GENETICS SOCIETY OF AUSTRALIA

8TH ANNUAL GENERAL MEETING

UNIVERSITY OF ADELAIDE

20-21 AUGUST 1959

PROGRAMME

ABSTRACTS

SCANNED FROM THE ORIGINAL

meeting 8 Lesley Andrew

# THE GENETICS SOCIETY OF AUSTRALIA

The Annual Meeting of the Society will be held on Thursday and Friday, 20th - 21st August 1959 at the University of Adelaide (Physics Lecture Theatre, Room 118.)

## PROGRAMME.

### Thursday, 20th August

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|---|---|---|
| 9.30 am | Sir Ronald Fisher | The Darwin Centenary |
| 10.00 am | Prof. M.J.D. White and Miss Lesley E. Andrew | "Effects of chromosomal inversions on size in the Grasshopper Morabá scurra." |
| 10.30 am | O. R. Byrne | "Inheritance of colour pattern variation in the locust, Chortoicetes terminifera." |
| 11 am | TEA | |
| 11.30 am | Dr. P.A. Parsons | "Pleiotropy and competition at the Vermilion locus in Drosophila melanogaster." |
| 12 noon | Dr. W.B. Mather | "Chromosome Evolution in the immigrans group of Drosophila" |
| 12.30 | Dr. A.M. Clark | "Genetic effects of pyrollizidene alkaloids in Drosophila melanogaster." |

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| 2.15 pm | Miss H. N. Turner | "Estimated and realised heritabilities and genetic correlations in an experimental flock of merino sheep. |

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| 2.45 pm | P.G. Schinkel | "Estimates of genetic parameters of fleece characters in S.A. merino sheep." |
| 3.15 pm | Drs. F.E. Binet and J.A. Morris | "On total Hereditary Variance in the case of certain mating systems." |
| 3.45 pm | TEA | |
| 4.15 pm | K.W. Shepherd | "An investigation of linkage relationships between genes for rust resistance in flax." |
| 4.45 pm | Dr. G.M.E. Mayo | "Use of artificial light for growing plant material in a controlled environment." |

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Observatory Building, University of Adelaide.

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| 8.15 pm | Prof. J.H. Bennett | An illustrated talk on "The genetical study of Kuru." |

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Friday, 21st August.

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| 9.30 am | H. Daday and C.G. Greenham | "Combining ability for cold hardiness in Lucerne (Medicago sativa L.) |
| 10.00 am | S.S.Y. Young | "Relative Efficiencies of Selection Methods." |
| 10.30 am | M.W. McDonald | Title to be submitted. |

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| 11.00 am | TEA | |
| 11.30 am | Dr. P.G. Martin | "The relation of antibody formation to the structure of D. N. A." |
| 12 noon | Dr. B.W.Holloway and Miss M. Monk | "Transduction in Pseudomonas aeruginosa." |
| 12.30 pm | Mrs. M.J. Mayo | "Abortion patterns in asci of a strain of Neurospora crassa." |

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| 2.15 pm | Dr. J.A.Pateman | "Further studies at the am locus in Neurospora crassa." |
| 2.45 pm | B.T.O. Lee and J.A. Pateman | "Polygenic inheritance of ascospore size in Neurospora crassa." |
| 3.15 pm | TEA | |
| 3.45 pm | R.N. Oram | "Recombination frequencies in diploid and tetraploid maize" |
| 4.15 pm | C.K. Pawsey | "Heredity in relation to some disorders and defects of Pinus radiata (D. Don) in South Australia." |

5.30 pm Sherry Party, Graduates Centre, University of Adelaide.

Genetics Society of Australia
1959 meeting - held in
Adelaide (August/September).

# ABSTRACTS OF PAPERS.

M.J.D. White and Lesley E. Andrew.
Department of Zoology, University of Melbourne.

"Effects of chromosomal inversions on size in the Grasshopper Moraba scurra."

Previous work, reported to the Society in 1958, showed that inversions of Moraba scurra influence viability in a complex way, there being a powerful genetic interaction between two different heterotic systems. It has now been shown that the inversions also have a marked effect on the overall size of the insects, certain structurally homozygous karyotypes being associated with large size, others with small size. No over-dominance exists, the various classes of heterozygotes being intermediate in size. The significance of the "size-effect" in relation to the "viability-effect" will be discussed.

O. R. Byrne.
Department of Genetics, University of Adelaide.

"Inheritance of colour pattern variation in the locust, Chortoicetes terminifera."

The Australian Plague Locust, C. terminifera, is polymorphic for colour patterns. Some of these colour patterns are briefly described and data from laboratory experiments given. A multiple allelic hypothesis for colour pattern inheritance is suggested.

P. A. Parsons

"Pleiotropy and Competition at the Vermilion Locus in Drosophila melanogaster."

Using larval competition under very crowded conditions as a criterion of fitness, the effect of suppressors of the vermilion gene on fitness was studied in D. melanogaster. When the gene is suppressed, the fitness of the suppressed flies is increased under conditions of high competition. The effect of the suppressor on fitness can be imitated by adding kynurenine to the larvae. Kynurenine, like the suppressor, permits brown pigment formation. Hence the vermilion gene when expressed has an effect on fitness as well as inhibiting brown pigment formation. Both effects are presumably associated with the conversion of tryptophan to kynurenine. The vermilion gene is therefore pleiotropic.

(This work was done in collaboration with Dr. M.M. Green of the University of California, Davis),

W. B. Mather.

Department of Zoology, University of Queensland.

"Chromosome Evolution in the immigrans group of Drosophila."

Chromosome evolution in the immigrans species group of Drosophila is discussed with special reference to the endemic Australian species D. rubidus and D. setifemur and the cosmopolitan species D. immigrans. Incidental observations are made on the staining properties of the X Chromosome and the "Pavan - Brever Phenomenon."

A. M. Clark

Department of Zoology, University of Melbourne.

"Genetic effects of pyrollizidine alkaloids in Drosophila melanogaster."

Several pyrollizidine alkaloids have now been tested for mutagenic activity in Drosophila. Some have been found to be inactive, while others show mutagenic properties comparable with ionizing radiations. If adult males are fed for seven days on sucrose-agar containing 0.001 molar heliotrine, their spermatozoa show an incidence of sex linked recessive lethals equivalent to a dose of more than 7,000 roentgen of X-rays. Some attempt has been made to correlate mutagenic activity with chemical constitution, but with only partial success. Distortion of the sex-ratio amongst progeny of ring-X males shows that the active alkaloids can induce a high incidence of breakage, but they do not appear to be very effective in producing gross structural rearrangements. In this respect, they resemble other chemical mutagens.

F. E. Binet and J. A. Morris.

Poultry Research Centre, C.S.I.R.O., Werribee, Victoria.

"On total hereditary variance, in the case of certain mating systems."

A schematic genetic model is presented, specifying a measurable character, fully determined by a single di-allelic locus. Hence epistatic and environmental components of variance are excluded. Consequently, the total phenotypic variance is hereditary and can be partitioned into an additivity - and a dominance - component on the one hand, and into components due to variation between and within relatively unrelated lines on the other hand. These sub-divisions are not considered on their merits in this paper. Attention is restricted to one aspect of total variance, namely its behaviour as a function of the coefficient of inbreeding. The analytical properties of that mathematical function are discussed and the genetical interpretation of these properties is outlined. The coefficient of inbreeding, (the argument of this function), is given a somewhat wider definition than its usual formal interpretation as a probability. It is defined as a measure of the deviations of actual genotype - frequencies from those at random mating at the same allele - frequency. The results of this analysis may be regarded as complementary to those obtained by such authors who partitioned this total on the one hand into additive genetic and dominance components and on the other hand into between and within inbred lines components.

G.M.E. Mayo.

Department of Genetics, University of Adelaide.

"Use of Artificial Light for growing Plant Material in a Controlled Environment."

During 1957 a plant growth cabinet was constructed for use in the Department of Genetics, University of Adelaide: members of the Society will be invited to inspect this cabinet. As an introduction, its design, performance, and in particular the "light (spectrum) corrected" high pressure mercury vapour lamps, as the principal or only source of light in this cabinet, will be discussed. The use of this cabinet in the study of the genetics of host-pathogen relations and in the study of the genetics of continuous variation will be dealt with.

H. Daday and C.G. Greenham.

Division of Plant Industry, C.S.I.R.O., Canberra.

"Combining Ability for Cold Hardiness in Lucerne (Medicago sativa L.)

With low frequency as the criterion, a determination has been made of the relative cold hardiness of Hairy Peruvian, Hunter River, Ladak and Rambler strains also their half diallel lines. Differences between strains and between $F_1$ lines are highly significant. General combining ability among the $F_1$ lines is highly significant, but the specific combining ability is not significant. Most of the variation is due to genetical effects, variation due to environment being small.

Rambler contributes most to the cold hardiness of the $F_1$ lines.

Extended daylight significantly increased dry matter production during winter but did not affect cold hardiness. The segregation of $F_2$ characters between hardy and susceptible plants shows independence for cold hardiness and winter growth.

The results are discussed in relation to obtaining plants that are more cold hardy, also that give greater winter yield.

S. S. Young.

McMaster Animal Health Laboratory, Glebe.

"Relative Efficiencies of Selection Methods."

The relative efficiencies, in terms of genetic values, of three selection methods; tandem selection, independent culling levels and the selection index were compared. This is an extension of the work published in 1942 by Hazel L.N. and Lush J.L. in the Journal of Heredity.

In all circumstances the index is never less efficient than the method of independent culling levels, though in some cases it is no more efficient. The method of independent culling levels is, in turn, never less efficient, but in some cases no more efficient, than tandem selection. The superiority of the index method over the other methods is at a maximum when the traits have equal genetic values.

P. G. Martin.

Department of Zoology, University of Adelaide.

"The Relation of antibody formation to the structure of DNA."

An hypothesis concerning the formation fo antibodies and the part played by DNA in this process will be presented. The structure and evolution of the blood group loci will be discussed in the light of this hypothesis.

B.W. Holloway and Marilyn Monk

Department of Bacteriology, University of Melbourne.

"Transduction in Pseudomonas aeruginosa."

Genetic transfer by transduction has been shown to occur in Pseudomonas aeruginosa. Several temperate phages have been found which carry out this transfer but not all phages are competent in this respect. A number of markers have been transduced but generally only one marker is transferred at a time. Rare linked transductions have been detected. Ultraviolet irradiation of the transducing bacteriophage has a stimulating effect on this genetic transfer. While this may be due to increased bacterial survival resulting from loss of killing ability by the phage, it is possible that irradiation may stimulate incorporation of the transduced genes.

M. J. Mayo.

Department of Genetics, University of Adelaide.

"Abortion patterns in asci of a strain of Neurospora crassa."

In outcrosses, strain 4540 of N. crassa always produces asci which show abortion patterns where two or four and possibly eight of the spores do not mature. McClintock has suggested that these patterns could arise from an interchange heterozygote, where spores containing a duplication and a small deficiency are viable. However, no interchange configuration could be detected cytologically in this strain nor any genetical evidence of duplication.

The relationships between linked genes within the three observable patterns and the frequencies of these patterns are considered in an attempt to explain the aberrant behaviour.

J. A. Pateman.

Department of Botany, University of Melbourne.

"Further studies at the am locus in Neurospora crassa."

The "amination deficient", am, locus in N. crassa is a complex one. It is of particular interest since mutation at many different sites in this locus affects the production of the enzyme glutamic dehydrogenase by the fungus.

Recent experimental work on the backmutation and recombination of different am alleles will be presented. The relationship between the sub-units, or "alleles", at this locus as determined by the criteria of functional complementarity, genetical recombination and mutation, will be discussed.

B. T. O. Lee and J.A. Pateman.

Department of Botany, University of Melbourne.

"Polygenic Inheritance of Ascospore size in Neurospora crassa."

Previous work has shown that the inheritance of ascospore size in certain strains of Neurospora crassa is controlled by a polygenic system with a small cytoplasmic component.

Various types of selection lines were set up both in strains that has been selected for the large-spored character and in wild-type strains. The results of these various treatments will be discussed.

Experimental work will be described which indicates that a part of the polygenic system responsible for about 1/6 of the total response to selection for increased ascospore size is apparently located about 10 to 15 cM. from the albino 2 (al.2) locus.

An experimental demonstration of the segregation of polygenes during tetrad formation will be described.

R. N. Oram.

Division of Plant Industry, C.S.I.R.O., Wagga

"Recombination frequencies in diploid and tetraploid maize."

Although the intent of synapsis of homologues at meiosis differs considerably between diploid and tetraploid forms of most species, and could be expected to affect the frequency and distribution of crossing over, recombination fractions in any segment in the two forms have not previously been compared. Here, such comparisons are made in two segments in maize, one (ShWx) in the middle of the short arm of chromosme 9, and the other (Su $Gl_3$) including the centromere of chromosome 4. Recombination frequencies per unit of pachytene chromosome length in these two regions are approximately average and less than average respectively.

Recombination fractions in diploids were determined in coupling phase heterozygotes. In tetraploids, Fisher's methods for determining recombination were used with some simplifying assumptions and corrections for viability differences between gametes and zygotes of differing genotypes.

Table.

Recombination fractions in the Sh Wx and Su $Gl_3$ regions in diploid and tetraploid maize.

| Season and treatment. | Recombination fractions: Diploid ♀ gametes | Diploid ♂ gametes | Tetraploid ♀ gametes | Tetraploid ♂ gametes |
|---|---|---|---|---|
| Late summer | Sh-Wx | | | |
| Colchicine | 0.224±0.008 | 0.233±0.006 | 0.180±0.024 | 0.277±0.058 |
| No colchicine | 0.201±0.008 | 0.258±0.013 | | |
| Early summer | | | | |
| No colchicine | 0.183±0.009 | 0.219±0.018 | | |
| Winter | | | 0.235±0.028 | |
| Winter and Summer | | | 0.223±0.042 | |
| | Su-$Gl_3$ | | | |
| Late summer | 0.282±0.009 | | | |
| Winter | | | 0.556±0.062 | |

Thus, tetraploidy appears to increase the frequency of recombination in the pericentric Su $Gl_3$ segment, but has little effect in the mid-arm Sh Wx region.

C. K. Pawsey.

Forestry and Timber Bureau, Mount Burr.

"Heredity in relation to some disorders and defects of Pinus radiata (D. don) in South Australia."

Observations among clones of Monterey pine are cited, together with some relevant figures, to show that heredity influences the incidence of dieback, fused needle, dead-topping and forking in this species.

K. W. Shepherd.

Department of Genetics, University of Adelaide.

"An investigation of linkage relationships between genes for rust resistance in flax."

Backcross techniques have been used to investigate the hypothesis that genes for rust resistance in flax exist as multiple alleles at a restricted number of loci. Supposed recombination has been detected in one backcross family and the significance of this will be discussed. In those families where no recombinants were observed, the upper limit of the recombination fraction may be calculated.

# GENETIC PARAMETERS IN A FLOCK OF SOUTH AUSTRALIAN MERINO SHEEP

By P.G. Schinckel

Estimates of the heritability of ten fleece and body characters have been made in a flock of South Australian Merino sheep. Genetic correlations between these characters were also estimated.

All estimates based on parent offspring regressions on a within year basis, and standard errors of the genetic correlations were estimated from the formula of Rae. In general there was good agreement between the significance of the genetic correlation coefficient as determined by Rae's method and the significance as determined by Morley's method.

A number of disagreements between the results here and those of Morley suggests the possibility of different relationships in the various genotypes.

The heritability of clean wool weight was lower than that of most of the components which determine it: probably due to the negative genetic correlations between some of these components.

TABLE OF ESTIMATES OF HERITABILITY (LEADING DIAGONAL) AND GENETIC CORRELATIONS

| | C.W.W. | $W^{0.6}$ | F.W.I. | St.L. | Cr. | N. | F.Diam. | Skin | S/P | C.V. |
|---|---|---|---|---|---|---|---|---|---|---|
| C.W.W. | 0.28±.07 | +.47±.10 | +.65±.21 | +.37±.09 | -.22±.09 | +.14±.12 | +.24±.07 | ?.23*±1.5 | ?.01±0.1 | +.28±.17 |
| $W^{0.6}$ | | ?.76±.08 | -.38±.12 | ?.04±.07 | +.06±.08 | ?.13±.08 | ?.21±.26 | -.28±.11 | -.03±.02 | -.04±.03 |
| F.W.I. | | | 0.34±.08 | +.42±.13 | -.41±.13 | +.26±.12 | +.35±.13 | ?.23±.45 | ?.07±.19 | +.30±.18 |
| St.L. | | | | 0.67±.07 | -.54±.10 | -.36±.08 | +.44±.09 | -.30±.10 | -.44±.11 | +.25±.11 |
| Cr. | | | | | 0.40±.05 | +.06±.09 | -.17±.11 | +.24±.13 | +.16±.12 | -.81±.17 |
| N. | | | | | | 0.62±.07 | -.70±.07 | ?.11±.11 | +.75±.12 | -.36±.12 |
| F.Diam. | | | | | | | 0.52±.07 | +.28±.13 | -.62±.12 | ?.05±.03 |
| Skin | | | | | | | | 0.27±.06 | ?0.7±.26 | +.08±.07 |
| S/P | | | | | | | | | 0.47±.07 | ?.18±.19 |
| C.V. | | | | | | | | | | 0.30±.07 |

* ? = sign indeterminate

genotypes.

The heritability of clean wool weight was lower than that of most of the components which determine it: probably due to the negative genetic correlations between some of these components.

TABLE OF ESTIMATES OF HERITABILITY (LEADING DIAGONAL) AND GENETIC CORRELATIONS

| | C.W.W. | $W^{0.6}$ | F.W.I. | St.L. | Cr. | N. | F.Diam. | Skin | S/P | C.V. |
|---|---|---|---|---|---|---|---|---|---|---|
| C.W.W. | 0.28±.07 | +.47±.10 | +.65±.21 | +.37±.09 | -.22±.09 | +.14±.12 | +.24±.07 | *?.23±1.5 | ?.01±0.1 | +.28±.17 |
| $W^{0.6}$ | | ?.76±.08 | -.38±.12 | ?.04±.07 | +.06±.08 | ?.13±.08 | ?.21±.26 | -.28±.11 | -.03±.02 | -.04±.03 |
| F.W.I. | | | 0.34±.08 | +.42±.13 | -.41±.13 | +.26±.12 | +.35±.13 | ?.23±.45 | ?.07±.19 | +.30±.18 |
| St.L. | | | | 0.67±.07 | -.54±.10 | -.36±.08 | +.44±.09 | -.30±.10 | -.44±.11 | +.25±.11 |
| Cr. | | | | | 0.40±.05 | +.06±.09 | -.17±.11 | +.24±.13 | +.16±.12 | -.81±.17 |
| N. | | | | | | 0.62±.07 | -.70±.07 | ?.11±.11 | +.75±.12 | -.36±.12 |
| F.Diam. | | | | | | | 0.52±.07 | +.28±.13 | -.62±.12 | ?.05±.03 |
| Skin | | | | | | | | 0.27±.06 | ?0.7±.26 | +.08±.07 |
| S/P | | | | | | | | | 0.47±.07 | ?.18±.19 |
| C.V. | | | | | | | | | | 0.30±.07 |

* ? = sign indeterminate

C.W.W. = clean wool weight

$W^{0.6}$ = body weight raised to 0.6 power

F.W.I. = $C.W.W./W^{0.6}$

St.L. = staple length

Cr. = number of crimps per inch

F.Diam. = mean fibre diameter

Skin = skin fold score

S/P = ratio of secondary to primary follicles

C.V. = coefficient of variation of fibre diameter