GENETICS SOCIETY OF AUSTRALIA

15TH ANNUAL GENERAL MEETING

UNIVERSITY OF SYDNEY

23-24 MAY 1968

PROGRAMME

ABSTRACTS

GENETICS SOCIETY OF AUSTRALIA

15th General Meeting

University of Sydney, Sydney May 23-24, 1968.

The Meeting will be held in Lecture Theatres 9 and 10 and Preparation Room 274 (between Theatres 9 and 10) in the Carslaw Building.

Meeting Fee - Members (Including Graduate Students) $2.00
Undergraduate Students $1.00.

- PROGRAMME -

THURSDAY - May 23.

9.00 - 10.00 a.m. Registration (Preparation Room 274)

10.00 - 11.00 a.m. Joint Sessions

Lecture Theatre 9 -

~~R.G. Beilharz~~ G. Miklos - ~~Gene action in body weight of mice~~ An unstable gene in Drosophila

A. Fleiss - Behavioural differences in three inbred strains of mice and their hybrids.

Lecture Theatre 10 -

B.T.O. Lee - Some genes for methionine biosynthesis in Pseudomonas aeruginosa

B.J. Mee - A detailed genetic analysis of the his I region of Pseudomonas aeruginosa

B.W. Holloway - DNA specificity in bacteria

11.00 - 11.30 a.m. Morning Tea

11.30 - 12.30 p.m. Joint Sessions

Lecture Theatre 9 -

I.T. MacBean - Correlated responses to selection for duration of copulation in Drosophila melanogaster

W.A. Pattie - Cessation of response to selection for clean fleece weight in Merino sheep

B.J. McGuirk - Response to selection for skin

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Lecture Theatre 10 -

K.K. Jha - Genetic control of recombination between histidine-3 alleles of Neurospora crassa.

D.M. Halsall and C.H. Doy
- The nature of 3-deoxy-D-*arabino*-heptulosonate 7-phosphate synthetase in extracts of *Neurospora crassa*: Biochemical genetics of allosteric isoenzymes.

M.J. Hynes - Control of amidase synthesis in *Aspergillus nidulans*

12.30 - 2.30 p.m. Lunch

2.30 - 3.30 p.m. (and all remaining sessions in LECTURE THEATRE 10)

J.M. Rendel and B.L. Sheldon
- Reverse mutation of sc^{1} to + in *D. melanogaster*.

G.W. Grigg - Phleomycin induced chromosome breakage and DNA breakdown.

J.M. Rendel - Selection in human populations with particular reference to twinning.

3.30 - 4.00 p.m. Afternoon Tea

4.00 - 5.30 p.m.

B.J. Hollingdale - Concurrent irradiation and selection for abdominal bristle number in *Drosophila melanogaster*

C.P. McPhee - An experimental investigation into the role of linkage in selection limits.

J.W. James - Optimum size of progeny testing programmes

8.00 p.m. Evening Lecture

E. Novitski - A Critical Look at Man's Future.

FRIDAY - May 24

9.30 - 10.30 a.m.

E.M. Craddock - Chromosome races in *Didymuria*

E.F. Pyne - Cytology of a marine Serpulid worm, *Galeolaria caespitosa*.

C.J. Driscoll - Pre-meiotic association of chromosomes of hexaploid wheat.

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11.00 - 12.00 noon

W.D. Jackson - Differential frequencies of carriers of a supernumary chromosome in the sexes of the shorthorned grasshopper Phaulacridium vittatum

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R.C. Moore - Comparison of the rate of DNA synthesis throughout the S-period between diploid and aneuploid cell populations in vitro

J. Langridge - A functional map of the genes for β-galactosidase in E.coli.

12.00 - 2.00 p.m. Lunch

2.00 - 3.00 p.m.

J.F. Kinnear - Developmental patterns in Calliphora: larval haemolymph proteins

M.D. Martin - Developmental patterns in Calliphora: protein synthesis in larval tissues

N.W. Dunn and B.W. Holloway - Relationship between host-controlled modification (HCM) and P-fluoro phenylalanine (FPA) - resistance in Pseudomonas aeruginosa

3.00 - 3.30 p.m. Afternoon Tea

3.30 - 4.30 p.m.

J.A. Pateman - The genetic regulation of nitrate reduction in Aspergillus

B.D.H. Latter - Selection for scutellar bristle number in Drosophila

W.R. Scowcroft - Selection and the components of scutellar bristle number

4.30 p.m. BUSINESS MEETING

6.30 p.m. - Botany Building, School of Biological Sciences

Fee $2.50 per person —

Food, Drink, Music, etc.

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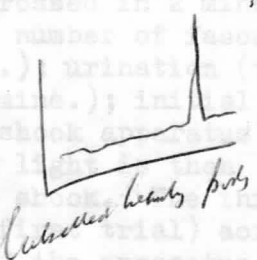

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15th General Meeting

Abstract of Papers

R.G. Beilharz: Gene action in bodyweight of mice.

Estimates of heritability in 9-weeks weight, calculated from parent-offspring regressions and responses to selection (when available) are presented for an unselected population of mice and several selected populations derived from it.

In the unselected population heritability found from twice the regression coefficient of progeny on sires was about 0.12. There was a substantial maternal effect as twice the regression coefficient of progeny on dams was about 0.59. There was no evidence for X or Y linkage of bodyweight.

In the populations selected for bodyweight, and for social dominance value, the resemblance of sons and sires increased very significantly. The population which responded most to selection for high bodyweight showed a particularly marked and increasing resemblance of sires and sons. It is suggested that selection has resulted in a situation where the Y chromosome is exerting a strong influence on bodyweight.

A. Fleiss: Behavioural differences in three inbred strains of mice and their hybrids.

Three inbred strains of mice (Balb c, C3H, C57Bl) and their hybrids, were studied for various behavioural traits, namely activity (the number of 4 inch squares crossed in 2 mins. in a box 16 inches square); defecation (the number of faecal boluses deposited in this arena in 2 mins.); urination (the number of urinations in this arena in 2 mins.); initial reaction to shock (Mice are placed in the shock apparatus and allowed to explore it for one minute. A light is then switched on, followed 2 secs. later by a shock. The initial reaction is the time taken to jump (for first trial) across the central barrier to the "safe" side of the apparatus); conditioned avoidance learning (ten trials were given in the shock apparatus; four on day one, three trials one hour later, and three trials 24 hours later. The percentage of "no shock jumps" and average times for each jump were used as measures.)

Differences between strains were found for most of these traits. Heterosis was found for initial reaction to shock, and conditioned avoidance learning, but not for activity, defecation and urination.

I.T. MacBean: Correlated responses to selection for duration of copulation in Drosophila melanogaster.

Duration of copulation in D. melanogaster has been shown to be heritable with a heritability of about 0.2, and has responded to selection in both directions, though the divergence obtained between the high and low selection lines is not great (about 10 minutes) which is reasonable in view of the rather low heritability. The response in the line selected for low duration is due to a reduction in the pre-sperm transmission period. An assay of the fecundity of the control and two selection lines showed, besides the reduced total egg production of the two selection lines below that of the control line, a significant amount of egg-wastage (virgin egg production) by the selection lines. Further experiments have yielded some idea about the genetic control of egg wastage. Other correlated responses to be discussed are mating speed and egg hatchability.

W.A. Pattie: Cessation of response to selection for clean fleece weight in Merino sheep.

Three flocks of Peppin Merinos (100 ewes each) have been maintained at the Trangie Agricultural Research Station since 1951. The flocks are closed; one is selected for high clean fleece weight (Fleece Plus), one for low clean fleece weight (Fleece Minus) and one is selected at random as a control (Random). Rams are replaced each year, five are used annually in the selection flocks and 25 are used in the random flock.

The flocks were chosen from a base flock of 1700 ewes born between 1944 and 1950. Previous work with this flock gave the heritability of clean fleece weight, calculated by dam-offspring regression as 0.47.

Linear response to selection occurred in the Fleece Minus flock where the realised heritability of clean fleece weight was 0.44 in the first generation and 0.38 for the next three generations. In contrast, response in the Fleece Plus flock ceased after the first generation. In this case the realised heritabilities were 0.51 in the first generation and 0.10 for subsequent generations. In addition, heritabilities calculated by dam-offspring regression of sheep born in the flocks after the first generation were 0.50 for the Fleece Minus flock, and 0.04 for the Fleece Plus flock.

These results indicate that additive genetic variation was exhausted shortly after selection began. However, other workers have shown that a strong negative genetic correlation exists between two of the most important components of fleece weight (fibre diameter and fibre density) and this may have contributed to the cessation of response.

B.J. McGuirk: Response to selection for skin fold in Merino sheep.

Since 1951 flocks of Merino sheep have been selected for high and low degree of skin fold at Trangie Agricultural Research Station. These flocks are respectively termed: Folds Plus

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Since 1951 flocks of Merino sheep have been selected for high and low degree of skin fold at Trangie Agricultural Research Station. These flocks are respectively termed: Folds Plus and Folds Minus. Each flock consists of 100 ewes which are mated to 5 rams. Response to selection is measured by deviation from a randomly selected control flock (Random).

Over the period 1951-1961, selection differentials were higher in the Folds Plus flock, due to the greater variation for skin fold in this flock. Realised heritability of skin fold, estimated by regressing response on selection differential, was 0.21 (standard deviation = 0.10) and 0.07 (0.15) in the Folds Plus rams and ewes respectively, and 0.51 (0.18) and 0.69 (0.23) for the Folds Minus rams and ewes.

When the regression was made to go through the origin, the corresponding figures for the Folds Plus rams and ewes were 0.26 (0.02) and 0.39 (0.07), and for the Folds Minus 0.77 (0.06) and 0.75 (0.07).

B.T.O. Lee: Some genes for methionine biosynthesis in Pseudomonas aeruginosa

A series of methionine requiring mutants has been classified into eight groups by a transduction analysis. The response of these mutants to methionine and its precursors has also been used to group the mutants. Some of the genetic groups give heterogeneous growth responses. The pathway for methionine biosynthesis in P. aeruginosa appears similar to that in other microorganisms.

B.J. Mee: A detailed genetic analysis of the his $\overline{\text{I}}$ region of Pseudomonas aeruginosa.

Five unlinked groups of genes appear to control histidine biosynthesis in Pseudomonas aeruginosa. One of these groups of genes, Group $\overline{\text{I}}$ is cotransducible with a gene for methionine biosynthesis. Double mutants were constructed which contained a Group I histidine mutation and the methionine mutation. These were used in three point crosses to order twenty-four His I mutants. The crosses were made using the transducing phage F116 and the results indicate that negative interference may be involved in the recombination mechanism. A map order for these His I mutants is proposed and the phenotype of the alleles is examined in relation to the map order.

B.W. Holloway: DNA specificity in bacteria

Different strains of the same bacterium each possess a DNA specificity which is recognised as "non self" by other strains of the bacterium. When either phage or bacterial DNA enters a bacterium of different specificity its biological activity is rapidly destroyed by nucleases (restriction). The only test for such differences in specificity in most bacteria is the biological test of restriction. It appears that the chemical factors responsible for DNA specificity are independent of the base sequence.

The genetic control of the mechanism by which this specificity is imposed on the bacterium and the process of recognition and destruction is particularly complex in the bacterium Pseudomonas aeruginosa. Genetic control factors so far identified include (1) a range of non-linked chromosomal genes (2) a temperature sensitive presumably non

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K.K. Jha: Genetic control of recombination between histidine-3 alleles of Neurospora crassa.

The dominant allele of recombination-4 (rec-4$^+$) reduces recombination between his-3 (link. gr. I) alleles without affecting crossing over between flanking markers (Jha, Genetics 57:865, 1967). In its absence the frequency is greater by a factor of two or three but the distribution of flanking markers among prototrophs is not altered. The rec-4 locus appears to be linked to tryp-3 on linkage group II. Another factor, not linked to his-3 or rec-4, which further reduces allelic recombination at his-3 in the presence of rec-4$^+$ can be recognised in the wild types Abbott A, Beadle a and Chilton a but not in the derivatives of Emerson wild type.

The second factor, tentatively designated as rec-6$^+$, reduces frequency of prototrophs by a factor of six in the presence or absence of rec-4$^+$. It appears that rec-6 does not affect recombination between tryp-3 alleles, reinforcing the view that specific regulatory genes, for recombination, exist in this organism. Possibly both specific and general regulatory elements occur.

D.M. Halsall and C.H. Doy: The nature of 3-deoxy-D-arabino-heptulosonate 7-phosphate synthetase in extracts of Neurospora crassa: Biochemical genetics of allosteric isoenzymes.

The DAHP synthetase of wild-type Neurospora crassa consists of three types of allosteric isoenzymes, those inhibited by tyrosine (DAHP synthetase (Tyr)) those inhibited by phenylalanine (DAHP synthetase (Phe)) and those inhibited by tryptophan (DAHP synthetase (Trp)). It was predicted that mutations affecting a specific type of isoenzyme would be selected by a technique based on inhibition of the remaining types by two of the three amino acids. This prediction was confirmed by the inhibition characteristics of crude extracts and subsequent fractionation.

A mutant defective in DAHP synthetase (Tyr) was selected by non-growth in the presence of phenylalanine and tryptophan but growth on Vogels minimal medium. The mutant locus mapped close to lys-5 on linkage group VI and was designated arom-6. A second mutation was induced in this mutant and selected by failure to grow in the presence of tryptophan, but growth on minimal medium. The new mutation (arom-7) was located on linkage group I close to his-3. A mutation defective for DAHP synthetase (Trp), arom-8, was isolated independently and mapping is in progress.

Agarose gel molecular sieving in the presence of PEP, but not added Co^{2+}, confirms that the mutants differ in the types of isoenzymes detected. The arom-6 mutant lacks DAHP synthetase (Tyr) isoenzymes, the arom-6 arom-7 double mutant lacks DAHP synthetase (Tyr) and (Phe) isoenzymes, but when these mutations are segregated arom-7 lacks only DAHP synthetase (Phe). Arom-8 mutants lack DAHP synthetase (Trp) isoenzymes. Thus in gross terms, mutation at a specific gene affects a specific kind of allosteric isoenzyme. However the pattern of remaining isoenzymes is disturbed

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The arom-6 mutation results in a requirement for 4-aminobenzoate for maximal growth on medium containing phenylalanine, tyrosine and tryptophan so linking aromatic vitamin synthesis with DAHP synthetase (Tyr).

Mutants have been obtained with DAHP synthetase insensitive to the allosteric modifiers tryptophan and tyrosine.

M.J. Hynes: Control of amidase synthesis in Aspergillus nidulans.

A wide variety of amides can be used by Asperigillus as nitrogen sources. An enzyme assay for amidase activity has been developed and used to determine the control pattern of enzyme synthesis. Aspergillus grown on acetamide as nitrogen source has 5-6 times the amidase activity (using acetamide as substrate) of Aspergillus grown on urea or nitrate. Ammonia strongly represses amidase synthesis. Acrylamide is a substrate for the enzyme but is not an inducer of its synthesis. Mutants capable of growing on acrylamide as nitrogen source have been selected and these produce high constitutive levels of amidase. The synthesis of amidase by constitutives (C mutants) is still repressible by ammonia. Diploids heterozygous for the C mutants produce constitutive but lower levels of the enzyme i.e. the C mutants are "semi-dominant". The significance of this is briefly discussed in relation to other control systems in fungi and bacteria.

J.M. Rendel and B.L. Sheldon: Reverse mutation of sc^1 to + in D. melanogaster.

A line of D. melanogaster homozygous for sc^1 was selected for constancy of phenotype. The stock now has 2 bristles on the scutellum. The number 2 is not quite as constant as the number 4 in wild type stocks. The width of canalisation is about 4.2σ in females and 3.5σ in males. In this stock, called the low variance stock, reversion to wild type has become very frequent. Outcrosses suggest that both the gene itself and the background are concerned. The possibility that it is the regulator background which is affecting the mutation rate is discussed.

G.W. Grigg: Phleomycin induced chromosome breakage and DNA breakdown

The copper containing protein phleomycin is an antibiotic and antitumor drug. It inhibits the DNA polymerase-mediated incorporation of nucleoside triphosphates into DNA in vitro and the synthesis of DNA in vivo. The concentrations of the drug necessary to inhibit the in vitro reaction by 50% are several orders of magnitude greater than that necessary to inhibit the in vivo reaction. The addition of phleomycin to the growth medium of a culture of E.coli B or E. coli 15 cells resulted in a breakdown of DNA of the cell population to low molecular weight fragments. The proportion of DNA degraded varied with the phleomycin concentration, 1γ/ml and 2γ/ml inducing 25% and 35% breakdown respectively within 1 hour. At concentrations of this order of magnitude phleomycin induces a substantial frequency of chromosome breaks in higher organisms.

E. coli B hcr$^-$ mutants, unable to respond to the presence of U.V.-induced lesions in DNA by making nicks close to the lesion and presumably defective in an endonuclease, do not degrade their DNA when treated with 2γ/ml of phleomycin. On the other hand mutant strains defective in a step of the repair part of the excision-repair process exhibited excessive DNA breakdown when treated with phleomycin. 1γ/ml of the drug induced 90% breakdown. This suggests an intimate relation between initiation of DNA breakdown by phleomycin and the excision-repair system of E. coli.

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The observed inhibition of DNA synthesis in vivo by low concentrations ($<10\gamma$/ml) of phleomycin is explicable by the induction of breaks in the replicating DNA molecule which thereby prevents unwinding of the circular molecule, rather than by a direct interference with the DNA polymerase reaction. The possible significance of these observations on DNA breakdown in explaining chromosome breakage will be discussed briefly.

J.M. Rendel: Selection in human populations with particular reference to twinning.

The rate at which the frequency of a deleterious gene will change when selection against it is reduced to zero, is very low; it is of the order of the mutation rate. Thus relaxation of selection pressure can have no important effects since the origin of Homo sapiens. Important changes can only have resulted from selection acting in favour of a condition once rare or against a condition once common. Litter size in man is possibly such a character. If the population was in equilibrium with its litter size two hundred years ago it is possibly out of equilibrium now; and since one might expect the survival rate of litters of more than one to have been more affected by improvements in hygiene than litters of one, litter size may be on the increase. As age of mother is declining and litter size depends on age of mother, litter size has been expressed at a standard age distribution. In Finland where records go back to 1875, it can be shown that litter size has increased since 1895. A comparison of mothers of different ages suggests that in 1875 something occurred which rendered all mothers after that date more and more likely to have twins. Danish figures however, do not support the suggestion in the Finnish data. In Denmark there was a rise from 1900 to 1935 followed by a fall which was halted in about 1965. The rates of increase are of the right order of magnitude.

B.J. Hollingdale: Concurrent irradiation and selection for abdominal bristle number in Drosophila melanogaster

A set of eight lines selected for increased one segment abdominal bristle number was derived from each of two base populations: (i) a highly inbred line and (ii) the Canberra wild-type outbred strain. The selected adults of five lines in each set were exposed to 1000r X-rays each generation. The other lines in each set were selected but not irradiated. In each line 100 pairs of parents were selected at 50% intensity.

After 20 generations of selection from the inbred strain, the mean in the irradiated lines was about one bristle higher than in the unirradiated lines, which stayed at the initial level. The small response of the irradiated lines shows that at least in an inbred background some induced variation can be utilised by mild selection. In the Canberra lines the selection regime was changed to 20 pairs selected at 20% intensity at generation 24 and radiation ceased at generation 30. Response patterns were complicated by the occurrence of genes with large effects on bristle number and, over the 65 generations of continuous selection, extra response in the irradiated lines which could possibly be due to their radiation histories was small.

C.P. McPhee: An experimental investigation into the role of linkage in selection limits.

Selection was carried out for sterno-pleural bristle number of Drosophila melanogaster under two frequencies of crossing over on chromosomes II and III. Under the one, cross-

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Selection was carried out for sterno-pleural bristle number of Drosophila melanogaster under two frequencies of crossing over on chromosomes II and III. Under the one, crossing over occurred normally and under the other it was suppressed during selection by balancing in female parents, wild chromosomes II and III with inversion chromosomes Cy and Mé. Results from three series of lines are reported, one selected for high and two for low bristle number. Each series comprised five lines with crossing over suppressed and five with crossing over occurring freely.

Ratios of selection advances under "free" to those under "suppressed" recombination were 1.5 for high bristle number and 1.1 and 1.7 for the two series of low lines. Responses in individual chromosomes were followed throughout the selection period. Chromosomes I and IV contributed almost negligibly to total response, most deriving in about equal amounts from chromosomes II and III. In some lines changes in bristle effect due to rare recombination were observed in Cy but not in Mé chromosomes.

There was no evidence for a greater reduction in fitness of the "suppressed" than the "free recombination"lines.

J.W. James: Optimum size of progeny testing programmes

The rate of genetic gain in animal breeding programmes is known to be affected by the scale of operations, greater progress being possible in large than in small operations. However, the cost of large programmes is also greater, and the increased cost must be balanced against the increased genetic gain in deciding on the most suitable scale of operations.

For example, in a progeny testing scheme aimed at the selection of a fixed number of dairy bulls, the genetic response would be increased by raising the number of bulls under test, and also by raising the number of daughters tested per bull. But both measures would increase the cost of the selection programme. The increase in rate of genetic improvement resulting from these measures can be calculated, as can the increased costs if relevant economic information is available. It is then possible to work out the profitability of different scales of operation, and thus choose a testing system of optimum size.

E.M. Craddock: Chromosome races in Didymuria.

A number of chromosome races have been found in a native stick insect Didymuria violescens (Leach), which is distributed throughout Eucalypt forests of the coast and highlands of south-eastern Australia. These races exhibit an extremely wide variation in chromosome number and a variety of sex-determining mechanisms. They are not morphologically distinct; taxonomically they are considered to be a single species. Hybridisation between races may occur to some extent. It is suggested that this mosaic pattern of chromosomal variation may conform to a stasipatric model of speciation.

E.F. Pyne: Cytology of a marine Serpulid worm, Galeolaria caespitosa Lamarck

Marine invertebrates, long ignored by cytologists, provide opportunities for the study of female gametogenesis which are not usually available in other animal groups. Galeolaria caespitosa, belonging to the Family Serpulidae, is a marine Polychaete worm which occurs in large numbers on the eastern coast of Australia.

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The eggs, which are shed spontaneously when the animals are removed from their calcareous tubes and placed in sea water, contain only a small amount of yolk and hence are very favourable material for cytological investigation.

The results of studies on oocyte differentiation, activation of the oocyte, completion of meiosis, syngamy and mitosis in the developing zygote, will be presented.

The diploid complement is 22, most of the chromosomes being sub-metacentric; the karyotype of the organism will be discussed.

C.J. Driscoll: Pre-meiotic association of chromosomes of hexaploid wheat.

Although largely autopolyploid, common wheat forms only bivalents at meiosis. This regulation of pairing is principally due to a gene(s) on the long arm of chromosome 5B. In the absence of this gene homoeologous chromosomes undergo pairing which results in multivalent formation. Feldman (1966) observed that excess dosages of $5B^L$ resulted in marked asynapsis, homoeologous pairing and interlocking of bivalents. From this he concluded that the $5B^L$ gene(s) operated at the time of pre-meiotic association of chromosomes rather than at synapsis. Colchicine applied prior to meiosis also produces asynapsis, homoeologous pairing and interlocking, (Driscoll, Darvey and Barber, 1967). Thus its effect is similar to that of excess dosage of $5B^L$. When colchicine was applied before the last pre-meiotic mitosis the resulting dodecaploid (12x) cells exhibited mainly bivalents with little asynapsis or multivalent formation. The bivalents in these cells are thought to involve previous sister chromatids that were pre-meiotically associated because of failure of anaphase movement, that is, they may be referred to as C-autobivalents. Thus colchicine supresses pre-meiotic association but has no effect on synapsis, crossing over or chiasma formation. Pre-meiotic association may simply be one example of somatic association. Chromosomes may normally go through an "association - disassociation cycle" becoming disassociated with each successive mitosis.

W.D. Jackson: Differential frequencies of carriers of a supernumerary chromosome in the sexes of the shorthorned grasshopper Phaulacridium vittatum

Samples of males reveal the presence of a large, mitotically stable supernumerary chromosome in five populations examined. A stable frequency (11.22 $\pm$ 0.3%) of male carriers has been observed over nine years in one population. Two males of the constitution 22 + X + 2B have been found in 1000 males examined. The B chromosome follows closely the behaviour of the X chromosome in spermatogonial mitosis and meiosis and often appears to form a terminalised chiasma with the X in diplotene; these two chromosomes move preferentially (70%) to opposite poles producing a differential transmission of the supernumerary to the two sexes. On the basis of this segregation and assuming random mating, the gametic matrix yields simultaneous equations in four unknowns, the solutions of which give estimates of the frequency of carriers in the two sexes. The expected frequency of single carrier females is 7.05%; examination of mitosis in the ovarian walls of a sample of 100 females treated with colchicine showed 5 carriers present.

R.C. Moore: Comparison of the rate of DNA synthesis throughout the S-period between diploid and aneuploid cell populations

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R.C. Moore: Comparison of the rate of DNA synthesis throughout the S-period between diploid and aneuploid cell populations in vitro.

When fibroblastic cells from the black-tailed wallaby are grown in culture they remain predominantly diploid and multiply rapidly for 40-50 generations, after which degeneration occurs. On one occasion in our laboratory a cell line emerged during the degenerative phase. This line, JU56, has continued to divide for

about three years with a generation time of about 17 hours.

Like almost all permanent cell lines, JU56 consists of aneuploid cells. The kinetics of DNA synthesis in JU56 cells have been compared with those for rapidly dividing diploid cells. At the time of measurement the majority of the JU56 cells had 18% more DNA at mitosis than the normal cells, and it was intended to determine whether or not the extra DNA was synthesised during a specific fraction of the S-period.

In the course of these experiments it was found that the kinetics of DNA synthesis in the diploid population altered progressively before any degenerative changes were observed. A prolongation of the S-period was found to occur, principally at the beginning of the S-phase. The nature and significance of the change, and the relationship between the DNA synthetic curves for diploid and aneuploid cells will be discussed.

J. Langridge: A functional map of the gene for β-galactosidase in E. coli.

J.F. Kinnear: Developmental patterns in Calliphora: Larval haemolymph proteins.

During the third larval instar of the brown blowfly, Calliphora stygia, plasma levels of protein, lipid and soluble carbohydrate show discontinuities at days 6 and 10 of development. These changes may be presumed to reflect changing tissue patterns of gene activity, particularly in the fat body, near the beginning and end of the instar. The major period of plasma protein synthesis, from day 3 to day 6 of development, ends abruptly at a time when no change in hormone titre has been detected. Plasma protein levels then decrease slowly to day 10, when a marked acceleration in this decline occurs. The second discontinuity, at day 10, apparently precedes a major rise in moulting hormone level by about 24 hr. The plasma proteins remain qualitatively rather uniform throughout third instar, but marked changes in composition become apparent at puparium formation. These observations, and evidence of the time of synthesis of the individual plasma proteins, are discussed in relation to the regulation of developmental processes.

M.D. Martin: Developmental patterns in Calliphora: Protein synthesis in larval tissues.

The pattern of incorporation of radioactive amino-acids into proteins of fat body, body wall, salivary gland and haemolymph during third instar has been investigated in the brown blowfly, Calliphora stygia. The results are discussed in relation to the contrasting nature and fate of fat body, salivary gland and body wall cells. As the major site of synthesis of larval plasma protein, the larval fat body is apparently the primary source of most of the proteins utilised at metamorphosis for growth and differentiation of adult tissues. Differences in the apparent rate of protein synthesis in anterior and posterior lobes of the fat body may apparently be attributed to differences in cell size and do not, in Calliphora, appear to indicate a functional differentiation of this organ. In contradiction to the situation in certain other Diptera, the salivary gland proteins of Calliphora are at least largely synthesised in the glands rather than being sequestered from the haemolymph.

N.W. Dunn and B.W. Holloway: Relationship between host-controlled modification (HCM) and P-fluoro phenylalanine (FPA) - resistance in Pseudomonas aeruginosa.

One method that can be used in attempting to understand the mechanism of HCM involves a genetic approach. An approach of this type which has proven successful is to select for other mutations which show pleiotropic responses affecting this phenomenon.

We have shown that over 80% of FPA-resistant mutants in P. aeruginosa have altered HCM properties. About 20% of these persist unaltered after growth through forty generations, whereas the remainder revert to normal. Selection for these mutations has permitted the collection of a large variety of mutants with altered restriction patterns. The relationship between FPA-resistance and HCM appears to be rather specific as a number of other cellular functions were unchanged in the FPA-resistant mutants. These functions

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The results thus indicate that there is a common site or mechanism relating both HCM and FPA-resistance in these organisms. The mutants isolated in this way are being used to try to determine the nature of this common site.

J.A. Pateman: The genetic regulation of nitrate reduction in Aspergillus

The enzymes nitrate reductase, nitrite reductase and hydroxylamine reductase are induced by nitrate or nitrite and repressed by ammonium in wild type Aspergillus. Mutant strains have been made which show constitutive synthesis of these enzymes during growth in the absence of inducer.

One of the constitutive mutants nir^{Cl} is a mutation in a regulatory gene nir which is loosely linked to the structural genes for nitrate reductase and nitrite reductase. The enzyme levels in the heterozygous diploid nir^{Cl}/nir^{+} show that nir^{Cl} is semi-dominant with respect to the induction of nitrate reductase and recessive with respect to nitrite reductase.

Mutations are also known which map in the nir gene and result in the failure to produce either nitrate reductase or nitrite reductase. These nir^{-} mutations are recessive. To account for the characteristics of the nir^{Cl} and nir^{-} mutations it is proposed that the nir gene produces a regulatory substance which has a positive action in the induction of the nitrate reduction enzymes. A model for such a system will be discussed.

B.D.H. Latter: Selection for scutellar bristle number in Drosophila

The behaviour of populations derived from a single wild-type stock by inbreeding, selection for increased bristle number, and subsequent natural selection, is to be discussed. Emphasis is to be given to response patterns, chromosomal analyses of selected populations, scute-substitution studies, and correlated responses in other bristle characters, in so far as they indicate the nature of the canalisation system controlling scutellar bristle number in wild populations. In particular, the information provided by analyses based on component individual bristle sites is to be discussed.

W.R. Scowcroft: Selection and the components of scutellar bristle number.

Recent evidence has supported the notion that scutellar bristle number is not under the control of a single developmental variable. A series of lines have been established in which selection has been for increased or decreased anterior bristles independently of the mean number of posterior bristles and vice versa. The response patterns suggest a conditional independence of anterior and posterior scutellar bristles.
