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Genes and the external environmental stimulus.

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The effect of external environmental stimulus on genes (the gene expression) is a well documented phenomenon in almost all fields of science that takes account of from microbes to humans. *Drosophila* has been proven to be a *very* powerful tool in such studies since it is very easy to research the genetic and environmental experiments. This is due to its small genome size, easy to work with, does not cause any disease, an adequate sample size for statistical analysis, conclusions drawn through graphical representations, and economical, in addition to several other advantages.

The objectivity of this work is to: 1). study the effect of external environmental stimulus on gene expression in strains of *Drosophila psedoobscura*, High Forest Range, Colorado. 2). compare its graphic results with the other two geographically apart populations collected from Strawberry Canyon and Santa Cruz Island (both in California). 3). implicate the importance of the graphically comparative results (statistical analysis for significant differences not considered here) from an individual human intellectuality view-point in an academic institution.

Experimental Procedure

Eight iso-chromosomal strains for the second chromosome of *D. pseudoobscura* from High Forest Range, 6000 feet above sea level, Colorado, were utilized for the experiment (Gupta, 1978). These strains were maintained in half-pint milk bottles using Carpenters medium. Heterozygous (F_1's) between lines were made by mating pairs of iso-chromosomal lines at random (1 × 2; 3 × 4; 5 × 6; 7 × 8). This was done so as to reconstitute the variety of genotypes present in nature (the results for heterozygote are not discussed here). The phenotypic trait considered for this experiment was the *absolute viability* percent in parents (as defined by Gupta, 1978, 2009a) to provide the experimental evidence for gene expression. The fertile eggs collected varied from 6 to 14 hours of age. For each parental homozygote, the eggs were collected and cultured at two densities (40 and 140 eggs/vial) at a specified temperature. Ten replicates were made at two egg densities and at three temperatures (14º, 21º, and 26ºC). Each vial contained 10-12 ml Carpenters medium. The results analyzed using 40 eggs/vial are not discussed here.

Results and Discussion

The three temperatures (14º, 21º, and 26ºC) on x-axis and the viability (%) on y-axis are illustrated in Figures 1, 2, and 3 for genotypes of *D. pseudoobscura*. Seven genotypes were considered as the one of the eight strains was contaminated during the experiment and thus was excluded from the computation.

The Figure 1 presents seven different parental genotypes numbered from 1 to 7, each raised at three different temperatures. The genotypes numbered 4, 5, and 7 show the highest viability at 21ºC but lowest at 26ºC. The genotypes numbered 2 and 6 have the highest viability at 21ºC but lower at 14º and 26ºC. The genotype 1 and 3 have the lowest viability at 21ºC but higher at 14º and 26ºC. This figure provides the following important evolutionary features: 1). the norm of two genotypes 1 and 3 is of 'V' shaped; 2). While the norm of five genotypes numbered 2, 4, 5 , 6 and 7 is of inverted 'Λ' shaped; 3). *only* genotype 7 has the more prominent inverted 'Λ' compared to the other genotypes numbered 2, 4, 5 and 6; 4). The genotype × temperature interaction effect is observed between the genotypes 1 and 4; and between 7 and 1. That is to say, one cannot determine the outcome of a phenotypic trait developed from a genotype when moved from one temperature to another. In other words, the development of a phenotypic trait from a genotype is temperature dependent. The data presents the evidence that the genotypes analyzed show the genetically difference among them and that the gene expression of each is temperature dependent (genes are expressed differently from one temperature to another for the phenotypic development from a genotype - viability). Further, the Figure 1 demonstrates, for example, for the presence of turning "***on***" for *highest* viability at one temperature, and turning "***off***" the genes for *lowest* viability for a genotype raised at different temperatures. Thus, the selection is best where the two genotypes have the highest genetic variation (greater heritability difference) and *do not cross* (no genotype × temperature interaction) each other.

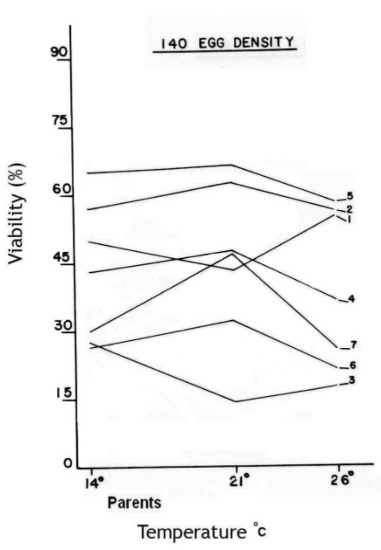

Figure 1. Seven genotypic norms of *D. pseudoobscura* (numbered from 1-7), High Forest Range, Colorado, for viability each raised at three temperatures.

For the present paper, the two genotypes 1 and 4 (g_1 and g_4) from Figure 1 were selected to explain the genes turned '*on*' and/or turned '*off*'' during the transcription and translation process towards the development of a phenotypic trait (viable progeny).

Figure 2 demonstrates that the two genotypes, g_1 and g_4, produce *two* different phenotypic distributions numbered 1 and 2, when raised at a temperature range between 19.0º and 20.5ºC. The viability range for phenotypic distribution number ranges from 42.5 to 45.0 % while for phenotypic distribution number 2 varies from

45.0 to 47.5%. However, the mean viability obtained is of 43.7 and 46.2 percent for genotypes g_1 and g_4. This implies a significant genetic impact than the temperature effect on viability. It is interpreted as the gene expression effect turned '*on*'.

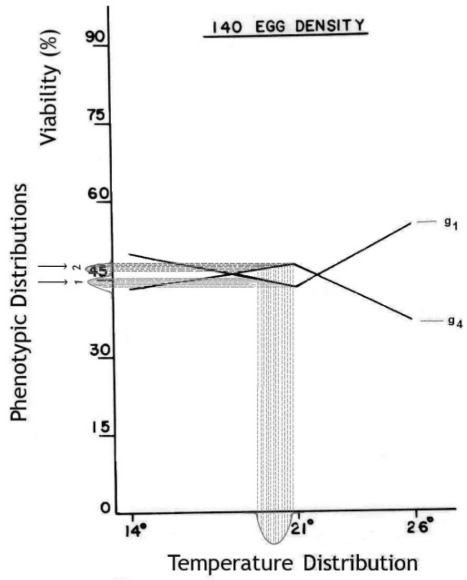

Figure 2. Two phenotypic distributions obtained from two genotypes, g_1 and g_4 taken from figure 1 authenticates the significant genetic impact.

It is interesting to ***note*** in Figure 2, even though the two genotypes g_1 and g_4 have a small difference in their genetic effects (small heritability difference) they produce two different phenotypic distributions each with different phenotypic mean (viability percent).

On the contrary, Figure 3 shows that the two distributions overlap demonstrating only ***one*** phenotypic distribution having the mean viability of 46.1% for both the genotypes when raised between 21.1° and 22.5°C. That is, one gets only one phenotypic distribution from two genotypes. It clearly implies the significant contribution of non-genetic factors (temperature effect) and less role of gene action. Thus, it is considered as the gene turned '*off*'.

Based on the experimental facts for *Drosophila pseudoobscura* strains from High Forest Range, the data confirms the ***two rules*** instituted by Anand P. Gupta (for details, see Gupta 2009a, b) and be named as Anand P. Gupta's two rules on genotype × environment interaction inference.

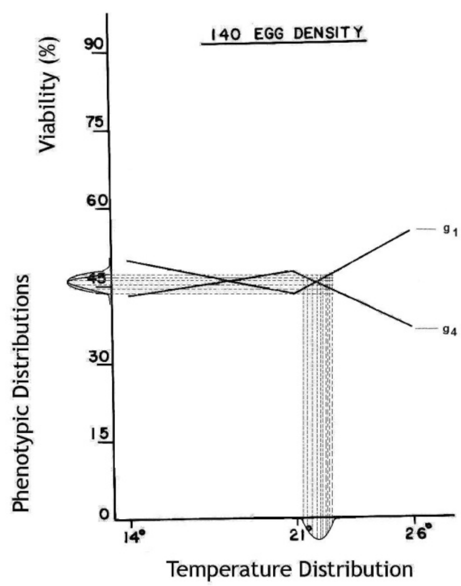

Figure 3. Only one phenotypic distribution obtained from two genotypes, g_1 and g_4 taken from Figure 1 reveals mainly the environmental impact.

Further, a graphic comparison among strains from the three different geographically located populations of *D. pseudoobscura* (Santa Cruz Island at sea level, California: from Gupta 2009a; Strawberry Canyon at 200 feet above sea level, California: from Gupta 2009b; and High Forest Range at 6000 feet above sea level, Colorado) was made to compare the effect of the external environmental stimulus. [All the iso-female strains from each of the three populations studied used the Carpenters medium under the same environmental conditions (three temperatures: 14°, 21°, and 26°C)]. Some of the evolutionarily important differences among many others are classified into two categories cited below:

A). Genotype and the temperature (external environmental stimulus):

i) The genotypes from each population are genetically different at a given temperature; ii). the genotypes from each population tested under three different temperature conditions vary from each other; iii) the number of genotypes providing the 'V' shaped norm vary from one population to another (Santa Cruz Island: *four*; Strawberry Canyon: *one*; and High Forest Range: *two*); iv) the number of genotypes providing the 'Λ' shaped norm vary from one population to another (Santa Cruz Island: *one*; Strawberry Canyon: *one*; and High Forest Range: *five*); v) each population demonstrated a genotype × temperature interaction effect (for example: for Strawberry canyon: genotype 5 showed an interaction effect with genotype 7, 8, 9 and 10; for Santa Cruz Island: genotype 3 interacted with genotypes 4, 5, and 7; and for HFR: genotype 1 interacted with genotypes 4 and 7); and finally vi) **the graphic comparison (statistical analysis not considered here for significant differences) among three populations provide the evidence that the genotypes tested from three geographically apart populations of *D. pseudoobscura* have become genetically different due to the effect of external environmental stimulus in time and space and that is an evolutionary process. That is to say, the genes were either turned 'on' or turned 'off' for a genotype to adapt the external environmental conditions in a given geographic location.**

B). Phenotypic distribution(s) based on the genetic and the temperature impact:

i) A consideration of two genotypes *not* involving the genotype × temperature (environmental stimulus) interaction range will always produce ***two*** different phenotypic distributions with two different phenotypic means showing the impact of gene effect for a phenotypic trait; ii) On the contrary, a consideration of the same two genotypes *involving* genotype × temperature interaction range will always produce ***only one*** phenotypic distribution (the two overlaps with one phenotypic mean).

The comparative results of the effect of the external environmental stimulus cited above are also relevant to an individual human intellectuality in an academic institution such as for: a teacher or a researcher or an administrator. The individual humans can be classified into either of the two groups: 1). ***In-group;*** and 2). ***Out-group.***

1. ***In-group:*** In this group an individual shares the information with the others. Such individuals usually form a group. The group may or may not have a leader to dominate them. Based on the group academic performance, it can be divided into two sub-groups: *positive academic* in-group and *negative academic* in-group. If the academic achievement is positive, then it becomes a positive academic in-group and each individual will have at least one or two dominant positive academic alleles. Conversely, if the performance of the individuals in this group is negative, it becomes a negative academic in-group and the individuals will share negative academic alleles. However, if the group is dominated by a ***leader*** (such as the Chair or Director of the Department) then the group individuals will have recessive alleles while the leader will always have dominant allele(s) as they will perform the academic achievements required and dominated by the leader (which in turn is considered as an *external environmental stimulus*). If the leader deals with the negative academic performance, then it becomes a negative in-group as he/she will share the unconstructively gathered facts with the group individuals. The leader of this group will show the *negative* dominant academic genes. (The group individuals, in such a case, carrying the recessive academic performance genes illustrate the phenomenon of genes as turned "off" while working under that group leader). Conversely, if the leader's achievement is academically positive, it becomes a positive in-group and will demonstrate the *positive* academic genes as the alleles of other individuals are dominated in that

group and the institution will progress academically. This is the case of genes turned "on" for individuals carrying the recessive alleles for positive academic performance under the group leader. Thus, the in-group individual will have either of the dominant/or recessive genes for positive or negative academic performance.

2. ***Out-group***: It involves only ***one*** individual. Such an individual more often than not makes the intellectual academic decisions and thus have a dominant *academic intellectual* genes for survival leading towards the best academic achievements.

Based on the two groups cited above, the ***leader***, thus, will always have either positive or negative academic dominant allele and will control the individuals having recessive academic alleles. I name such genes for *in-group* ***leader*** as having at least *one* or *two academic dominant alleles* for positive and the alleles for negative academic performance; for individuals dominated by the leader as having *two recessive* academic alleles. However, an *out-group* individual will have the dominant *intellectual alleles.* (That is, the in-group leader will have either a homozygote or heterozygote dominant allele(s) for positive or for negative academic performance while the individuals within that group will have recessive alleles. On the contrary, the out-group individual will always have the dominant intellectual genes).

Finally, it is evident that the external environmental stimulus not only has a different impact on the development of a phenotype from a genotype, but also a particular phenotype may have different impacts on other phenotypes based on an individual's genotype. Individuals carrying a particular intellectual academic gene in a given environment may influence the academic quality of an institution. That is, the genes are turned "on" or turned "off' for human intellectuality not only depends upon the individual's internal environment (such as hormonal, physiological, and genetic constitution of an individual) but also can be influenced by the external environmental stimulus. For example, a student coming from overseas accomplishes impressively much better in education in the United States of America compared to his/her own country of origin shows the important role played by the external environmental stimulus. Another example, the group leader (in an academic institution) having positive dominant performance gene can revolutionize the academic excellence as the human intelligence is influenced by the external environmental stimulus and thereby causing an evolutionary impact on education quality. These two examples, thus, show the evidence of genes as turned 'on' for an individual human intellectuality based on the external environmental stimulus effect. However, the extent of an external environmental stimulus effect on intellectuality would vary from one individual to another, and to what degree is not known yet.

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