") thick sheets of plexiglas. Cut plexiglas tubing, O.D. 22 mm (7/8"), I.D. 19 mm (3/4"), transversely into short sections, i.e. 19 mm (3/4") long. Cement three sections of tubing with Dupont household cement into a compact row crosswise in the central area of one side of a plexiglas stick. Such a food stick can be inserted into a large mouthed milk bottle, but I use small mouthed bottles with a 1 1/8" opening. It is necessary therefore after the cement is thoroughly dry to bevel the outer edges of the three pieces of tubing. This is easily accomplished by holding the assembled food stick at an angle against a power driven sanding belt. Small half moons of material are sanded away from both sides of each of the three tubular sections until the food stick can be easily inserted into the rearing bottle. The sanded material collects as a mass on the inner surfaces of the cylinders and can be removed after cooling.

FOOD SPONGES. Using a #12 cork borer, cut sponge plugs 3/4" thick from sheets of dry cellulose sponges. Thoroughly wash the sponge plugs, using a laboratory detergent, and thoroughly rinse; squeeze out the excess water and place the damp sponges into glass jars capped with aluminum foil; sterilize on dry cycle. The sterilized, slightly damp sponges fit snugly in the tubes of the food sticks and readily absorb the liquid media.

LIQUID MEDIUM. Banana-Malt-Liver (BML)

500 ml distilled water	10 gm Difco Bacto-Liver
80 gm banana peel	2.5 ml propionic acid
25 gm Fleischmann's Dry Diamalt	2.5 ml ethyl alcohol

PREPARATION OF BML. The bananas from which the peel is taken should be firm, i.e. slightly under-ripe with a yellow to greenish-yellow color. Place the peel, Diamalt, Bacto-liver, and approximately 400 cc water in a blender; blend at moderate speed until the peel is moderately disintegrated. The peel should not be completely pulverized. Place the mixture in a cooking vessel and use the remaining water to rinse the blender and add the liquid to the cooking vessel. Bring medium to a boil, simmer for 10 minutes, remove and pour into a large sterile pyrex bottle. Then add the propionic acid-ethyl alcohol mixture to the food, agitate, and store under refrigeration until used. The liquid medium should have a pH of approximately 4.0 and will keep well for several weeks.

SOLID MEDIUM. Diamalt, Cereal and Liver (DCL)

1000 ml distilled water

8 gm agar	20 gm Difco Bacto-Liver
45 gm cereal mixture *	160 gm banana peel
10 gm brewer's yeast **	5 ml propionic acid
45 gm Fleischmann's Dry Diamalt	5 ml ethyl alcohol

* Cereal mixture: 15 gm Gerber's High Protein Cereal
5 gm Kellogg's Concentrate
15 gm Kretschmer's Wheat Germ
10 gm Kellogg's Special K Cereal

Place all four dry ingredients in a blender and blend until thoroughly homogenized. It is convenient to prepare a large amount of cereal mixture beforehand and to store it in the refrigerator.

** I used Wheast instead of brewer's yeast. Wheast is a granular material consisting of inactive, dried Saccharomyces fragilis yeast which has been grown on fresh cottage cheese whey. It is available

from the Knudsen Creamery Co., P.O. Box 2335, Terminal Annex, Los Angeles, California 90054.

PREPARATION OF DCL. Place the agar and 500 cc water in a cooking vessel and heat until the agar is dissolved.

Place the banana peel and 400 cc water in a blender; blend until the peel is thoroughly homogenized. Add remaining solid ingredients and blend combined mixture until thoroughly homogenized. Add mixture to the agar-water in the cooking container, rinse the blender jar with remaining 100 cc water and add the liquid to the cooking vessel. Bring contents to a boil; simmer 10 minutes; remove from heat and allow to cool a few minutes. Add the alcohol-propionic mixture and stir thoroughly. Pour the hot medium into large shell vials or bottles, plug and store under refrigeration.

PREPARATION OF REARING BOTTLES. Fold a Tomac Kerchief or similar type material to form a pad approximately the size of the bottom of the rearing bottle. Insert the pad so arranged that it covers the bottom of the bottle. Use the pad without the addition of water.

Insert a sponge plug into each of the three cylindrical holders on a food stick and then thoroughly wet (i.e. soak the sponge) with the following liquids:

Sponge 1. distilled water

Sponge 2. 10% Karo solution (i.e. 10 cc light Karo syrup dissolved in 90 cc distilled water, boiled 10 minutes)

Sponge 3. BML liquid. Along with the amber colored liquid a sufficient amount of fine particles of the banana peel should be dispensed to form a thin coating of peel fragments on the end of the sponge plug.

I typically insert the sponge plugs into a number of food sticks, laying each food stick on its side with the ends of the sponge plugs facing upward. Using polythene wash bottles, one for each liquid, I squirt the liquids onto the sponge plugs until they are thoroughly wet.

Introduce 15 to 25 adult flies into the rearing bottle; drop in a prepared food stick and plug the bottle tightly with a cotton stopper.

Adults of D. crucigera and grimshawi cannot withstand prolonged exposure to temperatures exceeding 20°-21°C and are most comfortable at 18°-20° (65°-68°F). Under such conditions females will begin to lay eggs at 24 days but will not reach full productivity until 36 days. The flies are changed every 7 days at which time the food sticks of the 24+ day old flies are checked under a binocular scope for eggs, which can be identified by the appearance of long respiratory filaments on the surface of the BML sponge.

If eggs have been laid, withdraw the sponge with forceps and introduce into a vial or bottle containing solid food (DCL); plug the container with cotton. Lay the sponge on its side so that the egg filaments are exposed to the atmosphere. Return the vial containing the egg-bearing sponge to the rearing cabinet.

The mature larvae of both crucigera and grimshawi refuse to pupate in the solid food vials; rather, they engage in a period of wandering. In the field they leave their natural food sites and eventually burrow into the soil where pupation occurs. Natural conditions can be simulated by utilizing "sand jars".

Using a one quart or half-gallon mason jar with a screw-top lid, place a 3 to 4 inch layer of well-washed dry sand in the jar and wet well (but do not soak) with distilled water. After wetting the sand, unplug the vials containing the larvae and set the open vial upright in the sand layer. Discard the bell dome lid but retain the band. Place a 5 x 5" piece of fine bolting silk (grit gauze) on top of the jar and place the band over this; screw down tightly so that the cloth is smoothly stretched in place. I use #53 Nitex bolting silk sold by Trabler, Ernst and Tralber, 420 Saw Mill River Road, Elmsford, N.Y. If grit gauze is unavailable, muslin cloth can be substituted.

The mature larvae crawl out of the food vial over the surface of the sand, often up the sides of the jar; unless there exists a humidity gradient in the jar they will vigorously attempt to crawl out of the jar. They cannot penetrate the bolting silk or moderately heavy muslin but can and do penetrate almost any cotton plug. Eventually they burrow into the sand and pupate 1 - 3" under the surface. If the sand is too wet, they drown; if too dry, they desiccate.

The adult eventually emerges from the pupal case, pushes its way upward through the sand and then can be collected. The most effective method is to use an aspirator. I use one made

from a section of glass tubing, one end of which is covered with a piece of bolting silk and thrust into a section of rubber or tygon tubing. Adults should be collected on the day that they emerge and immediately placed on fresh food.

NOTES OF CAUTION. (1) The sponges in the food sticks must be thoroughly soaked, and especially the distilled water sponge. The adults must have liquid other than that in the food. The humidity in the bottle must be kept high, at least 90% relative humidity. If the rearing bottles are tightly plugged and if the humidity of the rearing room or chamber is not excessively low, the amount of liquid in the three sponges of a food stick will maintain the humidity in the bottles at an adequate level for 7 - 8 days. (2) The flies should not be crowded for they are pugnacious, especially the males. Fighting breaks their wings and increases mortality. (3) The sponge plugs can be repeatedly re-used if they are washed, rinsed and sterilized after removal from old food sticls. (4) The food sticks should be washed, rinsed, and dried after use but will not withstand sterilization. (5) The bananas should be washed in a mild detergent solution and then thoroughly rinsed before they are peeled.

Reference: 1. Wheeler, M.R. and F.E. Clayton 1965 DIS 40:98.

Travaglini, E.C. and D. Tartof. Institute for Cancer Research, Philadelphia, Pennsylvania. "Instant" Drosophila: A method for mass culturing large numbers of Drosophila.

In order to breed large numbers of Drosophila with minimum effort, we have modified Doane's procedure (DIS 45:189) for rearing larvae by substituting cellucotton (absorbent wadding, non-sterilized, obtainable at The Drug House, Philadelphia, Pennsylvania) for the plastic pad used for the substratum on which the larvae feed. Since the larvae ingest the cellucotton when it is soaked with a yeast-sucrose solution, they tend to tunnel through the cellucotton and therefore have a larger surface area to feed upon than the pad surface alone, and because of the easier access to food, it allows larger numbers of larvae to be raised in a box. Also, the cellucotton is disposable after being used.

The procedure is as follows: three layers of cellucotton are placed in the bottom of each polyethylene plastic box (5-1/2" x 7-1/2" x 3-1/2"; Freezette-flat, manufactured by Polly-flex) in whose detachable lid a ventilation hole (3" diam.) has been cut and covered by two layers of double-thick gauze secured with tape. To each box, 200 ml of the following medium is added (40 g of fresh brewer's yeast, 20 g of sucrose, and 140 ml of acid mix A). Acid mix A (0.4% propionic acid and 0.06% phosphoric acid) (Lewis, E.B., DIS 34:117) can be made up in ten liter quantities and stored at room temperature until used. Then, on the surface of each pad, a filter paper (2" diam., Whatman #1) containing 0.5 - 0.7 ml of fertilized eggs (proferably 18-hr embryos) is placed. Care should be taken not to drown or dry out these embryos before they hatch; the filter paper should be damp but not wet! If flies are desired, the boxes are incubated at 25°C in a properly ventilated area for six days and then after pupation, the cellucotton pads are transferred directly to population cages where the flies will hatch; after hatching, the cellucotton pads are discarded. Each box will yield approximately 5-7 g of adult flies.

If larvae are to be harvested, 100 ml of H_2O should be added to the cellucotton in each box just as the larvae begin to climb and another 300 ml H_2O 1 hour before the actual harvest takes place; the water will cause all the larvae to climb out of the cellucotton onto the sides of the box. The larvae are harvested by scraping them from the sides of the box with a spatula. Each box yields approximately 12 g of uniformly sized larvae.

This method has also been adapted to breeding flies in stock bottles over a period of two weeks at 25°C. In order to control the pH of the nutrient medium over this period of time, the yeast-sucrose medium had to be modified. The procedure is as follows: a wad of cellucotton (2" x 8", 2 layers thick) is pushed into the bottom of a bottle and this is wetted by the addition of a mixture of 6 g yeast, 3 g sucrose and 50 ml acid mix A, then 10 pairs of mature adults are put into a bottle. Each bottle yields approximately 1 g of flies.

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Nederström, A. and J. Lumme University of Helsinki, Finland. A simple method for recording the locomotoric activity of small insects.

We have recently developed a successful method for recording the daily locomotoric activity of D. littoralis and its sibling species. A small thermocouple made of 2XO.1 mm copper constantane is placed into a culture bottle horizontally and a piece of thin paper (10 x 7 mm) is mounted near the tip of the thermocouple. With a 1 mV recorder the temperature variations caused by the movements of flies inside the bottle have been recorded satisfactorily, when about 35 flies have been released into the bottle. In a smaller vial the recordings are far more pronounced, but it is difficult to tell true locomotion from slight movements. This method may be recommended as an extremely cheap way of recording insect locomotion.

References: Beck, S.D. 1968 Insect Photoperiodism; Strange, G. and R. Hardeland 1970 Oecologia 5:500-405.

Lefevre, G., Jr. San Fernando Valley State College, Northridge, California. A new symbol to distinguish insertional from reciprocal translocations.

David Perkins is introducing a special symbol to characterize insertional translocations for use by Neurospora geneticists. His proposal is joined by M.M. Rhoades for corn geneticists. Although C.B. Bridges established a special symbol for transpositions (Tp, shift of a chromosome segment from one place to another on the same chromosome), he did not differentiate between insertional and reciprocal translocations. After thorough discussion with Perkins, I am convinced that a useful purpose will be served by adopting his proposal. Henceforth, I shall use, and recommend that all Drosophila geneticists use, an arrow to replace the semicolon when symbolizing insertional translocations. For example, $T(1;3)N^{264-58}$, the current symbol, would become $T(1\rightarrow3)N^{264-58}$, the arrow showing that a segment of X has been inserted in chromosome 3. The arrow symbol also emphasizes that the translocation is not reciprocal. A more complete symbol could be $T(1\rightarrow3L)N^{264-58}$. An insertion of autosomal material into X could be noted by $T(3\rightarrow1)$, which should be preferred to $T(1\leftarrow3)$, an alternative symbol. The simultaneous insertion of X into 3 and 3 into X could be symbolized $T(1\rightleftarrows3)$.

Transpositions should continue to be symbolized as before: for example, $Tp(1)ct^{6al}$.

Maroni, G.P. University of Wisconsin, Madison, Wisconsin. A simple apparatus for the collection of large numbers of eggs.

Physiological and cytological studies in 3rd instar larvae require the rearing of larvae at a level of crowding that prevents excessive growth of microorganisms in the medium and insures the emergence of late 3rd instar larvae from the food onto the glass walls. When dealing with progeny of very infertile crosses, this concentration of viable offspring is impossible to obtain with the usual methods.

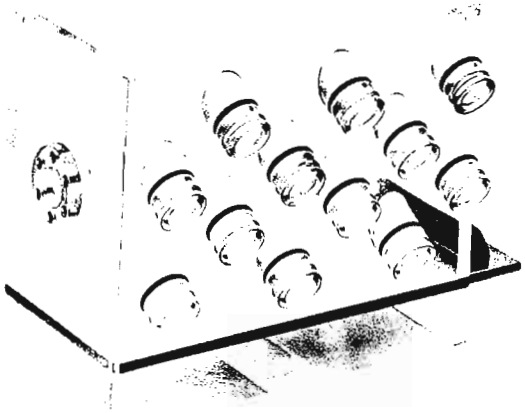
Several procedures for mass collection of eggs are known. We are communicating this one because we have found it both efficient and inexpensive. Forty or fifty pairs of flies are transferred to glass cylinders 30 mm O.D. and 95 mm in length, closed at the lower end with a cotton plug. The cylinders are then capped with the bottom of a small petri dish (we used Falcon plastic petri dishes 60 mm in diameter) with a small mound of food deposited at the center. The edge of the food serves as a glue to secure the plastic dish to the glass cylinder (2.5 ml of regular fly food at 60° C will consistently make a mound of the right size.

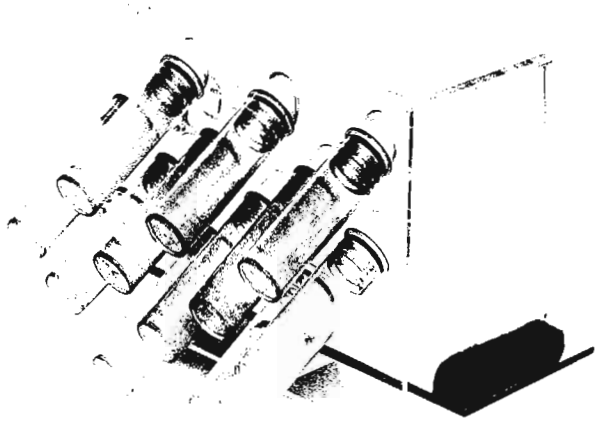
The cylinders are then inverted and after an egg laying period of 12 hours the dishes with food are replaced by fresh ones. Twenty-four hours later 1st instar larvae are collected and transferred to regular vials with food at a concentration of 100 larvae per vial. Large numbers of these cylinders can be handled with the same ease as regular vials.

In combination with starvation periods and short periods of egg laying this method can be used to obtain groups of synchronous larvae (J. Delcour, DIS 44:133).

Stern, K. University of Göttingen, Göttingen-Weende, Germany. Population cage for long-term experiments.

This population cage has been constructed for long-term experiments at the Institute of Forest Genetics of the University of Göttingen. It is available in three different sizes (6, 12 and 24 tubes) from Fa. Ernst Schütt, Laborbedarf, 34 Göttingen, W. Germany. The body is made of plexi-glass, the food containers are normal sexing tubes, 2.5 cm in diameter, and 10 cm in length. The bottom plate can be removed for cleaning without disturbing the population.





TEACHING NOTE

Roberts, P.A. Oregon State University, Corvallis, Oregon. Additional uses of the "C-scan" stock.

Students desirous of learning cytogenetic techniques using Drosophila stocks may find this exercise instructive without being cookbookish. Wild-type males are exposed to at least 4000 R of X-rays and mated en masse to homozygous "C-scan" (sc f;al b sp;ve st ca) females. F_1 females are individually mated to several C-scan males in vials or 1/4 pint bottles and the F_2 progeny are scored for crossover suppressors on X, 2L, 2R, 3L and 3R. The details of techniques for inducing, scoring, detecting, balancing and examining the recovered rearrangements cytologically are described in Roberts (Genetics, 1970, 65:429-448). At least 1 in 4 F_1 female offspring of males receiving 4000 R should carry a crossover suppressor effective enough to be detected using this stock if care is taken to transfer females and keep down bacterial growth in the less fertile cultures which are often semisterile owing to chromosomal rearrangement. Usually the suspected rearrangements are balanced then examined cytologically because this not only preserves the rearrangement but makes it possible to pick out larvae heterozygous for the aberration. If it is desirable to shorten the procedure, half the offspring of F_2 males carrying wild type alleles in the arm or arms in which crossing over is reduced should show the rearrangement in salivary gland chromosomes. This procedure not only demonstrates radiation mutagenesis, but provides the careful student with an opportunity for the discovery of a novel crossover suppressor since each rearrangement is unique. A wide variety of rearrangements including pericentric and paracentric inversions, reciprocal and insertional translocations, (and occasionally, a duplication or transposition) has been recovered using this procedure (see the above reference).

We have also used the C-scan stock in more routine experiments with beginning students in genetics. Students are given mated F_1 females each of which is heterozygous for C-scan and a stock rearrangement and are asked to determine from the pattern of crossover suppression and (or) pseudolinkage, what sort of rearrangement is present.