shall add at least once the author and year of publication of the quoted name or a full bibliographic reference.

The foregoing resolution was adopted in order to inhibit the confusion which has frequently resulted from the fact that authors have occasionally published a given name as "new" in two to five or more different articles of different dates—up to five years in exceptional cases.

The three propositions submitted by Dr. Franz Poche, of Vienna, failed to receive the necessary number of votes in commission to permit of their being recommended to the Congress. Out of a possible 18 votes for each proposition, Poche's proposition I received 9 votes, II received 6 votes, and III received 7 votes.

Zoological, medical and veterinary journals throughout the world are requested to give to the foregoing the widest possible publicity in order to avoid confusion and misunderstanding.

C. W. Stiles,
Secretary to Commission

SPECIAL ARTICLES

A NOTE ON THE CHROMOSOMES OF MOINA MACROCOPA

Banta and Brown[1] have shown that this cladoceran as well as certain others may be induced to increase the number of males by crowding parthenogenetic mothers. In order to study chromosomal evidence, several hundred parthenogenetic and sexual females have been sectioned. The most favorable time for observing the chromosomes is just before and after the eggs are laid.

The nucleus of the young egg is characterized by a number of deeply-staining granules, which increase in number and size until they fill the nucleus excepting a thin space beneath the membrane. This substance is not chromatin, as it does not react to chromatin stains after fixation in Gilson's fluid. Shortly before the eggs are laid, the mass breaks up into very fine granules, forming a homogeneous material which extends to the nuclear membrane. It gradually loses its staining properties until it appears relatively faint. At this stage there appears near one side a small, faintly-outlined spindle with a few irregularly shaped bits of chromatin within it. At about this time the nuclear membrane begins to dissolve, and the granular substance mingles with the yolk. In it very small, apparently ellipsoid chromosomes appear, and at a little later stage a well-defined spindle appears at the periphery of the egg, lying usually at right angles to the egg membrane.

After the egg is laid, the first division occurs: in the parthenogenetic egg without reduction in the number of chromosomes. In the sexual egg, the first maturation division results in the haploid number, which is 11. The diploid number is 22 in both types of egg. In the eggs of crowded mothers which should produce a high percentage of males, no evidence has yet been obtained indicating that the male number of chromosomes is haploid. Several such crowded mothers have been studied.

The chromosomes have not been seen in the form of rods. They are too small to determine whether tetrads are formed in the maturation divisions. It does not seem that their nearly spherical shape can be accounted for by faulty technique, as the tissues in general are in excellent condition.

With the exception of Schräder's work,[2] the number of chromosomes reported for Cladocera is not more than 8 or 8–10. Schräder reports 24. The chromosomes in *Moina macrocopa* have been previously studied, so far as the author can learn, only by Weismann and Ischikawa,[3] who report 4 in the females of *Moina paradoxa* (now *M. macrocopa*) and *M. rectirostris*.

The sperm cells in *Moina macrocopa* are extremely small in all stages, and thus far have yielded no satisfactory pictures of chromosomes.

Ezra Allen
Carnegie Institution for Experimental Evolution

[1] Banta, A. M. and Brown, L. A. 1923. Some data on control of sex in Cladocera. Eugenics, Genetics and the Family, Vol. 1.

[2] Schräder, F. 1925. The cytology of pseudosexual eggs in a species of Daphnia. Zeit. f. induktive Abstammungs- und Vererbungslehre, Bd. XL, Heft 1/2.

[3] Weismann, A., and Ischikawa, C. 1891. Ueber die Paracopulation in Daphnidenei. *Zoöl. Jahrb. Bd. 4.*

GENETIC EVIDENCE THAT THE CLADOCERA MALE IS DIPLOID

Cladocera males have long been supposed to be diploid in chromosome make-up. Because of the difficulty of Cladocera material for cytological study, not much evidence on this point has been produced. Chambers (1913, Biol. Bull; 25, p. 134) reported the male Simocephalus vetulus as having "considerably more than eight" chromosomes, which number he found in spermatogenesis. Miss Taylor (1914, Zool. Anz.; 45, p. 21) gave 8 or 10 as the diploid number in male *Daphnia pulex* and 4 or 5 as the reduced number in spermatogenesis. In view of the much larger chromosome numbers, 24 in females, found in material of a *Daphnia pulex* type studied by Schrader (1925, Zeit. ind. Abs.-u. Vererbungslehre; 40, p. 1) and by Dr. Ezra Allen in Moina macrocopa (about 20 in females) compared with the reports of these earlier workers, verification of the supposed diploid condition of the Cladocera male seemed desirable.

We are now in a position to report genetical evidence on this point. Individual males of *Daphnia longispina* from three different lines which were known to be heterozygous for one or more mutant characters were mated with (usually) 8 to 16 sexual egg bearing females of a stock known not to carry these (dominant) mutant characters. These sexual eggs hatch poorly but from four such crosses (all of these crosses from which we have reared more than a single individual) we have had offspring of two classes—those with, and those without the mutant character. In two of these crosses, two dominant mutant characters were involved and segregation in the male occurred for both characters.

Since it is obvious that chromatic reduction and segregation are not to be expected in a haploid male, the demonstration of segregation in these males constitutes genetic evidence that they are diploid.

ARTHUR M. BANTA,
THELMA R. WOOD
CARNEGIE INSTITUTION
OF WASHINGTON,
COLD SPRING HARBOR, L. I.

PENTATHIONIC ACID, THE FUNGICIDAL FACTOR OF SULPHUR

IN a previous paper (Young, '22)[1] it is pointed out that pentathionic acid is the fungicidal factor accompanying sulphur. It is further stated that this acid is a product of oxidized sulphur resulting only when oxygen and water are present. These earlier tests proved also that particulate sulphur is more readily oxidized and consequently more fungicidal than ordinary sulphur. This work was confirmed in the main by Tisdale ('25),[2] and its practical application by Lee and Martin ('27).[3] The conclusions have been questioned by some English workers ('25).[4]

During the present summer, the writers continued this investigation with the aim in view of ascertaining the definite chemical relationship of the toxic factor of sulphur to sulphur itself and to determine the effect of certain factors influencing this relationship. We assumed at the outset that the conclusion reached by Freundlich and Scholz ('22)[5] that pentathionic acid is a peptizing agent for sulphur made by the reaction of H_2S and SO_2 and confirmed by Kruyt ('27),[6] the latter giving a simple diagram of the structure of the sulphur particle peptized by the pentathionic acid $(S)S_5O_6=\frac{H+}{H+}$, is correct. In all previous work it was generally supposed that pentathionic acid is peculiar to colloidal forms of sulphur. However, if a test for pentathionic acid (the ammoniacal silver nitrate test given in Mellar's Modern Inorganic Chemistry) is applied to sulphur the characteristic brown color develops and slowly changes to black. Hydrogen sulfide, or the sulfide ion, is the only sulphur compound that might give the same test. When flowers or flour of sulphur is treated with lead acetate, copper sulfate, or silver nitrate, no precipitate of the respective sulfides appears. Sulphur treated with ammoniacal copper sulfate gives no precipitate even on standing; likewise, no sulfide ion is obtained when sulphur is treated with ammonium hydroxide for several hours. Moreover, known solutions of sulfite, sulfate or thiosulfate ions do not respond to the above test for pentathionic acid. It can only be concluded that ordinary forms of sulphur have associated with them pentathionic acid. Our tests showed further that the acid is adsorbed quite completely by the sulphur particle, so much so that none can be washed off, as can be done in the case of hydrophilic colloidal sulphur using a simple ultra filter. The ordinary particle of sulphur flour is hydrophobic, partly because the pentathionic acid is too small in amount to effect hydration to an observable extent. However, when pentathionic acid is added to amorphous sulphur, it, along with other factors, causes complete hydration.

Strong ammonia destroys pentathionic acid if treated for some time, breaking it down to thiosulfate. Freundlich and Scholz used this treatment in determining the acid quantitatively by titrating the thiosulfate with iodine. They give the following reactions:

$$2NH_4OH + H_2S_5O_6 \rightarrow (NH_4)_2S_3O_6 + S_2 + H_2O$$

$$2(NH_4)_2S_3O_6 + 6NH_4OH \rightarrow (NH_4)_2S_2O_3 + 4(NH_4)_2SO_3 + 3H_2O + 4S$$

$$2(NH_4)_2S_3O_6 + 6NH_4OH \rightarrow 5(NH_4)_2S_2O_3 + 3H_2O$$

On the other hand, strong ammonia does not completely destroy the $S_5O_6=$ ion on the sulphur particle. In this case, we are not dealing with free pentathionic acid but with strongly adsorbed $S_5O_6=$ which is not free. Consequently, when the pentathionic acid test is used on ammonia-treated sulphur, the nega-

[1] Young, H. C. The toxic property of sulphur. Ann. Mo. Bot. Gard. 9: 403–435, 1922.

[2] Tisdale, L. E. Colloidal sulphur: preparation and toxicity. Ann. Mo. Bot. Gard. 12: 381–418, 1925.

[3] Lee, H. Atherton, and J. P. Martin. The development of more effective dust fungicides by adding oxidizing agents to sulphur. SCIENCE 66: 178, 1927.

[4] Discussion on "The fungicidal action of sulphur." Ann. of Apl. Biol. 13: 308–318, 1925.

[5] Freundlich, H., and P. Scholz. Ueber hydrophobe und hydrophile Sole des Schwefels. Koll. Beih. 16: 234–266, 1922.

[6] Kruyt, H. R. "Colloids" translated by H. S. Van Klooster. John Wiley & Son (Inc.) Page 238, 1927.