APPENDIX[1]

TABLE OF CONTENTS

EXHIBITS

TABLE OF CONTENTS

[1] The following section contains the condensed articles and descriptions of exhibits received too late to include with volume 2.

Plants

General Genetics

AUTOPOLYPLOIDISM

Cesare Artom, R. Università di Pavia, Italy

Allopolyploidism occurs very commonly in plants. In the botanical species, in fact, the process of fertilization allows the meeting of extremely heterogeneous genoms. Nevertheless, during the maturation of the sexual cells of the hybrid the perfect stabilization of the gametes may take place. Thus are realized entirely new genetic constitutions that must be considered as veritable syntheses of heterogeneous genoms. Polyploidism among plants can thus very frequently be traced back to phenomena of allopolyploidism, a consequence of hybridization.

Among animals, on the contrary, the few polyploid species owe their origin to mutation phenomena.

Whenever the affinity between the homologous chromosomes suddenly ceases, the reductional phenomena do not take place. Thus diploid gametes are produced instead of haploid gametes, the former determining with their union a new tetraploid constitution. Or polyploidism may be brought about by means of nuclear fusions between the ovarian nucleus and nuclei derived from the polocytes, or, finally, fusions between nuclei derived from the first segmentations of the egg may occur.

A confirmation of such statements is afforded first by the Solenobia studied by SEILER, in which tetraploidism is brought about either by means of nuclear fusions between egg nucleus and second polocyte or by means of nuclear fusions between nuclei derived from the second egg division.

In the Artemia of SÈTE, I have been able to point out some facts which confirm my views. It is a parthenogenetic diploid biotype genetically linkable with the amphigonic diploid of CAGLIARI. In the egg of the Artemia of SÈTE the number of chromosomes appears in a haploid condition (21 tetrads). The diploid condition is reached in three different ways, which are analytically examined in a previous paper. Sometimes it is possible to observe in the biotype attempts at attaining tetraploidism. These attempts are either represented by nuclear fusion between the first polocyte and two haploid nuclei, or by a fusion of the first polocyte with the egg nucleus, both of them being diploid, or else by fusion of four haploid nuclei.

A student of mine, E. STELLA, has recently brought to this question a contribution of some importance. She established, first of all, that the amphigonic diploid biotype in localities very far from one another and geographically unlinkable is uniform and therefore altogether stable. Furthermore, STELLA has been able to demonstrate that the parthenogenetic diploid biotype (morphologically different from the amphigonic diploid) is

identical with the parthenogenetic tetraploid, the latter being but an enlarged image of the first, with larger somatic nuclei and cells.

My previsions based on cytological facts have been confirmed: In the tetraploid biotype (resulting from the parthenogenetic diploid biotype by means of automictic phenomena) the factorial complex can only be found duplicated. The tetraploid biotype must then, as far as its origin is concerned, be considered as an autopolyploid biotype.

HYBRIDS OF AEGILOPS AND TRITICUM

M. L. Blaringhem, Paris, France

Aegilops ventricosa Tausch, castrated in the moment of opening of the spikelets, without injury, is pollinated by *Triticum turgidum* L.; the product, a wheat with sterile stamens, is pollinated by *turgidum* and gives wheats partially self fertile in the F_3 generation.

The author obtained in the descendants (a) some lines nearly sterile and with slight indices of the ascendant *Aegilops ventricosa* but with the general aspect of a wheat, (b) numerous lines of spelt (*Triticum Spelta* L.), tall and productive, classified among the ancient varieties, and (c) some lines with the structure of spikelets and grains of the spelt but with non-imbricated spikes, with 3 to 5 grains in each spikelet, and free in the glumes (or palea). The new wheat is a new section of spelt, *Triticum Spelta polycoccum* Blaringhem.

HEREDITARY ANOMALIES IN MICE DESCENDING FROM STOCK RAISED (1921) BY LITTLE AND BAGG

Kristine E. H. Bonnevie, University of Oslo, Norway

An investigation of about 700 embryos of all stages of this strain of mice has first of all confirmed the results already reached by LITTLE and BAGG with regard to the recessiveness of the eye- and foot-anomalies in question, and also those of BAGG with regard to the manifestation of the anomaly in late embryonic stages as blood clots, and in somewhat earlier stages as clear blebs, on the dorsal side of the feet.

My investigation has further shown that the localization of the blebs at this place is a secondary one and that in young embryos 7 to 8 mm long clear blebs first appear in the neck region of the embryos and later extend under or perhaps within the very thin epidermis toward the head and back. A formation of large blebs is thus very often taking place on one or both sides of the head, especially round the eyes and above the nose, and in many cases also across the shoulder region and on the hind part of the back. From the shoulder region the fluid will, at further stages, nearly

always be removed along the dorsal side of one or both forefeet, at the distal end of which the existence of blebs has already been stated by BAGG. From the hind part of the back the bleb fluid is generally removed, not toward the hind limbs but along the dorsal side of the tail. In many cases the blebs may also persist at this place, their contents being gradually resorbed. Of special interest also are the minute "border-blebs" which are seen to occur in large numbers in embryos of 8 to 10 mm in length, especially on the tibial border of their hind legs. The fluid is here generally being resorbed at a relatively early stage, but before that time the blebs may already have caused characteristic abnormalities.

The bleb fluid seems as such to be of no harm to the embryo even if through its pressure some blood capillaries may be disturbed. Only when coming into conflict with developmental processes, such as, especially, those of eyes and extremities, may the blebs cause characteristic types of persisting abnormalities.

Convincing facts seem to prove that the bleb fluid has its origin within the young medullar tube and is extruded, in embryos 7 mm long, through an open area (foramen anterius) in the anterior part of the roof of the myelencephalon. The existence of such an area as well as the extrusion through it of some cerebrospinal fluid seems, as first shown by WEED (1917), to be of normal occurrence, the abnormality in our strain of mice consisting in an augmentation of the fluid extruded. The further distribution of the bleb fluid, after its exit from the medullar tube, seems to be governed by merely mechanical forces, the elasticity of the bleb-covering epidermis trying to remove the fluid, especially along the concavities of the embryonic surface relief.

In full accordance with this course of development the recessive abnormality of our mouse tribe is highly varying with regard to its expression (TIMOFÉEFF), and even more so in born individuals than in embryos, even if its penetrance is upon the whole very high. After they have been outcrossed with other mouse races, normal with regard to the factors in question, we find however a remarkable change of specificity causing changes in the occurrence of abnormalities on forefeet and hind feet as well as changes with regard to the symmetry relations, especially of forefoot abnormalities. Modifying factors seem, therefore, to have been introduced by the various out-cross races.

A thorough analysis of the abnormalities in embryonic as well as post-embryonic stages has shown that the final types of anomalies are, each of them, due to specific localizations of the embryonic blebs. A change of

specificity of the abnormalities should therefore be supposed to be due to a corresponding change of localization of the foregoing embryonic blebs, or, in other words, if our supposition of a mechanical distribution of the bleb fluid on the embryonic surface is correct, we should expect to find as one of the first manifestations of the modifying factors a series of changes in the embryonic surface-relief. An investigation on enlarged photographs of a large number of embryos from the out-cross races as well as from groups of extracted abnormals has in fact also proved that different mouse races are characterized by specific variations of their surface-relief in young embryonic stages. A direct correlation has, further, also been found to exist between the statistical occurrence of an embryonic concavity across the shoulder region and the number of forefoot abnormalities within the various groups of extracted abnormals.

Summing up, we have before us a monohybrid recessive gene causing, in the first instance, an abnormal augmentation of cerebrospinal fluid in embryos less than 7 mm in length. This surplus of fluid, after being extruded through the foramen anterius of the medulla oblongata, causes a bleb formation under the embryonic epidermis, which may further cause persistent abnormalities of eyes and feet. Modifying genes, introduced by out-cross races and influencing the surface-relief of young embryos, are causing a change of localization of the embryonic blebs and through this a change of specificity of the final abnormality.

THE MORPHOLOGICAL EXPRESSION OF DIOECIOUSNESS IN THE GRAPE

M. J. Dorsey, University of Illinois, Urbana, Illinois

The appearance of the perfect flower in the grape bearing both functional pollen and pistil is an event of considerable genetic and horticultural importance. The different species have usually been classified as dioecious by botanists, but in the horticultural varieties the hermaphroditic type of flowers is quite common. Since there seems to be some contradiction as to how far development proceeds in the pollen and pistil of the dioecious flowers, this study had as its objective the clearing up of that point.

Extensive germination tests were made of a large number of pollen grains taken from the reflexed type of anther, and over a three-year period none were found to germinate. In the pollen of the reflexed stamens studied germ pores were not present. These results would seem to throw open to question the validity of self-pollinations or crosses between varieties bearing the reflexed type of stamens and seem to run counter to the idea of the "mixed" pollen of some of the early investigators.

An examination was made of the extent of pistil development in a large number of staminate and intermediate flowers. In the early stages no distinction could be made between the strictly pistillate flower and the staminate or intermediate types. At bloom, however, great variation was found in the development of the embryo sac and attendant structures in the pistillate and intermediate flowers. In some instances there was abundant stigmatic tissue, but an aborted ovule and embryo sac, while in others there was an apparently normal embryo sac but no stigma. Fruit-setting in these types may therefore be prevented by two quite distinct causes. This condition should be taken into consideration in classifying seedlings as to flower type. It also shows how closely pistil development approximates the hermaphroditic condition in the intermediates and the occasional "wild vine" which sometimes sets fruit.

HEREDITY IN GUINEA FOWLS[1]

A. Ghigi, University, Bologna, Italy

In this paper I deal first with the factors which determine the color differences in each of the domestic breeds of guinea fowls; I then study the results of crossings between several wild varieties and domestic breeds of the genus Numida and state the first results I have obtained by crossing several wild varieties of Guttera.

Guinea fowls have been widely raised in Italy for about a century, several breeds being known which differed only in color. They are the following: (1) Common Grey, corresponding to the wild *Numida meleagris galeata* of Guinea, a variety which differs from all others in that the feathers at the base of the neck are uniformly purplish violet; (2) Lilac, very much like the preceding save that the fundamental hue of its body is a very pale lilac; (3) Pavonated or Violet, a variety free from pearly spots except on the long feathers at the sides and along the rachis of the feathers of some other parts of the body. Its fundamental hue is very dark, almost black, abundantly tinged with violet, which, under the action of the sunlight, becomes brown. A specimen of this breed obtained by REICHENOW from Africa is the *Numida zechi* type. Through the kindness of STRESEMANN I have examined this specimen and found that it is exactly identical with the domestic Pavonated breed. (4) White, a thorough albino, both on account of the depigmentation of its skin and of the whiteness of its feathers on which no trace of pearly spots is to be found.

In France instead of the White breed they raise a variety which I have called Spotted Light Buff. The skin of this variety is pigmented, having a

[1] A summary of this article is given in Italian in volume 2, page 60.

fundamental yellowish-white color, extremely light, on which one readily notices conspicuous pearly spots.

My first experiments were concerned with the behavior of the breeds 1, 2, and 3 in comparison with the White (albino). The albino is completely recessive with respect to any color whatsoever, but the behavior of this factor is curious. The entire F_1 generation is uniform and grey with a white spot in the center of the breast. In the F_2 generation a systematic segregation of the pure factors of the ancestors takes place; in the heterozygotic individuals, however, the white behaves so as to seem due to multiple factors, for it extends to all the lower parts, including the primaries and the adjoining secondaries, which, when not in motion, remain in close contact with the white abdomen. It is an interesting fact that not a white spot is ever to be found on the back; one might say that color predominates in the upper parts, while white is more or less preponderant in the lower parts, having an area of diffusion which radiates from a central point on the breast.

Later on I undertook to establish the genetic differential value of the colors which characterize the breeds 1, 2, and 3. I found that the Common Grey variety completely dominates the Lilac (2), and the Violet (3) varieties.

The hybrid F_1 of Grey and Lilac produces in F_2 three-fourths of Grey and one-fourth of Lilac, and the hybrid F_1 of Grey and Violet produces in F_2 three-fourths of Grey and one-fourth of Violet.

I have concluded, therefore, that in these three breeds two pairs of antagonistic factors exist, which I have set forth as follows: *M*, margarogen or pearl-producing factor, is present in the Common Grey and Lilac breeds. In the Pavonated it is replaced by *m*, which inhibits the pearl formation on the greater part of the body. *I* determines the fundamental dark color in the Common Grey and in the Violet (*zechi*). It is replaced by *i*, in the Lilac, the fundamental color of which is pale. These four factors are combined as follows: *MI* in the Common Grey, *mI* in the Pavonated (*zechi*) and *Mi* in the Lilac. The combination *mi* could be foreseen; as a matter of fact, I had obtained it in 1924 by crossing the Pavonated breed (*mI*) with the Lilac (*Mi*), getting the following results:

P $mmII \times MMii$
F_1 $MmIi \times MmIi$ phenotypically common grey
F_2 9 MI+3 mI+3 Mi+1mi

The last of these varieties, doubly recessive, is the Ghigi Blue guinea fowl, in which the pearly spots are confined to the sides as in the *zechi*. Its funda-

mental color, however, is not pale, as in the Lilac, but decidedly tinged with blue.

So long as the crossings take place within these four breeds, the behavior of the factors is regular, and the results are those usually obtained with dihybrids.

During the two-year period, 1928-29, I sought to find the value of the Spotted Light Buff breed. This breed possesses the margarogen factor (*M*). As for its fundamental pale brownish-yellow color, I had observed that it varied in intensity, some specimens being somewhat darker and more differentiated and others so light as to seem white. This difference is noticeable even at birth, for some chicks show very conspicuous longitudinal stripes of a tawny hue, while others are lightly colored with a dirty white. Furthermore, the greater intensity of this characteristic seems to be linked to the female sex. In fact, while I have obtained females of various shades of color, the males have always been very light, almost white.

Therefore, by crossing the Spotted Light Buff breed with the Violet of formula *mI* I have obtained in the F_1 an atavistic result: all the chicks came grey like the wild guinea fowl and like those obtained by crossing the Lilac and Violet breeds.

The result in the F_2 was the following:

Pearly Grey	177
Lilac	4
Violet (*zechi*)	60
Blue	4
Spotted Light Buff with pearls	49
Spotted Light Buff without pearls	17

The last group represents a new homozygotic combination, in which the yellowish (light-buff) color is associated with the factor *m*, which inhibits the extension of the margarogen factor.

There seems to be no doubt that the factor for the pale brown (which for the time being I shall designate by the symbol *X*, meaning thereby that it is an undetermined factor) is recessive with respect to (*I*), since it (that is, factor *X*) in the table given above does not exceed by much one quarter of the specimens possessing the factor of intensity (*I*). However, having crossed this year the two doubly recessive varieties, the Blue of formula *mi* with the new form Light Buff without pearls, which should have the same factors plus *X*, we find in the progeny 15 Pavonated, in which the factor (*I*) is undoubtedly present, and four Blue chicks. The fundamental color *X* is,

therefore, recessive with respect to the blue color and might be a mutant, but I can not account for the rise of the combination for the Pavonated which has the factor (*I*). On the other hand, in 1931 a certain number of specimens from the Light Buff group were obtained that were almost white, with a greyish tinge, and that bore a resemblance to their parents. These specimens are now being studied. It still remains to be seen how the Pavonated, produced by crossing the Blue with the Light Buff, will behave in the F_2.

This second new breed of a pale yellowish-brown color without spots, as well as the grey-tinged 1931 specimens, exhibits the same characteristics as the Spotted Light Buff: (1) variability of the intensity of the fundamental color and (2) linkage of a greater intensity with the female sex.

During the last few years I have repeated the crossing of the *Numida meleagris domestica* with the *Numida ptilorhynca,* which I had done as early as 1912. This time, however, I have been substituting the Lilac breed for the Common Grey, in the domestic variety, and the subspecies *Somaliensis* for the typical *ptilorhynca,* in the wild variety.

The findings concerning the behavior of the bristle-like nasal papillae of the latter have been confirmed. This behavior, considering the absence of the papillae in the *meleagris,* is exactly that of a multiple character. In the segregation in F_2 many specimens are produced which show nasal excrescences similar to those formerly designated as papillae.

I have also produced a homozygotic strain for the lilac color in which the facial characteristics, although still oscillating, are strongly accentuated. We have in this case a correlation between the specific characters and those of a recent mutant occurring in the domestic variety.

During the last three years I have also crossed *Numida meleagris* with *N. mitrata,* obtaining in the F_1 intermediate and uniform hybrids which have caused in the F_2 the greatest segregation concerning the few differential characteristics. The wine-colored ring at the base of the neck of the *meleagris* reappears in many specimens as a fundamental color separating the white transversal stripes. These stripes in the *mitrata* have a greyish-black background. The shape of the wattles causes many and varied combinations. However, while in some specimens we find a reversion to the form and size of the *meleagris,* none shows the characteristic thinness of the *mitrata.* An analytical study of these characteristics can be made only late in the fall after growth and molting have stopped.

The most important fact is the complete fecundity of the hybrids of the three wild breeds, *meleagris, mitrata,* and *ptilorhynca,* which segregate, variously correlated, the characteristics of the parental species.

Therefore, one feels authorized to modify the systematics of the genus Numida, which experiments have shown to be constituted of one single species separable into many geographic breeds to which it is wrong to attribute any specific value.

I have obtained the same result as concerns the oriental varieties of the genus Guttera (crested guinea fowl). A female hybrid, *G. liridicollis* × *G. barbata,* laid this year, for the first time, eleven eggs which were proved to have been fecundated by a *G. pucherani* cock. My previsions of some time ago concerning the genesis of these varieties localized in the damp forests of equatorial Africa have, therefore, been confirmed by experiment; this experiment also proves that in this case hybridization is one of the greatest factors in the production of varieties which the systematists are accustomed to consider as distinct species.

INHERITANCE OF COCOON COLOR AND OTHER CHARACTERS IN SILKWORMS

Carlo Jucci, R. Università di Sassari, Sassari, Italy

Silkworms (*Bombyx mori*) constitute very fine material for the dynamic study of inheritance since it is possible to follow the characters in all the stages of their organic development in order to find out how the characteristic genetic potentiality transmitted by the parents develops when once at work in the new organism.

In respect to the growth curve the three-molting breeds differ sharply from the four-molting ones, and the bivoltine breeds from the univoltine. In comparison with the four-molting ones the three-molting breeds show less growth because they economize one of the molts by deferring as long as possible the rejuvenating process of the organism, which finds itself compelled to advance at a slower rate. The bivoltine breeds also show less growth than the univoltine ones, a growth less not in its relative value, since the growth capacity is the same or almost so in both, but in its absolute value, because the hatching weight is lower, in view of the fact that the eggs of the bivoltine breeds (which give two generations a year) are smaller. The number of the molts behaves as a Mendelian factor; the voltinism certainly depends upon many factors, and the problem of its genetic behavior merges in the general problem of inheritance of metabolic type.

The developmental capacity of the egg depends upon the constitution of the egg itself, determined in turn by the physiological constitution of the maternal organism. So the developmental capacities of the fertilized egg and of the virgin egg (capacity for sinechepidosis and capacity for partheno-

genesis) are an excellent index of the physiological capacity of the individual and of the breed.

It is possible to follow growth capacity in the reciprocal crosses in the successive stages of larval development. As regards the weight at the end of the larval period, there appears to be a decided predominance of the maternal character. The initial advantage given by the cytoplasmic supply of the egg is so great that it is not lost in the course of the postembryonic life.

Opaque skin is a Mendelian factor that is dominant over transparent skin, and in F_2 segregation occurs in the classic ratio 3:1. The transparent-skin character seems to be caused by the deficiency in the hypodermic cells of the urate crystalline granules to which the skin of the common breeds owes its characteristic opacity. When the opaque-skinned worms get ripe, the urates contained in the hypodermic cells redissolve, so that the uric content of the blood rises to a level about three times higher. Nothing like it takes place in the transparent-skinned silkworms. Therefore, in physiological terms, the opaque-skin factor consists in the capacity of the hypodermic cells to extract urates from the blood, accumulating them in the cytoplasm in the form of crystalline concretions.

In *Bombyx mori* there occurs a migration of the pigments from the blood of the silkworm to the secretion of silk glands; this is the origin of the yellow color of the cocoon (carotinoids, carotin and xanthophyll, derived from the mulberry leaves). The "capacity of migration" behaves as a Mendelian unit character dominant over the "incapacity of migration" (silkworms with yellow blood and white cocoon). The two races Chinese Golden (Oro Chinese) and European Yellow (Giallo Indigène) both possess capacity of migration, but the migrations occur at a different time, that is, before maturation in the Golden and after in the Yellow race. So, notwithstanding the fact that the total quantity of pigment is the same or about the same for the same quantity of silk, the cocoons of Golden are a deeply golden yellow while the cocoons of Yellow are pale yellow; but inside the reverse is true and the pigment distribution is just inverted. In the F_1 of the hybrid ♀ Golden× ♂ Yellow (and reciprocal) the pigment distribution in the cocoon's layers and the "degree of precocity of pigment migration" from blood to silk are intermediate between those of the parental races. If the two races Golden and Yellow are crossed with the same White Japanese race, the F_1 hybrids get the "migration time" characteristic of the parental blood colored race; so the two crosses ♀ Golden× ♂ White and ♀ White× ♂ Golden produce a Golden cocoon, and the two crosses ♀ Yellow× ♂ White and ♀ White× ♂ Yellow produce a Yellow one. In hybrids having a White mother the

blood is colored no less than in the reciprocal crosses with Golden or Yellow female or in the pure blood-colored races (very strong and most precocious dominance). In addition to carotinoids the silkworms also absorb from the mulberry leaves pigments of the flavone group. Generally these flavones pass through the chrysalis blood to the eggs, contributing to the pigmentation of the yolk (while the cocoon is colored by carotins and xanthophylls migrating from the blood of the ripened silkworm to the silk glands). In some races, however, the flavones pass through the blood to the silk; so in the "Japanese Green" the cocoon pigment "bombiclorina" is a flavone. The "green" character is therefore, in physiological terms, "the capacity of the silk glands for absorbing the flavones from the blood."

Whether or not this capacity is a Mendelian character as is the "capacity of the silk glands for absorbing carotinoids from the blood" only the F_2 of the hybrids can prove.

In the F_1 the "green" is dominant over "white" (that is, permeability for "flavones" dominates over "impermeability") and is recessive to lemon, orange, rose, European yellow (flesh-colored) and golden. The dominance, however, is far from perfect; often the F_1 cocoons demonstrate little uniformity, varying from the type of the yellow race to the type intermediate between the parentals. Also, in the cases in which they are of the yellow type (golden, lemon, orange, flesh-colored, rose) the cocoons contain flavones. The cocoons exposed to NH_3 vapors became characteristically "rusty" owing to the formation of an ammoniacal salt of the flavones. Therefore in the hybrid the two parental characters "capacity of the silk glands for absorbing carotinoids" and "capacity for absorbing flavones" are both developing, if the "green" keeps chromatically concealed. The reaction in the F_2 of the "rusting" by NH_3 is expected to be valuable as a means of establishing the ratios of dissociation between the parental characters, ratios which should not be easy to establish by any other means because the "permeability for flavones" is evident only in absence of "permeability for carotinoids."

The lack of uniformity of the F_1 of crosses between green and yellow races is probably due to the presence in some individuals of the green race of some factor concerned in the "carotinoids permeability," or to the presence in some individual of the yellow races of some factor concerned in the "flavones permeability" (being not sufficient, when alone, to produce its effect, the gene would keep potential so the ordinary selection could not remove it).

CYTOLOGICAL STUDIES IN THE DIPLOID OFFSPRING OF A HAPLOID OENOTHERA

J. Adolph Leliveld, Botanical Institute, Amsterdam, Netherlands

Of late years crosses made between Oenothera species have sometimes resulted in a yield of haploids. STOMPS (1930) reports that the reduction division in these haploids may give in a single case a normal pollen grain or embryo sac with seven chromosomes. It may be understood that in this way a self-pollination yields a new diploid plant.

As a matter of fact, such a diploid plant may be presumed to possess two quite homologous groups of seven chromosomes and, correspondingly, the cytological behavior should be that of an entirely homologous type.

In the year 1931, some fixations were made of the F_2 of such a new diploid *Oe. franciscana.* The haploid from which it originated was the result of a pseudo-cross between *Oe. franciscana,* the cytology of which had been studied earlier, and *Oe. longiflora.* The original *Oe. franciscana* had seven loose pairs of chromosomes.

The cytological results, however, did not correspond to the expectations. Diakinesis was the first stage remarkable by its deviations: chromosome pairing by two's occurred, but this was seldom the case. By far the greater part of the nuclei studied showed the pairs locked up by two's, or even an interlocking of three or more pairs was seen. Besides these constellations chains of four and even once a chain of six chromosomes were noticed.

Prometaphase proved to be in the possession of a still considerable number of linkages: the interlockings became more rare; there seemed to be a tendency to loosen the connections and to come to an entire pairing-up of the chromosomes. Thus, a large part of the nuclei showed one to three pairs lying apart from the others: they possessed only one terminal connection between the two chromosomes. In almost all nuclei the last-mentioned type of pairs was present, but they were not always apart from the other pairs.

Early metaphase was interesting on account of the progressive diminution of the number of linkages or interlockings. Part of the pairs were ring-shaped, part of them possessed one terminal connection, and these last ones in a considerable number of cases lay apart.

According to a number of investigators of the present time, ring and chain formations and interlockings would be the result of structural heterozygosity. Here, however, any heterozygosity whatever of the homologous chromosomes is excluded.

The question arises whether the pairs with the single terminal connection do not arise from the loosening of the interlockings.

When one keeps it in view that the behavior of the chromosomes during diakinesis and prometaphase equalizes to a normal metaphase, the question arises anew whether the said behavior in diakinesis and the following stages, that is, the mean average of the configurations with its corollary deviations, may not be taken as a fact inherent to the species instead of being the direct result of the genetical make-up of the type. This idea has already been advocated by some of the Oenothera investigators.

DIE GENETISCHEN BEZIEHUNGEN ZWISCHEN KÖRPERFARBE UND AUGENFARBE BEIM KANINCHEN

Hans Nachtsheim, Institut für Vererbungsforschung der Landwirtschaftlichen Hochschule, Berlin-Dahlem, Germany

Der Vortragende berichtet über von ihm in den letzten Jahren ausgeführte Versuche mit Kaninchen, deren Ziel die Klarlegung der zum Teil sehr innigen genetischen Beziehungen zwischen Körperfarbe und Augenfarbe ist.

Zunächst wird die Wirkung der verschiedenen Farbfaktoren auf Haar- und Irisfarbe betrachtet. Die Kombination der dominanten Faktoren liefert die für das Wildkaninchen charakteristische sogenannte Wildfärbung und dunkelbraune Irisfarbe. Je mehr rezessive Farbfaktoren an die Stelle der dominanten treten, um so stärker wird das Haarkleid aufgehellt. Mit der Aufhellung des Haarkleides geht im allgemeinen eine Reduktion der Irispigmentierung Hand in Hand, doch zeigt es sich, dass nicht alle Farbfaktoren Haar und Iris in gleichem Masse beeinflussen; einige Faktoren, die das Haarkleid stark beeinflussen, sind auf die Irispigmentierung nur schwach oder überhaupt nicht wirksam. So unterscheidet sich ein schwarzes Kaninchen von einem wildfarbigen durch das Fehlen des Wildfarbigkeitsfaktors. Zwischen der Augenfarbe eines schwarzen und der eines wildfarbigen Kaninchens ist jedoch kein Unterschied. Eine Besonderheit bietet das sogenannte marmorierte Auge mancher Chinchillakaninchen dar. Hier scheint ein Faktor im Spiele zu sein, der die Irispigmentierung reduziert, ohne auf das Haarkleid einen entsprechenden Einfluss zu haben. Bisher wurde das marmorierte Auge *nur* bei Chinchillakaninchen beobachtet. Ob dies in einer engen Koppelung zwischen dem Faktor für marmorierte Augen und dem Chinchillafaktor seine Erklärung findet, oder ob noch innigere genetische Beziehungen zwischen den beiden Merkmalen bestehen, bedarf noch der weiteren Prüfung.

Neben den eigentlichen Farbfaktoren zeigen die Faktoren für Leuzismus und Scheckung besonders interessante Beziehungen zur Augenfarbe. Englische und holländische Scheckung sind zwei genetisch verschiedene und

auch phänotypisch leicht zu unterscheidende Scheckungstypen. Die Englische Scheckung ist dominant, die Holländerscheckung ist mehr oder weniger rezessiv gegenüber Einfarbigkeit. Beiden Typen gemeinsam ist eine starke Variabilität; das eine Extrem ist ein Tier mit sehr viel Pigment und nur geringen weissen Abzeichen, das andere Extrem ist ein fast weisses Tier mit nur ganz kleinen Pigmentzentren. Bei der Englischen Schecke entspricht die Augenfarbe, gleichgültig wie der Scheckungsgrad ist, immer der Haarpigmentierung, d. h. eine schwarz-weisse Englische Schecke hat dunkelbraune, eine braun-weisse braune, eine blau-weisse graublaue Augen usw., auch bei extrem-weissen Englischen Schecken, wo sich die Haarpigmentierung auf schmale Augenringe und gefärbte Ohren beschränkt. Bei der Holländerschecke hingegen entspricht die Augenfarbe der Haarpigmentierung nur bei den mittleren Scheckungsgraden und den extrem-gefärbten Tieren. Bei den extrem-weissen Tieren mit nur kleinen Pigmentzentren um die Augen und am Schwanz sind die Augen blau ohne Rücksicht auf das Haarpigment (sogenannte Glasaugen) oder auch—bei etwas stärker pigmentierten Tieren—zweifarbig, d. h. blau und dunkelbraun, braun, graublau usw., entsprechend der Haarpigmentierung (Heterochromie). Das blaue Auge der extrem-weissen Holländer entspricht morphologisch vollkommen dem blauen Auge des leuzistischen Weissen Wiener-Kaninchens, d. h. im vorderen Teil der Iris fehlt das Pigment, Retina und hintere Irisschicht aber sind pigmentiert, und nach dem Prinzip der halbdurchsichtigen Medien kommt so die blaue Augenfarbe zustande. Die Holländerfaktoren, die das blaue Auge hervorbringen, sind andere als der Weisse Wiener-Faktor, doch zeigt sich ein Zusammenwirken dieser Faktoren im Kombinationsprodukt. Wird der Weisse Wiener-Faktor in einfacher Dosis in Holländer gebracht, so treten blaue Augen und Heterochromie auch bei Holländern mittleren Scheckungsgrades und extrem-gefärbten Tieren auf. Der Weisse Wiener-Faktor zeigt diese Wirkung auf die Irisfarbe aber nur im Zusammenwirken mit Holländerfaktoren, in Englischen Schecken ist es in einfasher Dosis ebenso unwirksam wie in ganzgefärbten Tieren ohne Scheckungsfaktoren. Bei einer Verbindung der beiden Scheckungstypen ist die Englische Scheckung epistatisch über die Holländerscheckung, soweit die Haarfarbe in Frage kommt. Bezüglich der Augenfarbe ist die Holländerscheckung epistatisch, d. h. Englische Schecken können Glasaugen und Heterochromie aufweisen, wenn sie gleichzeitig extrem-weisse Holländerschecken sind, und kommt noch der Weisse Wiener-Faktor in einfacher Dosis hinzu, so spielt er die gleiche Rolle wie bei der Kreuzung mit reinen Holländern.

Schliesslich wird noch das Zusammenwirken des Weissen Wiener-Faktors

mit den verschiedenen Allelen der Albinoserie besprochen. Bei der Kreuzung von Weissen Wienern mit Albinos erhält man in F_1 gefärbte Tiere und in F_2 neben den anderen Typen doppelt-rezessive Individuen, "Weisse Wiener-Albinos," die im Phänotyp Albinos sind. Der Albinofaktor ist also epistatisch über den Weissen Wiener-Faktor. Bei der Kreuzung von Weissen Wienern mit dem nächst-höheren Typ der Albinoserie, dem Russenkaninchen, erhält man wiederum in F_1 gefärbte Tiere und in F_2 als doppelt-rezessive Individuen "Weisse Wiener-Russen." Diese sind im Phänotyp weder Weisse Wiener noch Russen, sondern vollkommene Albinos mit roten Augen, es sind synthetische Albinos ohne Albinofaktor. Die Paarung dieser phänotypischen Albinos mit "normalen" genotypischen Albinos liefert nicht wiederum Albinos, wie sonst jede Paarung albinotischer Tiere, sondern Russenkaninchen. Die Versuche mit Weissen Wienern und den höheren Typen der Albinoserie haben noch nicht zu endgültigen Ergebnissen geführt, doch kann als sicher gelten, dass im Zusammenwirken des Weissen Wiener-Faktors mit den höheren Allelen der Albinoserie ein Wechsel in den Epistase-Verhältnissen eintritt, der bei den "Weissen Wiener-Russen" bereits eingeleitet ist.

DOES THE ENVIRONMENT CAUSE GENETICAL CHANGE IN MAN?

Boleslaw Rosiński, Lwów, Poland

The paper I am going to present does not deal with the inheritance of any particular character in man in a strictly genetical sense. It is a statistical work on the cephalic index. I was interested as to whether the cephalic index of man will undergo any changes after he has lived for one or more generations in different conditions of environment. Stated specifically, I studied the cephalic index of the Polish people in their native country and compared it with that of the offspring born in Texas to Polish immigrants.

Many research students who have investigated the European people of the present and past have stated that they are composed of distinct anthropological types. According to the theory of CZEKANOWSKI there exist four fundamental elements in Europe: Nordic, Laponoid, Armenoid and Ibero-Insular. From these elements there are derived the six other types (secondary types) in this way: Northwestern from Nordic and Ibero-Insular, Subnordic from Nordic and Laponoid, Dinaric from Nordic and Armenoid, Alpine from Laponoid and Armenoid, Preslav from Laponoid and Ibero-Insular and Litoral from Armenoid and Ibero-Insular. Therefore an intermingled European population can be represented by the following equation:

$$a^2+l^2+h^2+e^2+2al+2ah+2ae+2lh+2le+2he=1$$

In this equation a indicates the Nordic, l, the Laponoid, h, the Armenoid and e the Ibero-Insular element, whereas 2al, 2ah, 2ae, 2lh, 2le and 2he indicate the secondary types.

Having this equation, we can define the percentage of the fundamental elements of which the different populations are composed. Among the American people of Polish origin born in Texas we have established the following anthropological types:

		Men		*Women*	
Anthropological type		*Number*	*Percentage*	*Number*	*Percentage*
Nordic	a^2	63	17.2	47	12.8
Northwestern	2ae	53	14.4	40	10.9
Subnordic	2al	124	33.8	134	36.6
Laponoid	l^2	38	10.4	36	9.8
Preslav	2le	31	8.5	37	10.1
Litoral	2he	8	2.2	3	0.8
Dinaric	2ah	37	10.1	31	8.5
Alpine	2lh	13	3.5	38	10.4
Amount		367	100.1	366	99.9

From these percentages of the anthropological types we can derive the percentage of fundamental elements of which our population is composed. These are as follows:

	Men	*Women*
Elements	*Percentage*	*Percentage*
Nordic a	41.4	35.8
Laponoid l	37.0	40.9
Armenoid h	8.3	10.3
Ibero-Insular e	13.4	12.9
	100.1	99.9

According to the anthropological characteristic of fundamental elements the theoretical cephalic index of the skull of the Nordic element can be regarded as equal to 76.0, that of the Laponoid and the Armenoid to 88.0 and that of the Ibero-Insular to 68.5. For the European people of the present time the average of the theoretical calculated cephalic index will be in agreement with the average of actual cephalic index obtained by the measurements if we accept the dominance of the cephalic index of Armenoid and Laponoid over that of Nordic and of Ibero-Insular. Similarly the cephalic index of Nordic dominates over Ibero-Insular.

In order to answer the question of whether the environment changes the dominance of cephalic index in man I have calculated the theoretical cephalic index of Polish offspring born in Texas and compared it with the actual

index obtained by the measurements. The average of the actual cephalic index of American people of Polish origin born in Texas equals:

Men	A 83.66 ± 0.13. $v = 4.23 \pm 0.10$
Women	A 84.42 ± 0.13. $v = 4.23 \pm 0.11$

There is a perfect agreement between the theoretical and actual average of cephalic index if we accept for the Texas born offspring the dominance of the same anthropological types over the others as we have in Poland. The theoretical calculated index under these conditions equals:

Men	M—83.08
Women	M—83.89

The small difference between the actual and the theoretical indexes can be explained by the fact that the theoretical index refers to the skulls and the actual index is based on measurements of living people. It is known that the skull index is lower than the head index.

This result seems to justify the conclusion that the environment does not change the dominance of cephalic index in man.

EPILEPSY, TWINS AND HEREDITY

J. Sanders, Rotterdam, Netherlands

I had the opportunity to investigate 3 pairs of identical and 1 pair of non-identical twins who had epilepsy. I will begin by telling you something about these twins.

WILHELMINA B. and NEELTJE B. were born July 24, 1915. At the age of 4 years MIEN had a convulsion. Some days later NEL had one. Sudden unconsciousness was followed by shock of the extremities and the head. MIEN had a convulsion of one-half hour's duration, NEL one of one hour. After these convulsions the children had more small ones. At the age of 14 years NEL had a bad attack. MIEN had a bad attack at the age of 15½ years after a fright caused by a fire which also caused NEL to have an attack.

The children are both right-handed. They were the same at school. NEL helps the mother at home because she cannot go into a business in consequence of the severe attacks; MIEN sews at a shop.

The father as a child had some convulsions as did also a sister of the mother. This sister could not learn and has now sometimes a strange feeling of changed consciousness. The physician considers these attacks of this mentally deficient woman to be epileptic.

The skin of MIEN and NEL is nearly the same. The teeth and the jaws differ, due in great part to the bad condition of the teeth. Investigation shows that psychologically the twins are not nearly the same. The I.Q. of MIEN amounts to 80 and that of NEL to 90. They belong to the group of the backward-normal persons.

Anthropometrically there is little difference. MIEN is a little taller and heavier than NEL, but the indices are nearly the same. They both have strabismus convergens manifestus, but it is worse in MIEN. Objectively there is a great conformity between the eyes of MIEN and the eyes of NEL. Dactyloscopically they differ. The formula, in accordance with HENRY, is

$\frac{25\ o\ o}{3\ o\ o}$ for MIEN and $\frac{17\ m\ o}{27\ m\ o}$ for NEL.

The second pair of twins were born August 15, 1919. At the age of 3 years JAN had the first epileptic attack; COR's came one-half year later. They had one each month until 2 years ago. Since 1930 they have had more severe attacks. The epilepsy of COR is more severe than that of JAN. The mother has had 9 children, all alive. Two children are mentally deficient and one has also had some attacks. The father had epileptic attacks from the time he was twelve until he was thirty years of age.

The teeth and jaws of JAN and COR have much conformity with each other. Psychologically the twins are rather similar. The I.Q. of JAN is 81, of COR 84. They belong to the backward-normal children. They also conform anthropometrically. Objectively the eyes are nearly the same. Both are right-handed. There is difference in the fingerprints. The formula according to HENRY is in COR $\frac{25\ i\ m}{27\ o\ o}$, in JAN $\frac{25\ i\ i}{11\ o\ o}$.

The third pair of twins, the children G., were born December 3, 1921. NINI G. had many convulsions in the second year of her life. She has had epileptic attacks since her eighth year. JOOPJE had the first convulsion the same day as NINI but has been free from them since her fourth year. NINI now has many very severe attacks. In the last 3 years she has been unable to go to school. Before that time she was number 4 at school, JOOPJE number 2. NINI could learn very well. JOOPJE is an intelligent child with an I.Q. of 115. NINI is now very slow and has the intelligence of a child of 6 years. She has been growing very fast during the last 3 months, so that her weight is 8 K.G. higher than that of JOOPJE. The epileptic attacks have injured her mind.

The children conform very much anthropometrically, in the eyes and dactyloscopically. The formula according to HENRY for the fingerprints of both children is $\frac{1\,U\,i}{1\,A\,i}$. In the family there is no epilepsy or other psychosis.

The fourth pair of twins is not identical. They were born November 1, 1928. These children are not of the same sex. JOPIE M. had the first epileptic attack at the age of nine months. Next day MARY had a similar attack. The number of attacks of MARY is 5 daily, of JOPIE, one. The grandmother on the mother's side was a melancholiac.

I have here been describing very briefly 4 pairs of twins, all with epilepsy. In the literature I found published the following cases of epilepsy of twins.

	Identical twins		*Non-identical twins*	
Investigator	*Concordant*	*Discordant*	*Concordant*	*Discordant*
LUXEMBURGER	6	4	..	7
LEGRAS	2	1	..	1
OLKON	1	..	..	..
LOTTIG	1	..	..	..
ROSANOFF	3	1	1	7

With my own cases I get the following numbers:

Identical twins		*Non-identical twins*	
Concordant	*Discordant*	*Concordant*	*Discordant*
16	6	2	15

So the hereditary index of epilepsy amounts to

$$\frac{16}{6} : \frac{2}{15} = 20$$

This index points to a hereditary factor. But the numbers are small, so the result is not very reliable. We must wait for our final conclusion until many more cases have been published. These must not include identical twins only. The non-identical twins are of the same importance for any conclusion.

THE INHERITANCE OF TWO TYPES OF TASTE DEFICIENCY IN MAN

Laurence H. Snyder, Ohio State University, Columbus, Ohio

The taste deficiency for phenyl-thio-carbamide is clearly shown to be a simple autosomal recessive character. One thousand families are presented in support of this statement. The data are treated statistically, and all deviations are less than their probable errors. The taste deficiency for a second

compound, di-ortho-tolyl-thio-carbamide, is shown by means of 200 families. This deficiency is not a simple recessive character, as evidenced by the fact that in many families in which neither parent tastes the compound some of the children do. An additional fact noted is that while many individuals taste both compounds, many taste phenyl-thio-carbamide only, and many taste neither compound, no one seems to taste di-ortho-tolyl-thio-carbamide only. These two facts taken together point to an epistatic relationship of the factors. A hypothesis which satisfies all the facts and meets all the statistical requirements is offered. This involves two pairs of factors with peculiar epistatic relationships. These taste deficiencies, adding as they do to our list of common unit factors in man, provide suitable material for linkage studies in man.

ESSAI D'ANALYSE PHOTOGRAPHIQUE D'UNE SPORÉE TÉTRAPOLAIRE DE PLEUROTUS

R. Vandendries, Rixensart, Brussels, Belgium

Nous avons essayé de rendre compte, par la photographie, des résultats obtenus en confrontant, deux à deux, vingt-six haplontes de *Pleurotus columbinus,* espèce tétrapolaire. Nous disposions d'un tableau de croisements traduisant par des signes les résultats d'une analyse microscopique complète. Quatre groupes sexuels, portant respectivement les facteurs sexuels ab', $a'b'$, ab' et $a'b$, peuvent donner matière à dix pairages différents:

1. Deux de ces combinaisons sont fertiles et produisent des mycéliums diploides, porteurs d'anses d'anastomose. Ce sont les combinaisons $ab \times a'b'$ et $a'b \times ab'$, où les deux individus confrontés ont leurs deux facteurs sexuels différents. Nos photographies de cultures sur disques d'agar permettent de reconnaître morphologiquement ces croisements fertiles.

2. Les confrontations d'individus de même formule sexuelle, au nombre de quatre, savior: $ab \times ab$, $a'b' \times a'b'$, $a'b \times a'b$ et $ab' \times ab'$ montrent que les deux mycéliums confrontés croissant l'un dans l'autre comme le font deux boutures d'un même individu. Nos photographies sont éminemment suggestions à ce sujet et démontrent cette analogie.

3. Les confrontations d'individus ayant un facteur sexuel commun au nombre de quatre: $ab \times ab'$, $a'b \times a'b'$, $ab \times a'b$ et $ab' \times a'b'$. Ces quatre groupes de combinaisons sont stériles. Mais ici une discrimination est possible et parfaitement rendue par la photographie. Entre les individus de formule ab et ceux de formule ab' se manifeste une répulsion caractérisée par un barrage net; pareil barrage se manifeste entre les individus du groupe $a'b$ et ceux du groupe $a'b'$. Il résulte de là que la cause déterminante du barrage est la presence du même facteur soit a, soit a', attaché aux facteurs

différents b et b'. Nos photographies donnent une démonstration très nette du phénomène et de son caractere général. Ce résultat confirme celui de OORT sur *Coprinus fimetarius*. Au contraire les combinaisons $ab \times a'b$ et $ab' \times a'b'$ où le facteur b ou b' est commun et les facteurs a ou a' sont différents ne donnent pas lieu au barrage. Les individus qui y sont confrontés croissent l'un dans l'autre, sans manifestes de répulsion, mais ils ne se conjuguent ni ne s'anastomosent, la culture reste stérile. Dans quelques cas nous avons pu observer, comme le fit OORT, une action d'inhibition de l'un organisme sur l'autre. Cette action serait donc due à la différence entre les deux facteurs a et a' attachés soit au facteur commun b soit au facteur commun b'. Ces cas de stérilité apparaissent à toute évidence sur nos photographies.

SUR UN CAS D'ALBINISME GÉNÉRAL

Thr. Wlissidis, Athènes, Greece

Dans une note précédente présentée au dernier congrès international biologique sur l'hérédité qui a eu lieu a Berlin le II Séptembre 1927, nous avons exposé une analyse sur l'arbre généalogique jusqu' à la cinqième génération des ancêtres d'un cas d'albinisme général observé sur deux jeunes frères étudiants.

De cette analyse résulte, que le phénomène est recessif et il se limite au sexe mâle.

Nous avons poussé la recherche plus loin et nous avons constaté que le père de ces deux jeunes gens eut aussi d'une autre mère une fille, qui n'a donné aucun signe d'albinisme.

ANIMAL EXHIBITS

COLEOPTERA

HEREDITY IN THE X AND Y CHROMOSOMES OF PHYTODECTA

Exhibitor, A. de Zulueta, Museo Nacional de Ciencias Naturales, Madrid, Spain

Mounted specimens and drawings (made by SERAPIO MARTINEZ, Madrid) of *Phytodecta variabilis* are shown. These represent several different color patterns whose genes are transmitted both through the X and the Y chromosome. The patterns include striped ("de lineas"), yellow ("amarillo"), red ("rojo"), black ("negro") and two others not yet fully investigated. This Chrysomelid beetle lives in Spain in the shrub *Retama sphaerocarpa*, the various patterns being found together but in different proportions in different localities. The distribution of patterns between the sexes also varies greatly. In Madrid the striped pattern is almost confined to the females, while in Granada it occurs with almost equal frequency in both sexes.

LEPIDOPTERA (FIRST SECTION)

Organized by John H. Gerould, Dartmouth College, Hanover, New Hampshire

GENETIC INVESTIGATIONS WITH SILKWORMS

Exhibitor, Carlo Jucci, R. Università di Sassari, Sassari, Italy

Various characters have been studied both in their physiological development and in their genetic behavior. Specimens, pictures and graphs demonstrate the chief results obtained in each subject: growth curve, moult number, developmental capacity of eggs, growth capacity, skin characters (yellow and white, opaque and transparent skinned worms), and color of the blood and of the cocoon.

With reference to the color of the blood and of the cocoon there are shown: (a) the pigment migration from blood to silkworms "fully grown" and "ripe" of several pure breeds and crosses; blood samples in capillary tubes, alcoholic extracts from blood and from silk glands; migration curves in hybrids and in parent breeds; (b) distribution of the pigments in the various layers of the cocoon in Chinese Golden and European Yellow and F_1 hybrids of these two breeds and of each breed with White; (c) F_1 cocoons of various crosses between the "Green" breed and White and Yellow breeds, both normal and "rusted," exposed to NH_3 vapors (showing the presence of flavones also when the green color is concealed, as recessive); (d) Green Japanese cocoons normal, found "rusty," made "rusty" with KOH or NH_3; (e) main cocoon exhibit.

In the main cocoon exhibit there are: (1) pure breeds, lemon, orange, rose, green, golden, white, flesh-colored; (2) F_1 reciprocal hybrids between golden, flesh and white breeds; (3) F_2 hybrids (segregation 3 Yellow : 1 White); (4) F_3 Golden, Yellow and White hybrids and backcrosses; (5 and 6) F_1 reciprocal crosses of Green with White and Yellow breeds; (7) F_1 hybrids of recessive white (Awojiku) with various breeds; (8) F_1 hybrids of dominant white (Bagdad) with various breeds; (9) various F_1 crosses; (10) commercial strains.

LIVESTOCK

DOMESTICATED ANIMALS

Organized by N. I. Vavilov, Institute of Plant Industry, Detskoe Selo, Union of Socialistic Soviet Republics

The ACADEMY OF SCIENCES of the Union of Socialistic Soviet Republics sent the photographs of the results of studies of the primitive domesticated animals in Mongolia and Turkestan.

IMPORTANCE OF PROVED SIRES IN DAIRY CATTLE BREEDING

Exhibitor, Animal Husbandry Department, Cornell University, Ithaca, New York

SUB-LETHAL RECESSIVE GENES IN CATTLE

Exhibitors, O. L. Mohr and C. Wriedt, The University, Oslo, Norway

The demonstration comprised photographs and skeleton material from calves homozygous for recessive genes that cause malformations or abnormalities that lead to death closely after, or in some cases before, birth.

Material from the following six cases was demonstrated: (1) bulldog calves (*Achondroplasia congenita*), Norwegian Telemark breed; (2) amputated calves (*Akroteriasis congenita*), Holstein-Friesians, Sweden; (3) hairless calves (*Hypotrichosis congenita*), Holstein-Friesians, Sweden; (4) short-spine calves, "Elk-calves," Oplandske mountain breed, Norway; (5) calves with rudimentary and completely anchylosed lower jaw, Lyngdal breed, Norway; (6) calves with congenital contractions, Western Norway.

Data demonstrating the recessive inheritance were presented. In all the cases the spreading of the gene in question occurred through a limited number of prominent sires that were heterozygous for the undesirable gene.

INHERITANCE OF SHORT EARS IN GOATS

Exhibitor, S. A. Asdell, Cornell University, Ithaca, New York

A female goat of unknown history has ears projecting one inch from the head. When she is bred to a normal prick-eared male her progeny have intermediate ears. The F_2 (¼ blood) by a normal male approach the normal but are somewhat variable. The backcross of son by normal male to the original goat gives progeny (¾ blood) whose ears closely resemble those of the dam. The condition is one of multiple factor inheritance without dominance. The number of factors is believed to be small. The homozygosity or otherwise of the dam is as yet unknown.

MICE AND RATS

TAIL MUTATION IN MICE

Exhibitor, N. Dobrovolskaia-Zavadskaia, University of Paris, Paris, France

The object of this exhibit is to show the result of selection of some particular forms of the tail mutation in our mice.

The following five forms are represented by the living animals exhibited: (1) Three different lines of mice (XXiX, XiX and agouti) are tailless or have a filiform tail (these two forms could not as yet be separated from one another). They breed true when crossed *inter se* in the limits of each line. They segregate for normals and abnormals when crossed with the normals and in crosses between the lines XXiX and agouti.

The following lines are not breeding true; they segregate in crosses *inter*

se and with the normals, but the abnormals reproduce all or in a considerable proportion one definite form. (2) One line has a compound "kinky tail"; the tail of the abnormals bears always 2 or 3 kinks. Neither taillessness nor filiform tail have been seen for a long time; only a tendency to helicoidal twisting has not yet been eliminated. (3) Another line is characterized by a short straight tail with "filiform tip" (attenuated); small single kinks are not rare at the end of the bony part or between the skeleton and the filament. (4) There is a line with frequent manifestation of a "deficiency" of the skeleton (interrupted). This form has not yet been obtained in such an isolated state as the preceding ones, but cases of deficiency are observed much more frequently than outside of this strain, and transmission from parent to offspring of a similar deficiency is not rare. A father and a daughter, both with a deficiency in the middle of a short tail, are exhibited. (5) The fifth form is illustrated by a male with a tail in the form of a "pendant." He gave descendants with "deficiency" tails, but no one similar to himself. The other cases of "pendant" that were observed in the laboratory behaved in the same way.

POULTRY

MORPHOLOGICAL CHARACTERS AND GROWTH

THE DEVELOPMENT IN VITRO OF THE FOWL BLASTODERM AND OF THE EMBRYONIC FEMUR RUDIMENT (MOTION PICTURE)

Exhibitors, Canti, H. B. Fell and C. H. Waddington, Strangeways Research Laboratory, Cambridge, England

PLANT EXHIBITS

FERNS

EFFECT OF X-RAYS ON FERNS

Exhibitor, Lewis Knudson, Cornell University, Ithaca, New York

FUNGI

Organized by S. Satina, Carnegie Institution of Washington, Cold Spring Harbor, New York

ASCOMYCETES (SECOND SECTION)

TYPES OF SEGREGATION OF SEX AND SELF-STERILITY FACTORS IN THE ASCOMYCETOUS FUNGUS DIAPORTHE

Exhibitor, D. M. Cayley, John Innes Horticultural Institution, Merton, England

This is an exhibit of experimental results showing the inheritance of the phenomenon of intra-perithecial aversion (a peculiar form of self-sterility)

and the different types of segregation of sex and four self-sterility factors in *Diaporthe perniciosa* (Marchal).

The occurrence of intra-perithecial aversion or no aversion depends upon the type of segregation of the four self-sterility factors, *XY, AB,* during meiosis in the parent ascus. The haplont colonies show mutual aversion, irrespective of sex, when the allelomorphs of the self-sterility factors contributed by the two haplonts are not balanced, for example, *XYAb* and *XYAB, Xyab* and *xYaB*. The colonies show no aversion, irrespective of sex, when like meets like (that is, haplonts of the same genetical constitution), for example, *XYAb* and *XYAb, xyaB* and *xyaB;* when haplonts carry one pair of factors (either *XY* or *AB*) in common, and the allelomorphs of the other pair are balanced, for example, *XYAb* and *XYaB, XyAB* and *xYAB;* when the haplonts have no factor in common, for example, *XYAB* and *xyab*. Two haplonts can fuse to form a zygote only when they show no mutual aversion, have no factor in common, and are of opposite sex.

The haplont mycelia carrying intra-perithecial self-sterility aversion factors fall into four groups. All the members of the same group show no aversion, but through lack of balance the members of one group show aversion to all the members of all the other groups. But all the groups have the same factors differently combined; hence they all have the same zygote in common, and when certain types of segregation occur one group can give mycelia of another in its progeny.

Segregation can occur at either the first or second division in the ascus: sex and the self-sterility factors segregate independently of one another at either or both of the meiotic divisions.

PHYCOMYCETES

BASIDIOBOLUS

Exhibitor, Z. Woycicki, University of Warsaw, Poland

GOSSYPIUM (COTTON)

INTERSPECIFIC HYBRIDIZATION WITHIN THE GENUS GOSSYPIUM

Exhibitor, S. S. Kanash, Agricultural Experiment and Plant Breeding Station, Uzbekistan, Union of Socialistic Soviet Republics

A MORPHOLOGICAL STUDY OF THE CHROMOSOMES OF THE COTTON PLANT

Exhibitors, P. A. Baranoff and K. A. Mikhailova, Agricultural Experiment Station, Uzbekistan, Union of Socialistic Soviet Republics

ORYZA (RICE)

HAPLOID PLANT OF RICE

Exhibitor, Toshitaro Morinaga, Kyushu Imperial University, Fukuoka, Japan

In September, 1930, sixteen flowers of a normal variety of rice, Dekiyama, were cross-pollinated with the pollen of a dwarf variety Bunketu-to, producing 13 well developed F_1 seeds. All the F_1 seeds germinated. Of those 13 plants, 12 have grown up very vigorously, showed perfect fertility, and were proved to be true hybrids by their morphological characters. The remaining plant was markedly small compared with the other F_1 individuals. This dwarf F_1 plant, though much reduced in size, resembled Dekiyama, the maternal plant. The plant was highly sterile and produced only one small germinative seed. Both Dekiyama and Bunketu-to possess 24 somatic chromosomes, while the dwarf F_1 plant showed only 12 chromosomes in its root-tips. The reduction divisions of the dwarf F_1 plant were not observed, but the pollen grains produced were very irregular in size. Thus there is no doubt that the small F_1 individual is not a true hybrid but a haploid plant containing only the maternal set of chromosomes. The haploid plant is now growing in the greenhouse.

GENETICS OF WILD SPECIES

Organized by Edgar Anderson, Arnold Arboretum, Boston, Massachusetts
Exhibitor, Arne Muntzing, Svalöf, Sweden

This exhibit consists of herbarium specimens and photographs illustrating work on the genetics and cytology of Galeopsis: pure lines, species crosses, and the artificial synthesis of the tetraploid species *G. Tetrahit.*

Exhibitors, E. M. Marsden-Jones, Potterne, England, and W. B. Turrill, Kew, England

Herbarium specimens are shown which illustrate studies on the species problem in three genera: Centaurea, natural and artificial hybrids; *Ranunculus acris,* sex expression; Silene, genetics of *S. vulgaris* (a very polymorphic species) and *S. maritima.*

Exhibitors, Karl Sax and Edgar Anderson, Arnold Arboretum, Boston, Massachusetts

Maps and charts illustrate the distribution and distinguishing characteristics of the species of Tradescantia native to the United States. Photomicrographs illustrate points of particular interest: triploidy in *T. bracteata;* chromosome interchange in *T. edwardsiana* and in *T. reflexa*; chromosome structure in *T. reflexa.*

Exhibitor, J. W. Gregor, Scottish Plant Breeding Station, Corstorphine, Edinburgh, Scotland

Photographs, drawings and charts illustrating cytological and genetical relationships in wild and cultivated types of timothy (*Phleum alpinum* and *Phleum pratense*) are shown.

PLANT PATENTS

Organized by R. C. Cook, American Genetic Association, Washington, District of Columbia

ADDITIONAL EXHIBITS PRESENTED BY THE SCIENTIFIC INSTITUTES OF THE UNION OF SOCIALISTIC SOVIET REPUBLICS

Organized by N. I. Vavilov, Institute of Plant Industry, Detskoe Selo, Union of Socialistic Soviet Republics

A special group of exhibits was prepared to show the present organization of plant breeding work in the Union of Socialistic Soviet Republics. Two booklets prepared especially for the SIXTH INTERNATIONAL CONGRESS OF GENETICS have been published in English on genetics and plant breeding in the Union of Socialistic Soviet Republics. A series of charts showed the chief results of the studies on the problem of the origin of cultivated plants. The new map of geographical centers of the origin of the most important cultivated plants was shown.

QUANTITATIVE VARIATION IN DIFFERENT PLANTS

Special attention was devoted during the last year to the study of quantitative characters. Charts and maps showed the results of these studies for Cucurbitaceæ, Gramineæ, and vegetables. A new summary of the homologous series for Gramineæ was presented. There were exhibits on variation found in wild fruits such as apples, pears and apricots.

BARLEY

Materials for the new ecological classification of barley (ORLOV) were shown. G. D. KARPETCHENKO prepared tables illustrating the results of crosses between different geographical groups of barley that indicate a great difference in genetic constitution.

MAIZE

KULESHOV (Leningrad) presented two tables showing the world distribution of varieties of Indian corn and their classification according to the number of leaves.

OATS

EMME presented results of species crosses in oats. In the same section are presented new species of oats described by the INSTITUTE OF PLANT INDUSTRY (A. MALZEV, Leningrad), as well as the standard varieties of oats cultivated in the Union of Socialistic Soviet Republics.

POTATOES

The INSTITUTE OF PLANT INDUSTRY (S. M. BUKASOV, Leningrad) presented the results of cytological and morphological studies of new species of potatoes discovered recently in South America. There are altogether 14 species of potatoes cultivated by natives in Peru, Bolivia and Columbia instead of one species (*Solanum tuberosum*) which was supposed to have been the only species cultivated in these regions.

WHEAT

Exhibits were prepared illustrating the new classification of wheat. In this classification several new species discovered in the last few years have been included. The laboratory of the ACADEMY OF SCIENCES (LEPIN) presented the results of the study on the inheritance of quantitative characters in wheat.

GENERAL EXHIBITS

GENERAL CYTOLOGY

Organized by N. I. Vavilov, Institute of Plant Industry, Detskoe Selo, Union of Socialistic Soviet Republics

CYTOLOGY

G. A. LEWITSKY presented the results of a new method used by him and his school in the study of the morphology of chromosomes.