

GENETICS SOCIETY OF AUSTRALIA

11TH ANNUAL GENERAL MEETING

UNIVERSITY OF SYDNEY

16-17 AUGUST 1962

EXPLANATORY NOTE

CHANGE OF VENUE

PROGRAMME

ABSTRACTS

SCANNED FROM THE ORIGINAL

THE GENETICS SOCIETY OF AUSTRALIA

ELEVENTH ANNUAL MEETING, 1962.

At the tenth annual meeting of the Genetics Society of Australia, held in Brisbane in May 1961, it was resolved that the eleventh annual meeting should be held in Canberra during August 1962, at a time which would be convenient to members wishing to attend both the Genetics Society meeting and the ANZAAS meeting in Sydney. The latter is scheduled for the period Monday to Friday, August 20 - 24, 1962.

A meeting of representatives of the undermentioned Australian Biological Societies was also held in Brisbane during May 1961, with the object of co-ordinating the activities of the Societies with special reference to pre-ANZAAS meetings. The Societies represented were the Physiological Society, the Biochemical Society, the Endocrine Society, the Society of Plant Physiologists, the Mammals Society, the Genetics Society, the Society of Microbiology, the Association of Clinical Biochemists, and the Ecological Society. It was agreed at this meeting that the Societies should aim to hold meetings at the same time and place, and to exchange programmes and other relevant information.

As a result the Microbiologists, Plant Physiologists and Biochemists have resolved to hold their annual meetings in Sydney this year, during the week prior to ANZAAS, in line with the established tradition of pre-ANZAAS specialist society meetings. The Australian Physiology Society proposes to hold its meeting in May 1962 in Melbourne. Information as to the remaining societies' activities is not yet available.

A further consideration is the fact that the World Poultry Congress is to be held in Sydney during the period 10 - 18 August, 1962, and a number of eminent overseas geneticists will be present including Lerner, Dempster and Dickerson. A number of our own members will of course be attending and participating in some of the sessions of the Congress.

It seems highly desirable from all points of view that the Genetics Society meeting should therefore be held in Sydney during the week preceding ANZAAS, preferably on 16-17 August, and that close liaison be established with the organizers of the World Poultry Congress. A number of the Sydney members of our Society have agreed to the desirability of the suggested change in venue, and have indicated their willingness to be hosts for 1962.

Members who will find the proposed change inconvenient are requested to contact the Secretary not later than March 20, 1962.

B.D.H. Latter,
Secretary,
Genetics Society of Australia,
P.O. Box 109, City,
CANBERRA. A.C.T.

28th February, 1962.

THE GENETICS SOCIETY OF AUSTRALIA

11th ANNUAL MEETING

16 - 17th AUGUST, 1962

PROGRAMME

THURSDAY, 16th August.

- MORNING
- 9.00 Mr. D.W. Cooper: "An inherited serum transferrin variant in the Red Kangaroo."
- 9.30 Mr. N.H. Luig: "Recessive suppressors in Aspergillus nidulans closely linked to an auxotrophic mutant which they suppress."
- 10.00 Dr. K.S. McWhirter: "Paramutation at the R locus in maize during endosperm development."
- 10.30 Morning tea.
- 11.00 Dr. G.E. Dickerson: "Recombination loss in the performance of poultry."
- 11.30 Dr. R.D. Brock: "Radiation induced quantitative variation in subterranean clover."
- 12.00 Dr. A.H. Gibson: "Heterosis studies with nodulated plants of subterranean clover."
- 12.30 Lunch.

AFTERNOON

- 1.30 Dr. C.E. Folsome: "Fine structure genetic analysis of recombinational topology in the phage T4 rII region."
- 2.00 Dr. C.I. Davern: "The biology of RNA phage."
- 2.30 Dr. P.A. Parsons: "A widespread biochemical polymorphism in Drosophila melanogaster."
- 3.00 Afternoon tea.
- 3.30 Dr. A.M. Clark: "X-ray induced non-disjunction of the X chromosomes in female Drosophila melanogaster."
- 4.00 Dr. S. Smith-White: "New pollen tetrad patterns in Astroloma."
- 4.30 Dr. J. Peacock: "Chromosome replication in Vicia."

EVENING

- 7.30 Business meeting.
- 8.00 Dr. A.S. Fraser: "The genetics of scutellar pattern in Drosophila melanogaster and D. simulans."

FRIDAY, 17th August.

MORNING

- 9.00 Miss M. Gordon: "Physical and immunological investigations of heat denatured surface antigens of Paramecium."
- 9.30 Dr. A.H. Reisner: "Immunogenetic studies of monomolecular layers of the soluble surface proteins of Paramecium."
- 10.00 Mr. J.H. Claxton: "The patterns of skin follicles in sheep and their relation to pattern determination."
- 10.30 Morning tea.
- 11.00 Dr. C. Kidson: "Complex genetic control of a single enzyme in human erythrocytes."
- 11.30 Dr. B. Griffing: "The potentiality of reciprocal selection."
- 12.00 Dr. J.H. Bennett: "Association between genes at sex-linked loci."
- 12.30 Lunch.

AFTERNOON

- 1.30 Miss B. Kindred: "Canalisation of variation due to environment in the house mouse."
- 2.00 Dr. P. Pennycuik: "Hyperthermia and whisker development in the mouse."
- 2.30 Miss C. Jacobson: "Development of vibrissae in offspring of irradiated normal mice, and ones from genetic lines showing abnormal vibrissa number."
- 3.00 Afternoon tea.
- 3.30 Mr. D.C. Wark: "The inheritance of resistance to blue mould in two species of Nicotiana."
- 4.00 Dr. A.J. Pritchard: "Cytological observations in the African species of the genus Trifolium."
- 4.30 Dr. J.R. McWilliam: "Selection for seed retention in Phalaris."

EVENING

- 7.00 Informal dinner in C.S.I.R.O. Animal Genetics Laboratory.
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THE GENETICS SOCIETY OF AUSTRALIA

11th ANNUAL MEETING

ABSTRACTS OF PAPERS

Mr. D.W. Cooper: "An inherited serum transferrin variant in the red kangaroo (Macropus rufus)."

An inherited serum transferrin variant has been found in the red kangaroo using Smithies' starch-gel electrophoresis technique and Fe59 autoradiography. The frequency of the variant allele in one population is 0.07. The implications of this discovery in the light of work on this polymorphism in other mammals are discussed.

Dr. K.S. McWhirter: "Paramutation at the R locus in maize during endosperm development"

In the course of the sporophytic generation in which the allele R^r (coloured aleurone, red seedling) is heterozygous with Rst (stippled, spotted aleurone, green seedling) in R^rRst plants, the R^r allele (or chromosomal region) is altered genetically such that subsequent to extraction from R^rRst plants its conditions greatly reduced pigmentation of the aleurone layer of R^rR^gR^g kernels. The genetic process underlying the invariable, heritable alteration in phenotypic expression of the R^r allele has been termed paramutation.

Evidence of the occurrence of paramutation of an R^g factor (colored aleurone, green seedling) during endosperm development was obtained using a mating procedure which enabled comparison of kernels developed on the same ear. The results definitely establish that paramutation occurs in somatic cells. The change in pigment-producing potential of R^r (or R^g) recognised as paramutation is interpreted as the cumulative result of small changes occurring sequentially throughout somatic cell development of R^rRst plants.

Dr. R.D. Brock: "Radiation-induced quantitative variation in subterranean clover"

A single treatment with X-rays and neutrons generated variation in flowering time in the late flowering variety, Tallarook, which was comparable in magnitude with that generated in F2's of inter-variety crosses. Selection for early and late flowering time resulted in a symmetrical response.

A second radiation treatment applied to the early and late flowering mutants generated additional variability in both lines. However, the additional progress achieved by selection from this freshly induced variability was only approximately 20% of that achieved in the first cycle.

The symmetrical response to selection and the absence of other drastic changes in the mutants suggests that this technique may offer an attractive alternative to wide hybridisation as a method of generating variability in well-adapted self-fertilising species.

Dr. C.E. Folsome: "Fine structure genetic analysis of recombinational topography in the phage T4 rII region"

Twenty three sequentially arranged areas of the rII region bounded by 27 rII mutants have been located relative to four UV mutational hot spots, so that some areas encompass and others do not encompass the UV mutational hot spots. UV stimulated recombination

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Dr. C.E. Folsome: "Fine structure genetic analysis of recombinational topography in the phage T4 rII region"

Twenty three sequentially arranged areas of the rII region bounded by 27 rII mutants have been located relative to four UV mutational hot spots, so that some areas encompass and others do not encompass the UV mutational hot spots. UV stimulated recombination over all areas at a constant UV dose was examined. Recombination frequencies were elevated for all UV crosses. About UV hot spots recombination frequencies were increased by a factor of two, while at the same dose, recombination frequencies about some UV mutationally silent areas were increased by a factor of 0.5. Other UV mutationally silent areas showed higher UV stimulation of recombination. No

correlation was observed between map distance (0.01 to 1.00 units) and the extent of UV stimulation of recombination. These results indicate that a topography of recombination in many facets reflects a topography of mutation. The results are not inconsistent with the hypothesis that recombinational events at the fine structure level of analysis may originate by the same molecular mechanism as some mutational events, tautomeric shifts of nucleic acid bases.

Dr. P.A. Parsons: "A widespread biochemical polymorphism in Drosophila melanogaster"

Newly hatched ebony (e"e") larvae will survive on food containing about one third the concentration of phenyl-thio-carbamide (PTC) as Oregon-R larvae. This differential effect probably occurs because PTC, a dopa-oxidase inhibitor, is more toxic to e"e" larvae which may contain less dopa-oxidase than wild-type larvae.

Recently in an Oregon-R stock of flies an allele at the ebony locus reacting to PTC in a similar way to e"e" flies has been found. This "ebony" allele is wild-type in body colour. Flies collected in the wild at Eugene, Oregon are also polymorphic, so the allele in the Oregon-R stock probably came from the wild population from which the stock was derived. Other polymorphic stocks found so far are Oregon-K, Kaduna (Africa) and Bikini, while a Canton-S stock has been found to be 100% "ebony". Flies collected in the wild near Cambridge are also polymorphic. Hence the polymorphism is probably very widespread and is of great importance in maintaining the genetic variability of the species.

The selective basis of the polymorphism is under investigation, and it has been found that the heterozygotes lay more eggs than the homozygotes and that there is assortative mating. It is remarkable that the "ebony" allele has probably persisted in the Oregon laboratory population for at least 36 years since the Oregon-R stock was collected. This in itself implies a high degree of overdominance.

Professor A.M. Clark: "X-ray induced non-disjunction of the X-chromosomes in female Drosophila melanogaster"

With the identification of non-disjunctional syndromes in man, there is a revival of interest in the induction by radiation of changes in chromosome number. It is possible that the induction of trisomy-21 in man might be a way of assessing the genetic significance of low levels of radiation, providing a meaningful application of the concept of a doubling dose. However, even in Drosophila, there is surprisingly little information available on radiation induced non-disjunction, and the dose/effect relations for lower doses and dose rates have yet to be established.

In the current work, Asc or y apr females are mated to y v/sc^{8YB} males. This scheme allows reliable identification of exceptional offspring. The figures in the table indicate the present state of the project: these figures will be brought up to date at the meeting.

<u>Females</u>	<u>Treatment</u>	<u>Total offspring</u>	<u>Non-disjunctional</u>
y apr	Control	45,741	4
	70 r in 30 secs	10,497	2
	110 r in 30 secs	21,060	5
	250 r in 4 mins	5,482	6
Asc	Control	6,929	5
	110 r in 30 secs	5,309	1

Dr. J. Peacock: "Chromosome replication in Vicia faba"

The paper will deal with autoradiographic evidence which supports a polyneme rather than a unineme structure.

Miss M.M. Gordon: "Physical and immunological investigations of heat denatured surface antigens of Paramecium"

Heat denaturation of proteins comprises two separate reactions: an activation of the molecule followed by coagulation of the activated monomers. Three surface antigens of stock 51 of Paramecium aurelia were subjected to heat treatment. Ultracentrifugation of a heat denatured preparation suggests that low order polymers were formed, while the loss of native antigenicity with time, at a constant temperature, fits a log-linear curve.

Sufficient heating will cause complete loss of native antigenic sites and the appearance of new sites specific for the heat treated protein. Proteins which were antigenically related prior to heating also show partial identity after heat treatment, indicating that the antigenic structure of the polymer may depend on the antigenic structure of the native protein. All partly inactivated preparations tested contained the full complement of both native and denatured sites.

Taking into account results obtained by Reisner and MacRitchie on the behaviour of the proteins at an air-water interface, it is probable that the unpolymerised activated monomers return to the native configuration on cooling.

A.H. Reisner, F. MacRitchie, and G.E. Hibberd: "Immunogenetic studies of monomolecular layers of the soluble surface proteins of Paramecium"

The antigenicity of the soluble surface proteins (serotypic antigens) synthesized by Paramecium aurelia has been demonstrated to be under strict genetic control (Sonneborn, 1950; Beale, 1952). Danielli et al (1938) demonstrated that when a protein is allowed to unfold at an air-water interface its antigenic properties vanish. Our investigations demonstrate, however, that redispersal of the monolayer, formed by the serotypic antigens in Paramecium, in aqueous solution, reconstitutes upwards of 70% of the native antigenicity.

Spectrophotometric analyses of redispersed monolayers has revealed changes in the UV absorption spectrum characterised by a disappearance of the 2,800 A peak. This change may be due to an increase of the light scattering properties of the protein brought about by low order aggregation. Work by Gordon (unpublished) has revealed that such low order aggregation can cause complete loss of native antigenicity. Thus, such a mechanism would account for the antigenic losses demonstrated following formation and compression of the protein monolayers.

These experiments indicate that the proteins' primary structure together with their intramolecular disulphide bonds are sufficient to define the molecules' antigenic structures and, therefore, presumably their tertiary structures.

Mr. J.H. Claxton: "The patterns of skin follicles in sheep and their relation to pattern determination"

The distribution of skin follicles has been quantitatively measured in Merino and RomneyxSouthdown cross sheep during the period 70-140 days of foetal age. The degree of departure of the distribution from a random one has been used to suggest methods by which the position of follicles is determined.

There is no evidence favouring the hypothesis that the pattern of follicles is pre-determined. Rather the controlling mechanism seems to be associated with a series of inhibitory and stimulatory sequences arising from the follicles themselves after each has been initiated. This mechanism is compared with those thought to operate in some other animals.

Dr. C. Kidson: "Complex genetic control of a single enzyme in human erythrocytes"

Glucose-6-phosphate dehydrogenase (G6PD) exhibits a critical role in the control of carbohydrate metabolism in the non-nucleated human erythrocyte. Inherited deficiency of this enzyme occurs in many human populations, as a sex-linked trait of intermediate dominance. Female heterozygotes may have variable chemical expression, possibly indicative of mosaicism of erythrocyte populations. Comparative studies of the deficiency in Negroes, Melanesians and Europeans have revealed differences in the underlying mechanisms governing G6PD deficiency, and have served to elucidate some of the genetic controls of production and expression of this enzyme in the normal erythrocyte. Thus there appears to be control at separate loci of the production of G6PD isozymes, of the quantitative level of the enzyme, of an activator enzyme and of an inhibitor. Mutations apparently may affect one or more loci with a common end result, deficiency of activity of the enzyme, which is associated in the erythrocyte with increased tendency to lysis under certain conditions. The elucidation of this complex genetic control pattern has been facilitated by cross-reaction experiments employing erythrocyte stroma and lysate preparations from normal and "deficient" subjects of different racial groups.

Dr. B. Griffing: "The potentiality of reciprocal selection"

A theoretical analysis of the potentiality of reciprocal selection is considered with emphasis on multiple alleles exhibiting overdominance.

Professor J.H. Bennett: "Association between genes at sex-linked loci"

The gene-combination frequencies for two closely linked loci on the X-chromosome may be far removed from their equilibrium values many generations after equilibrium has been attained at the separate loci. General formulae have been developed expressing these gene-combination frequencies in terms of the number of generations of random mating and the initial frequencies; their use will be illustrated for a particular example. An excess of double heterozygotes of one linkage phase may persist for a great many generations even in the absence of selective differences if there is close linkage. The percentage excess of double heterozygotes of one linkage phase over the other is an index which might be useful in ethnographic studies with closely linked genetic markers such as colour blindness and glucose-6-phosphate dehydrogenase deficiency.

Miss B. Kindred: "Canalisation of variation due to environment in the house mouse"

A canalisation system will act on both genetic and environmental variation. The effects of different treatments administered to pregnant females carrying both wild-type and Tabby fetuses will be discussed.

Dr. P. Pennycuik: "Hyperthermia and whisker development in the mouse"

The number of whiskers found in the 5-10 day old mouse was reduced by exposing the mother to hyperthermia in the twelfth day of gestation. The degree to which the whiskers were affected was related to the magnitude of the rectal temperature increase. Exposure of the mothers to hyperthermia on the eleventh and thirteenth day of gestation had no effect on whisker development, but exposure on these two days and on the twelfth day of gestation caused a reduction in the litter size at birth.

Miss C. Jacobson: "Development of vibrissae in offspring of irradiated mice"

A loss of certain vibrissae occurs in the offspring of irradiated female mice, and also in some genetic lines, while in other lines there is an increase in vibrissa number. Examination of these offspring at the embryonic stages when vibrissae are being initiated shows that after irradiation, there is general destruction of the ectodermal follicles, but in those vibrissae which are present at birth, regeneration occurs, apparently through the influence of the dermal papilla. The mechanism by which the abnormal vibrissa number is produced in genetic lines differs from the irradiation effect.

Mr. D.C. Wark: "The inheritance of resistance to blue mould in two species of Nicotiana"

Preliminary screening showed different levels of resistance to blue mould in different local geographic races of the Australian species of Nicotiana. Crosses were made between highly resistant and less resistant races within the species N. goodspeedii and N. debneyi.

In the case of N. goodspeedii the higher level of resistance was inherited as a single dominant factor, but in the case of N. debneyi a polygenic type of inheritance was indicated.

Dr. A.J. Pritchard: "Cytological observations in the African species of the genus Trifolium"

Chromosome numbers have been recorded for 14 African species and varieties in the genus Trifolium. Differences between the species involve chromosome size, chromosome morphology and polyploidy. All species investigated belong to that section of the genus with a basic chromosome number of $x = 8$.

A consideration of karyotype, growth form and distribution of these species suggests that some of them are primitive and that the highlands of East Africa may be a centre of origin of the genus.

Dr. J.R. McWilliam: "Selection for greater seed retention in Phalaris"

The loss of seed from the maturing inflorescence of Phalaris tuberosa (seed shattering) constitutes a serious economic problem in harvesting seed from this species. This paper describes a breeding programme undertaken to produce an improved variety which will retain a greater percentage of seed through to maturity. The approach to this problem has been along the following lines:

- (a) a survey of the natural variation for this character in a range of ecotypes of the species;
- (b) a detailed study of the plant characters associated with the retention of seed;
- (c) estimation of the heritability of this trait and progress from selection;
- and (d) the design and operation of a selection programme with reference to this single character, and also in conjunction with other characters of agronomic importance.