have gained from coking. The results of our awakening are shown in the newly issued summary of the 1920 census. In 1914 the United States had 754 establishments manufacturing chemicals, with products worth $200,195,800. In 1920 it had 1,374 establishments, with products worth $694,643,000. The increase in the value of the products in six years was 247 per cent. The manufacture of potash and potassium products was slightly more than twice as great—measured in value—as in 1914; that of acids about two and a half times as great; that of sodas and sodium almost three times as great, and that of coal tar products was $133,340,000, as against $8,839,000 in 1914, or about fifteen times as great.

Gratifying as this progress is, the complexity of some essential chemical industries, the careful adjustments they must establish with other industries, render more progress necessary before we are safe. Leaders in the coal-tar business, which are vital to national defence, declare that although we have far surpassed all other nations except Germany and Switzerland, we need five years yet to make our position impregnable. For the time being many of our drug-making and dye-making firms—we had 213 companies making these and other coal-tar products last year—have a right to complete tariff protection. The chemists at Columbia University have adopted resolutions asking for a "selective embargo." Any embargo needed in certain parts of this field can and should be provided by wise tariff legislation, and not, as some demand, by the arbitrary decrees of a licensing bureau.—*New York Evening Post.*

SPECIAL ARTICLES

TRIPLOID INTERSEXES IN DROSOPHILA MELANOGASTER[1]

In an experiment made to determine the locus of the new second-chromosome recessive mutant "brown" by means of a back-cross with the well-known second-chromosome recessives plexus and speck, one culture was found that produced a total of 96 females, 9 males, and about 80 individuals that were intermediates between males and females.

The "intersexes," which were easily distinguished from males and from females, were large-bodied, coarse-bristled flies with large roughish eyes and scolloped wing-margins. Sex-combs (a male character) were present on the tarsi of the fore-legs. The abdomen was intermediate between male and female in most characteristics. The external genitalia were preponderantly female. The gonads were typically rudimentary ovaries; and spermathecæ were present. Not infrequently one gonad was an ovary and the other a testis; or the same gonad might be mainly ovary with a testis budding from its side. The intersexes showed considerable variation, apparently forming a bimodal group—on the one hand a more "female-type," the extreme individuals of which might even lack sex-combs, and, on the other hand, a more "male-type," many of the individuals having large testes and normal male genitalia. All intersexes proved sterile.

Just as striking as the production of intersexes was the fact that the 96 females and 9 males of that same culture showed three, instead of two, large classes representing original combinations, namely, plexus speck, plexus brown, and brown speck. Extensive tests were made of these flies; and each was found to have received from the father a second-chromosome carrying plexus brown and speck, and to have received from the mother one of three different second-chromosomes, namely, a plexus brown, or a plexus speck, or a brown speck chromosome. That is, the mother of the intersexes had carried *three* second-chromosomes, instead of two. For each of the loci plexus, brown and speck she had carried two recessive genes for the mutant character and one wild-type allelomorph, with nearly complete dominance of the wild-type gene in each case.

A condition of triploidy for certain sections of chromosome had been met with in the previous (unpublished) studies on duplications and on translocation; but that this triploidy was far more extensive soon became evident.

[1] Paper read before the Pacific Division A. A. A. S., Univ. of Cal., Aug. 5, 1921.

The third-chromosome recessive "white-ocelli" had been present in the original culture; and tests of the flies produced by that culture showed that white-ocelli was being distributed in the same abnormal fashion as were plexus brown and speck. Not only were the second- and third-chromosomes involved, but the X-chromosome as well, as was shown by specific tests with sex-linked characters.

The hypothesis that the intersexes were triploid was easily put to test by direct cytological examination. The chromosomes (which were unusually clear and well separated) consisted of two sets of three V's (the two sets differing in the size of the V's), a pair of rods, three or two small round chromosomes, and a J-shaped chromosome or not. That is, all intersexes possessed the second- and the third-chromosomes in triplicate and the X- in duplicate, but they might possess three or two fourth-chromosomes, and have or lack a Y-chromosome, so that four sub-types of intersex constitution were found.

About ten per cent. of the daughters from the original culture, when tested, produced in turn intersexes and further disturbances of the linkage ratios. These females were presumably triploid for all the chromosomes (except the fourth, which might be present in duplicate). It was then discovered that these intersex-producing females could be identified by their somatic characters, which were similar to, but less extreme than, those of the intersexes—namely, large size, coarse bristles, and large roughish eyes. Stocks producing triploids and intersexes were maintained more easily by taking advantage of the fact that triploid females carrying two white and one eosin gene have a pale yellow eye-color lighter than that of their diploid white-eosin sisters, and likewise that the third-chromosome dominant Delta is dominant over two recessive non-Delta genes, but the triploid heterozygote is markedly different from the diploid heterozygote.

With material from these stocks genetical proof was obtained that the intersex-producing females possess in triplicate the loci for a large variety of first-, second- and third-chromosome genes, and that they might possess fourth-chromosome loci in triplicate or in duplicate. This genetical finding, checked by cytological examination, extends the direct proof of the chromosome theory of heredity to specific second- and third-group mutant characters and specific V-shaped chromosomes. Such direct proof had already been provided for certain sex-linked mutants and the rod-shaped chromosomes by the phenomena of non-disjunction of the X-chromosomes,[2] and more recently for the small round chromosome and the mutants of the "fourth" group through study of "Diminished" individuals haploid for that chromosome because of non-disjunction.[3]

In the triploid strain individuals triploid for the fourth-chromosome alone have been identified as a distinct somatic type, tested genetically in a variety of ways, and proved to be such by direct cytological examination.

A significant new conclusion proved by the intersexes is that sex in *D. melanogaster* is determined by a balance between the genes contained in the X-chromosome and those contained in the autosomes. It is not the simple possession of two X-chromosomes that makes a female, and of one that makes a male. A preponderance of genes that are in the autosomes tend toward the production of male characters; and the net effect of genes in the X is a tendency to the production of female characters. The ratio of $2X$: 2 *sets autosomes,* or $3X$: 3 *sets autosomes* (or $1X$: 1 *set autosome?*) produces a female, while $1X$: 2 *sets autosomes* produces a male. An intermediate ratio, $2X$: 3 *sets autosomes,* produces an intermediate condition—the intersex. The fourth-chromosome seems to have a disproportionately large share of the total male-producing genes; for there are indications that the triplo-fourth intersexes are preponderantly of the "male-type," while the diplo-fourth intersexes are mainly "female-type."

The condition $3X$: 2 *sets autosomes* should be "super-females," and $1X$: 3 *sets autosomes* "super-males." Triploid females produce a

[2] *Genetics,* 1, 1916.

[3] In press, *Proc. Nat'l Acad.*

small proportion of males that are somatically quite different from males and from intersexes and that are sterile. There is genetical evidence that these males are $1X : 3$ *sets autosomes* in constitution. Studies of "high non-disjunction" show that triplo-X individuals ordinarily die, but in certain lines they occasionally survive as females that are somatically quite different from diploid or triploid females and that are sterile. Such females occur also in the progeny of triploid females; and, in the case of those produced by non-disjunction, both genetical and cytological proofs of their constitution ($3X : 2$ *sets autosomes*) are now complete.

Calvin B. Bridges

THE AMERICAN CHEMICAL SOCIETY

(Concluded)

DIVISION OF DYE CHEMISTRY

A. B. Davis, *chairman*

R. Norris Shreve, *secretary*

Contribution to the estimation of H acid: H. R. Lee. The stability of diazo-benzene and p-diazo-toluene is taken up from the standpoint of their use as standard volumetric solutions. Data showing the relative stability of these diazo salts both in acid and alkaline solution are presented. Tables showing comparative analyses of a large number of samples of commercial and pure H acids are given. The method used by the Newport Company for the analysis of H acid is outlined. The use of p-diazo-toluene for the analysis of a number of amino-naphthol-sulfonic acids other than H acid is suggested.

A new alizarin process: Chas. W. Schaffer. This process depends on a cheap process for manufacture of pyrocatechol and then the synthesis of alizarin according to Baeyer and Caro from pyrocatechol and phthalic anhydride. Phenol is nitrated and reduced wth zinc giving ortho and para amino-phenol. This is diazotized, not filtered and the diazo solution run directly into the still. In the distillation the diazonium chloride, being unstable, is decomposed—water and acid first coming off—and at 243–245° C. the pure pyrocatechol comes over. The p-amino-phenol may also be diazotized and sublimed, giving hydroquinone.

Bleaching of dyed cotton fabrics: J. Merritt Matthews. Owing to the demand of the American public for more cotton goods with larger variety of colors it was necessary to modify the old-fashioned method of bleaching in order to properly preserve the color and also to produce a satisfactory bleached fabric. The extension of cotton goods in the field of wearing apparel has been made possible to great degree by the fact that a variety of color effects can now be employed. This has been very beneficial to many of our manufacturing enterprises and has also made it possible to use the cheaper staple cotton in place of the more expensive staples of wool and silk. Furthermore, it has led to the development of apparel materials which can meet the conditions of modern treatment in the laundry. There is an ever increasing demand for faster dyes owing to the fact that modern methods of usage are such as to put a very severe burden on the color. It has been the endeavor of the dyestuff manufacturers to increase continually the line of such fast dyes for the purpose not only of enlarging the color palette, but also of simplifying the method of dyeing so that the dyer is not more inconvenienced by the use of these fast dyes than he would be by using the more fugitive colors.

The immediate needs of chemistry in America: William J. Hale. The industries are fast ridding themselves of poorly trained chemists and hence the recent period of business depression has come in this respect like a godsend to chemistry in America. A classification of chemists everywhere is attempted. In order that industrial advancement may be made all the more apparent, the highest development of the several classes of chemists is an absolute necessity. Four distinct factors constitute the immediate needs of chemistry in America, the most pertinent being the development of chemists with engineering training. In fact, physics and engineering are no less important than chemistry itself in the training of the young chemist. The greatest need for the future as well as for the present is the collaboration of universities and industries upon researches which take their rise from industrial problems.

Contribution to the chemistry of malachite green: Joseph R. Minevitch. Tetramethyldiamidotriphenyl methane, which is prepared by the condensation of dimethylaniline and benzaldehyde in the presence of hydrochloric acid, when oxidized with lead peroxide as a solution of the dihydrochloride either with or without sufficient acetic acid does not give exclusively the tetramethyldiamidotriphenyl carbinol. The tetracarbinol possesses crystalline properties and forms mala-