3). The particular composition of the mother can thus be handed on indefinitely from daughter to daughter (see 7).

Only the sex-chromosomes are concerned in this unique maturation and breeding results show that only sex-linked characters are subject to exception in these cases (see 8).

The Y-eggs (5 per cent.) by the X-sperm give males (XY) with no supernumerary chromosomes. These males have received their X-chromosomes from their father and the breeding results (see 4) show that in all sex-linked characters (see 5) they are exact duplicates of the father.

These males will be able neither to produce exceptions (see 6) nor to transmit the power of producing exceptions (see 14) since their chromosome mechanism is that of any ordinary male (see 17).

The XY-eggs (45 per cent.) by the X-sperm will give females (diploid with respect to X (see 11)) which will, to all appearances, be the type expected from the cross, since they will exhibit characters from either or both parents. But since they contain a supernumerary Y-chromosome they will themselves be able to produce exceptions, and breeding tests showed that half the expected females do in fact produce such exceptions (see 10).

19. Such non-disjunctional females which are heterozygous for recessive characters, when bred to any male, produce exceptional daughters which are of one type only, namely, heterozygous dominants. This fact shows that the *non-disjunction occurs at the reduction division,* for if at the reduction division the X-chromosomes separated the egg would receive either the dominant bearing chromosome or the recessive bearing chromosome. After the following equational division of the chromosomes two *like* chromosomes would be produced, both dominant or both recessive bearing. If non-disjunction occurred at this stage (2d polar body) exceptional daughters pure dominant or pure recessive would appear. Since females of this type do not appear, we must conclude that the non-disjunction occurs normally at the reduction division and not at the equation division.

The XY-eggs (45 per cent.) by Y-sperm give males ($XY =$ male) with a supernumerary Y-chromosome. Since these males receive their Y-chromosomes from their mother they will be of the expected classes of sons (see 12). In the spermatogenesis of such males the extra Y may go either with X or with the other Y and these two cases seem to occur with equal frequency. The spermatozoa of such a male are then of four types: XY—Y—X—YY. When mated to any female only expected offspring could appear (see 12). The types XY and X are female producing. Some of the daughters produced will thus have a supernumerary Y and will themselves produce exceptions (see 12 and 13).

Some of the sons of such a cross would possess the power of transmitting non-disjunction as did their father of like composition (see 12 and 13). Although the presence of the males having the composition XYY has been proven genetically, their occurrence has not yet been studied cytologically.

If in a non-disjunctional female Y went equally often with either X, then no linkage would be shown between non-disjunction and any sex-linked gene (see 15).

Likewise the method which would unfailingly secure a pure stock of any sex-linked gene is utterly useless for a freely segregating Y-chromosome (see 16).

In conclusion, *there can be no doubt that the complete parallelism between the unique behavior of the chromosomes and the behavior of sex-linked genes and sex in this case means that the sex-linked genes are located in and borne by the X-chromosomes.*

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HOT WATER TREATMENT FOR COTTON ANTHRACNOSE

DURING the past three months we have been making a study of the effect of hot water at different temperatures on the anthracnose fungus and cotton seed. The results are very interesting and seem to have an important bearing on the control of the disease. Cotton anthracnose is known to be carried in the seed. The fungus penetrates the seed coats and the hyphæ and spores have been found in the cotyledons on the inside of the seed while the seeds were still in a dormant condition. So far, no treatment has been reported which will kill the fungus without killing the seed. Our hot water treatment studies were made with a view of determining whether or not the fungus could be killed by hot water without injuring the seed. Our results so far are very encouraging and are considered to be of sufficient importance to warrant publication at this time of this preliminary statement.

To begin with, we placed cotton seed in water at different temperatures and for different lengths of time and then germinated them between blotters in the ordinary way in incubators with a view of determining how high a temperature cotton seed would stand without injury. As a result of these tests we find that cotton seed can remain in water at 70° Centigrade for fifteen minutes without injuring the germination. 50 per cent. of the seed germinated that were allowed to stand in water at 75° Centigrade for fifteen minutes. In a few cases more than 50 per cent. of the seed germinated that had been treated five minutes at 80° Centigrade, but in the majority of cases a very small per cent. of the seed treated for five minutes or longer at 80° germinated.

The fact that cotton seed which had been allowed to stand in water at 70° Centigrade for fifteen minutes germinated as well as the untreated checks prompted us to germinate a large number of treated seed under sterile conditions and to examine the seedlings for anthracnose. We used for this purpose the method which has been in use in this laboratory for the past four years for testing seed for disease by germinating them in sterile test tubes.[1] These tests seem to show conclusively that the fungous hyphæ and spores in the seed are killed when cotton seed is allowed to remain in water at 70° Centigrade for fifteen minutes and the germinating power of the seed is not injured. An average of 22 per cent. of the seedlings in the checks from the same lot of seed and germinated under the same conditions were diseased. We now have two fields on the college farm planted with seed which were given this treatment and so far there is no indication of disease in the seedlings, while in the fields planted with the same lot of seed but not treated diseased seedlings are abundant. The field tests will, of course, not be complete until the end of the season when the plants are all mature.

[1] Twenty-fourth annual report of the South Carolina Experiment Station, page 43.

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THE AMERICAN CHEMICAL SOCIETY. IV

WATER, SEWAGE AND SANITATION SECTION

Edward Barton, Chairman

H. P. Corson, Secretary

A Sanitary Survey of White River: JOHN C. DIGGS.

During the summer of 1913 a sanitary survey was conducted on the West Fork of White River, an Indiana stream 388 miles in length. A knowledge of the condition of this river is of great importance because this stream is used as a public water supply and means of sewage disposal for cities whose population totals over 300,000. A great part of the work was conducted from a floating laboratory, which served also as the living quarters of the members of the surveying party. Private and public water supplies of cities bordering the river were also examined and sanitary surveys conducted in towns visited.

Hypothetical Combinations in Reporting Water Analyses: RICHARD B. DOLE.

Various common methods of making hypothetical combinations were illustrated in order to show the wide divergence of practise in America, and the combinations were interpreted in order to show the similarities and differences of opinion as to the quality of a given water. The author emphasized the advisability of distinguishing between the facts of analysis and the opinions expressed as hypothetical combinations. He also showed how the value of water may be deduced from the ionic statement without reference to hypothetical combinations and quoted the opinions expressed by several authors and scientific associations as to the advisability of reporting water analyses in ionic form and omitting the report in hypothetical combinations in order that analyses by different chem-