

AUSTRALIAN GENETICS SOCIETY

5TH ANNUAL GENERAL MEETING

UNIVERSITY OF SYDNEY

13-14 AUGUST 1956

PROGRAMME

ABSTRACTS

SCANNED FROM THE ORIGINAL

PROGRAMME FOR GENETICS MEETING - 13th and 14th AUGUST, 1956.
ZOOLOGY DEPARTMENT, UNIVERSITY OF SYDNEY.

MONDAY 13th AUGUST

10.15-10.45am.	M.J.D. White	Further studies of cytogenetic polymorphism in the grasshopper <u>moraba scurra</u> .
10.45-11.30am.	TEA	
11.30-12 am.	B. Holloway	Genetic recombination in <u>pseudo-</u> monas.
12-12.30pm.	G. Grigg	Genetic control of spore production in neurospora.
12.30-12.45pm.	M. Clarke	The spontaneous mutation from apricot to white in <u>Drosophila melanogaster</u> .
12.45-2pm.	LUNCH	
2-2.15pm.	A.S. Fraser and T. Nay	Absence of Interaction between the Tabby and Crinkled genes in mice.
2.15-2.30pm.	R. Dun	The influence of the poll gene on fleece characters in merino sheep.
2.30-3pm.	J.M. Doney	The effect of inbreeding in four small families of merino sheep.
3.30-4pm.	G. McBride	The effect of antibiotic feed on the heritability of growth rate in chickens.
4-4.30pm.	TEA	

TUESDAY 14th AUGUST

9.30-10am.	E.M. Hutton	Some problems in the breeding of sub-tropical pasture plants.
10-10.30am.	B. Griffing	Application of Fisher's general theory of linkage in polysomic inheritance to the special case of trisomic inheritance.
10.30am.-11am.	R.N. Oram	Linkage in auto tetraploid maize
11-11.30am.	TEA	
11.30-12am.	J. Langridge	Developmental selection in flowering plants.
12-12.30pm.	Miss H. Newton Turner	Results of selection in merino sheep
12.30-1pm.	J.M. Rendel	The effect of age on coincidence and crossing over in <u>Drosophila</u>

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1-2pm.	LUNCH	

TUESDAY 14th AUGUST (Cont.)

2-2.30pm.	F. Morley	Inheritance and ecological significance of seed dormancy in subterranean clover.
2.30-3pm.	M.W. McDonald	Genetically controlled high sulphur amino-acid requirement in poultry.
3-3.30pm.	Miss Olga Kooptzoff	A blood group study of some native of Dutch New Guinea.
3.30-4pm.	R.B. Dun	Distribution of vibrissae in the normal mouse.
4-4.30pm.	TEA	
4.30-5pm.	Miss H. Newton Turner	The estimation of genetic parameters without father identification.

8pm.	Professor J. Bennett	Human Genetics.
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WHITE, M.J.D. : Further studies on cytogenetic polymorphism in the grasshopper Moraba scurra *megacanthus* from non-migrating, winter appearance

Three aspects of this work will be described: (1) cytological study of laboratory-bred hybrids between the eastern ($2n \delta = 15$) and the western ($2n \delta = 17$) races, and the information that this provides as to the origin of the 17- chromosome condition by a translocation plus deletion; (2) further work on the adaptive heterosis associated with the pericentric inversions in the CD and EF chromosomes; (3) chromatographic studies on the biochemical polymorphism of the natural populations.

HOLLOWAY, B.W. : Genetic Recombination in Pseudomonas aeruginosa

Genetic recombination has been shown to occur in the bacterium Pseudomonas aeruginosa. The general pattern of recombination is similar to that occurring in Escherichia coli although some differences occur. No 'F' factor has yet been detected in Pseudomonas. Recombination takes place predominantly between certain different strains although at least one strain is self fertile to a low degree. Genetic analysis is somewhat restricted by the low number of suitable genetic markers available. However linkage studies have been made with both inter- and intra- strain crosses. Matings between lysogenic and non lysogenic parents give additional evidence for both the genetic nature of the prophage and the unilateral transfer of genetic material during recombination. Attempts have been made to influence recombination by colchicine and by chelating substances such as Versene but no effects were observed in either case.

GRIGG, G.W. : Genetic control of conidiation in a heterokaryon of Neurospora crassa.

Wild type strains of Neurospora crassa produce two types of vegetative spores macroconidia and microconidia in the proportions of 99% to 1%. A microconidial non-colonial heterokaryon was produced from a macroconidial colonial and a macroconidial non-colonial homokaryon. The macroconidial col-1 strain was found to have the genetic constitution microconidial (m) suppressor of microconidial (su^m) and the other $m^+ su^{m+}$.

The dominance relations of m, su^m and col-1 with their wild type alleles and the particular nuclear ratio in which they are present determine the microconidial, non-colonial phenotype of this heterokaryon. As a further consequence of the dominance relationships between col-1 and its wild type allele, only one of the two pleiotrophic effects of the mutant gene is expressed in the heterokaryon.

The enormous discrepancy between the estimates of the nuclear ratio by two different plating methods is shown to be due to an almost complete suppression of one type of homokaryotic colony by the other.

1(T⁻m⁻) x L(IV⁻Ad⁻S) (1) (F⁻ fertility) in Neurospora Similarly with donor accepting system in Pseudomonas but no F⁻ is self sterile $\equiv F^-$
 select T⁺m⁺IV⁺Ad⁺ & study w/ S. F⁺ x F⁻ Fertile F⁺ x F⁺ < fertile

CLARK, A.M. & GUNSON, Mary M. : A spontaneous mutation from apricot to white in *D. melanogaster*

A spontaneous mutation from apricot to white has been obtained in a stock labelled with the recessive markers yellow, echinus, crossveinless, cut, vermillion forked.

From females heterozygous for y w apr ec cv ct v f as well as for the Curly inversions and for In (3R)C, two apricot eyed males were obtained from 10, 197 offspring. The recovery of these males indicates that the mutation at the white locus appears to have left the apricot locus unaffected.

In the same material, 8% crossing over was recorded between y and w, suggesting that in the absence of the extensive autosomal inversions the frequency of recombination between white and apricot might be of the order of 1/20,000 - 1/30,000.

The occurrence of the w apr chromosome in *Drosophila* is of interest, since no case for pseudo-allelism is really complete without the recovery of both products of recombination. In most cases, only the wild type chromosome is in fact recovered. Although not obtained as the product of crossing over, the multiple stock we now have demonstrates that the double recessive chromosome, w apr, does in fact exist.

FRASER, A.S. & NAY, T. : The Absence of Interaction between the Tabby and Crinkled genes in mice.

The Tabby (Ta) and crinkled (cr) genes are mimics, genetically independent. An aspect of their effect is the reduction in number of facial vibrissae. This is compared for various combinations of these genes. The ++.++ type shows little variation from 14 whiskers. ++.Ta+ type is of the order of 9. ++.TaTa is of the order of 6.0. The crcr.++ type is of the order of 6.0. No further increase in gene dosage affects these values.

DUN, R. : The influence of the poll gene on fleece characters in merino sheep.

The table below gives the differences between the hogget fleece measurements of polled and horned half sibs, the progeny of heterozygous poll merino rams.

		Greasy fleece weight (lbs)	Yield (%)	Clean Fleece Weight (lbs)	Staple Length (cm)	Crimps Per Inch	Folds	Body Weight (18m) (lbs)
EWES	Diff.	-0.28	-1.16	-0.29	+0.55	+0.73	+0.51	-2.93
	S.E.	0.38	1.16	0.28	0.28	0.57	1.46	2.92
RAM	Diff.	+1.39	-1.51	+0.62	+0.37	-0.11	+2.38	-0.08
	S.E.	0.42	2.15	0.30	0.36	0.67	1.93	3.04

DONEY, J. MacKay : Effect of inbreeding on four small families of merino sheep

Inbreeding without selection has been practised at the McMaster Field Station on four families of Merino sheep derived from a single original strain. Matings were commenced between 1942 and 1944. Full recording of fleece and body characters has been carried out since 1947. Due to differential progress of the four lines several confounding factors have been introduced. The most convenient method of deriving the effect of inbreeding was found to be a variance analysis according to family, year, and amount of inbreeding. Within this framework some bias is introduced by a certain amount of confounding between the three classifications. Other sources of bias were introduced outside these main classifications by a strong confounding of degree of inbreeding and age and by a reduced fertility associated with increasing inbreeding. The probable magnitude and direction of these influences have been taken into account in the interpretation of the analyses.

It is found that inbreeding has a highly significant effect on body size (15% decrease for 25% inbreeding coefficient), fertility (about 50% decrease), fleece weight (12% and 15% reduction in greasy and clean weight respectively) and wrinkle score (33% reduction). The fleece components; fibre diameter, number of fibres per unit area, staple length and yield do not seem to be affected by inbreeding.

The interpretation of these results in relation to the genetic nature and time of action of inbreeding effect is discussed.

HUTTON, E.M. : Some problems in the breeding of sub-tropical pasture plants.

The main problem is to determine what species are worth concentrated effort and which characters in the selected species need improving. Characters required in a grass or legume are :- high intake and utilization by the animal, often referred to as palatability; a long growing season and high dry matter production probably dependent on a short-day flowering response; maintenance of a high crude protein content with age; ability to recover rapidly from grazing; perenniality and persistence under grazing; resistance to drought and frost; resistance to insects and diseases; freedom from toxic principles.

A study of the breeding system of a number of legumes has been made. Bagging of racemes to find the degree of compatibility was unsuccessful as a considerable amount of bud-abscission occurred. It was necessary to study the pollination process in flower buds collected and "fixed" at different stages of development. I. endecaphylla, P. lathyroides, and S. gracilis are autogamous. With D. uncinatum pollination occurs at tripping which always follows opening of the flower. All these legumes are self-compatible and variation is at a minimum in I. endecaphylla, P. lathyroides, and S. gracilis. In D. uncinatum variations in flower and stem colour reflect the mode of pollination.

With L. glauca some 170 small flowers are arranged in a "wattle-like" head, and these open about 3 a.m., the anthers being held over the stigma until anthesis occurs about 8 a.m. Due to this mechanism and a restricted period of anthesis, this species is mainly self-pollinated and populations of the different strains exhibit limited variability. The best strains come from Peru and El Salvador and crosses are being made between these to develop a vigorous type which retains its high protein leafage in winter. This perennial browse legume could become important in areas where deferred grazing is practised.

White Clover, Centrosema pubescens, and I. endecaphylla are representative of the small group of pasture legumes which will withstand intensive grazing. I. endecaphylla is a promising coastal legume but contains primary aliphatic nitro compounds (one of which is a β -nitro propionic acid) that cause a chronic condition terminating in the death of the grazing animal. Some 2,000 single plants of all available strains of I. endecaphylla have been examined and the range in primary aliphatic nitro compound content was from 7.5 mgrms to 18.0 mgrms. per gramme fresh weight. Intra-strain variation is limited, so attempts are being made to increase it by high energy treatments and interspecific crossing.

Grasses receiving attention are included in the genera Sorghum, Paspalum, Setaria, Digitaria, and Chloris. In Sorghum alnum an attempt is being made to develop a strain free from cyanogenetic glucosides. Paspalum and genera like Panicum, Cenchrus, and Brachiaria contain a high proportion of apomictic species in which intra-strain variation is at a minimum. One approach in Paspalum is to find species with a degree of sexuality so that crosses can be made with them as the female parent.

GRIFFING, B. : Application of Fisher's general theory of linkage in polysomic inheritance to the special case of trisomic inheritance.

Application of Fisher's general theory of linkage in polysomic inheritance is made to the special case of trisomic inheritance. The enumeration and classification of (1) trisomic genotypes, and (2) monosomic and disomic gametes derived from a trisomic organism is presented. Gametic matrices are constructed and the estimation procedures are outlined for various genetic parameters.

GRAM, R.N. : Genetics of autotetraploid maize.

Recombination fractions in the segments $su_1 - gl_3$ and $sh_1 - wx$ have been estimated in diploid and autotetraploid maize. Fisher (Philos. Trans. Roy. Soc. London. B. 233: 55-89, 1949) has shown that a determinate estimate of the recombination fraction in tetraploid plants heterozygous at two loci can only be obtained by completely identifying the genotype of each gamete in the sample. Since there are ten possible gametic genotypes, data from second backcross progenies are necessary to distinguish between them. The data have been analysed by Fisher's method, with modifications removing disturbances due to monosomy or trisomy in about 5% of the functional gametes of tetraploid maize. Double reduction frequencies at the loci involved in the linkage experiments, and at several others, have been determined together with estimates of the frequencies of numerical non-disjunction of the chromosomes on which they are situated. The relation between frequencies of double reduction and the distances of the genes from their respective centromeres will be considered.

TURNER, Miss H.N. : Results of Selection in Merino Sheep:
Progress Report.

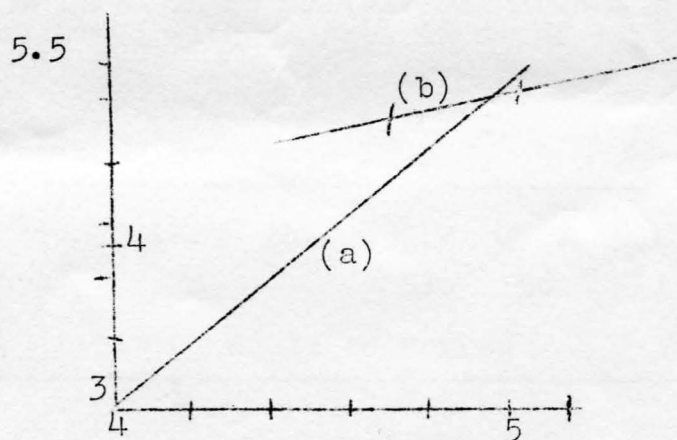
Two sheep-breeding experiments have been in progress at the C.S.I.R.O. National Field Station, Gilruth Plains, since 1950. In one, two methods of sire-selection (half-sib and mass selection) are being compared, with fleece weight of a specified quality as the criterion of selection. In the other, selection is for high or low values of a single characteristic. There are altogether eight pairs of groups in this experiment, with eight characteristics under selection.

This paper will present results to date on :

- (i) Response to selection.
- (ii) Realised heritabilities.
- (iii) Correlated responses.

RENDEL, J.M. : The effect of age on coincidence and crossing over in *Drosophila melanogaster*.

According to existing hypotheses one expects coincidence to increase as recombination frequency increases. This can be shown to happen in a regular way when recombination is increased by including a greater length of chromosome in the region marked. Fig. I shows the relationship between coincidence and recombination when both are expressed in probits. (Line A). Data were taken from Anderson and Rhoades. (See Table I)



Shultz and Redfield have shown that the recombination frequency can be increased by including an inversion in another chromosome. The Curly inversion on chromosome II was therefore introduced into stocks carrying *sc ct* and *v* on chromosome I. These stocks segregated for *Cy*. and sister *II*, either $\frac{sc\ ct\ v}{+}$ or $\frac{+}{+}$ could be compared. Four F_1 s were made, $++$ being $\frac{sc\ ct\ v}{+}$, $\frac{sc\ +}{+}$, $\frac{+}{+}$, $\frac{+}{+}$. Single Curly and $+$ females mated to *sc ct v* males were set up and recombination and coincidence calculated. When the values were converted to probits they followed line (b) in Fig. I. Table II gives recombination and coincidence values. It is clear that the relationship between coincidence and recombination is not the same in line a and b. In a second set

RENDEL, J.M. (Cont.)

of the same 4 kinds of F_1 s as before were set up and allowed to lay in 4 bottles. They¹ laid in the first from the 1st to the 4th day, in the second from the 4th to the 8th, in the third from the 8th to the 12th, and in the fourth from the 12th to the 16th day. Results are set out in table III. The increase in coincidence accompanying increased recombination due to the Cy inversion found in the first experiment is only present during the first laying period. After this coincidence is lower in Cy heterozygotes than in normals, although recombination is more frequent.

In both ++ and Cy heterozygotes recombination decreases in frequency with age but coincidence increases. These results are incompatible with Mather's model, which shows a chromosome divided into two parts d , the average distance from the centromere to the first chiasma and l_1, l_2, l_3 etc. the average distance between the 1st and 2nd, 2nd and 3rd, 3rd and 4th chiasmata, l determines coincidence. Any increase in distance, however, brought about must alter l_1, l_2 or l_3 as the case may be. But suppose d and l_1 etc. determine the average distance between potential points of chiasma formation, and the frequency with which crossing over takes place is somewhere between 0 and 1 at each potential point of crossing over, then the frequency of crossing over could be altered by increasing the probability of a cross over at a potential point of crossing over without changing d and l . Thus d and l can vary quite independently of p , the probability of a cross over at a potential point of crossing over, and so changes in coincidence can be independent of changes in recombination depending on the way changes in p are correlated with changes in d and l .

TABLE I

Recombination	16.5	24.8	39.2	49.7	58.2	18.1	32.7	43.1	53.4
Coincidence (Anderson & Rhoades)	3	8	31	56	71	6	25	49	71
	Scute to forked					echinus to forked			

TABLE II

Without Cy				With Cy			
N	Co. in 1	Co. in 2	Coincidence	N	Co. in 1	Co. in 2	Coincidence
11400	18.36	14.00	37.20%	11931	27.77	17.50	46.57

TABLE III

Markers sc, ct and v.

++			Cy		
N	Total distance	Coincidence	N	Total distance	Coincidence
3653	30.55	20.66	3762	41.47	27.54

of the same 4 kinds of F_1 s as before were set up and allowed to lay in 4 bottles. They¹ laid in the first from the 1st to the 4th day, in the second from the 4th to the 8th, in the third from the 8th to the 12th, and in the fourth from the 12th to the 16th day. Results are set out in table III. The increase in coincidence accompanying increased recombination due to the Cy inversion found in the first experiment is only present during the first laying period. After this coincidence is lower in Cy heterozygotes than in normals, although recombination is more frequent.

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4278	28.54	46.57	4254	39.99	37.53
3548	24.52	48.75	3773	33.90	41.46

DUN, R.B. : Distribution of vibrissae in the normal mouse.

Vibrissal groups on the head and forelegs were scored in a large number of 3 to 10 days old litters from mice strains with normal follicle development.

In six inbred lines, all vibrissal groups were extremely constant with the exception of the inter-annals; each line differing in amount of group variation at this site.

Mice from oestrogen sensitivity selection strains showed numerically constant vibrissal groups with the exception of inter-annals and the supra-orbitals which showed an extra vibrissa in up to 16 per cent of groups. Genetic variation in inter-annual vibrissa score is probably polygenic in nature whereas the supra-orbital group differences may be due to a major gene.