

# SCIENTIFIC PROCEEDINGS.

ABSTRACTS OF COMMUNICATIONS.

**Eighty-eighth meeting.**

*College of Physicians and Surgeons, January 16, 1918.*

*President Gies in the chair.*

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**Experimental studies of self-incompatibilities in fertilization.**

By **A. B. STOUT** (by invitation).

[*From the Botanical Gardens, Bronx Park, N. Y.*]

The phenomenon of self-incompatibility in the fertilization of hermaphrodites is well illustrated by conditions existing in the common chicory plant (*Cichorium Intybus*). The flowers are perfect, they are anatomically all alike, the flowers are open only for a short time so that pistils and stamens are ready for pollination at the same time, and the parts are decidedly adapted for self-pollination, and yet when controlled self-pollinations are made many plants, set no seed. Many cross-pollinations are also incompatible, but both pollen and pistils will function in certain crosses. The inability to set seed to self-pollination (or cross-pollination as well) is here best described as due to some sort of physiological incompatibility operating between sex organs (including sex cells themselves) that are fully formed, anatomically perfect, potentially functional and of simultaneous development.

Studies in chicory have been pursued by the writer during the past six years. Nearly 2,000 plants (all but the first crop were pedigreed) have been studied and controlled pollinations made of heads comprising a total of over 450,000 flowers. There is thus available more data on self-compatibility for this plant than for any other or perhaps for all other species in which the phenomenon has been studied. Publications giving data in detail and conclusions for results obtained previous to 1917 together with dis-

cussion of literature and theories have already been made. A brief summary of results and conclusions can be made here, however, as follows:

1. The results obtained with chicory indicate (*a*) that self- and cross-incompatibilities are strongly in evidence in this species; (*b*) that self-compatible plants may arise sporadically from parents that are self-sterile even after three generations of self-incompatible ancestry; (*c*) that the progeny of such plants do not breed true to this character; (*d*) that the degree of self-compatibility varies greatly; (*e*) that selection for high degrees of self-fertility continued for four generations has not been effective in isolating a completely self-fertile strain.

2. Self-compatibility and self-incompatibility are entirely independent of differences in vegetative vigor. In the selection experiments, races widely different in vegetative vigor have been isolated. Self-sterility and self-fertility appeared in all these races with much the same frequency. Sister plants of the least vigorous dwarf race or sister plants of the most vigorous vegetative race were either self-fertile or self-sterile indiscriminately.

3. Self-compatibility and self-incompatibility operate independently of potential sex vigor. The total production of flowers varied greatly among the various strains. Plants producing large numbers of sex organs were either self-sterile or self-fertile, as were plants with the fewest number.

4. Self-compatibility and self-incompatibility may operate independently of the purely nutritive relations of the embryos to their parent plants. Ten flower-heads self-pollinated on a completely self-sterile plant will set no seed, while ten heads on the same plant pollinated on the same day with pollen from a highly cross-compatible plant will set abundant seed. The fruits are rather small achenes having no endosperm and are practically composed only of the embryo: provided the pollination is compatible, they seem to develop equally well throughout the season.

5. Self-compatibility and self-incompatibility appear independently of any combination of germ-plasm elements in so far as these can be judged by the expression of characters. Each operates alike between gametes that are similar or those that are dissimilar in respect to hereditary units of genetic analysis. Plants

widely different in such qualities as color of flowers, type of branching, shape of leaves, etc., are either self-fertile or self-sterile, and plants of a sister series quite similar in all respects are either self-fertile or self-sterile. When an  $F_1$  plant of hybrid origin is self-fertile in any degree, the evidence indicates that any of the sex cells may function in any recombination; on the other hand, in self-sterile sister plants whose sex cells must, it would seem, be of much the same diversity none are compatible. Also all the sex cells of an  $F_4$  plant which must have much the same germ-plasm constitution may fail to function together, while those of a sister plant may be highly functional. Two self-sterile plants, sisters of an  $F_1$  cross or sisters of any generation, may be cross-fertile or cross-sterile quite indiscriminately.

6. The development either of self-compatibility or of self-incompatibility occurs in both cross-bred and inbred races, the latter often being highly constant races. Both self-fertile and self-sterile plants occurred among sister plants that were  $F_1$  hybrids of rather wide crosses; they also appeared among inbred strains derived by crossing self-sterile parents for as many as three generations, and they occurred among the progeny of self-fertile plants even after four generations of self-fertile parentage. The evidence at hand makes it clear that self-compatibilities do not necessarily decrease as a result of inbreeding.

7. The results obtained in the cultures of chicory make it clear that self-incompatibility and self-compatibility are here not to be described as dominant and recessive characters, or paired allelomorphs, and that there is no simple Mendelian formula that fits the results. The evidence at hand for the behavior of similar phenomena in other species is also quite in agreement with this conclusion.

8. The conditions controlling sex-fusions, judged by the behavior of compatibilities and incompatibilities in such species as *Cichorium Intybus*, arise in connection with the development of the sex organs and sex cells as such. In this sense the controlling factors are of epigenetic and individual development.

9. The factors which determine or prohibit successful fertilization in chicory, whatever their essential nature may be, are highly variable as to degree, specificity, and transmission in heredity.

10. In respect to the general results, the phenomenon of incompatibility appears to present some analogy to that of so-called antigen-antibody reactions in immunity, and to isoagglutination and isoprecipitation phenomena. Here, however, the incompatibility exists between organs produced side by side in the same flower and which are of close somatic relationship.

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**A demonstration of cerebellar and cerebral lesions in dogs.**

By **I. STRAUSS** and **I. FRIESNER** (by invitation).

[*From the Department of Physiology of Columbia University.*]

Dr. Pike with his characteristic modesty has asked us to present these dogs. They show lesions which resulted in part from design and in part from accident. The experiments were undertaken in an attempt to study the relations between the internal ear and the central nervous system.

From a clinical point of view otologists look upon the results of labyrinthine stimulation or destruction as divided into two heads:

1. Nystagmus.
2. Vertigo.

The brain pathways which intermediate the nystagmus impulses are well known. On the other hand, those which have to do with vertigo are very little known. Recently the theory has been advanced that the cerebellum intermediates the labyrinthine impulses which ultimately pass to the cerebrum, and have to do with our sense of position.

It was in the attempt to test this theory experimentally that these operations were undertaken. Some of the dogs show the result of injuries to the cerebellar peduncles. In another in attempting to reach the peduncles we accidentally injured the vermis and had to stop. Another dog shows the result of a bilateral cerebellar lesion as well as a vermis lesion. We have but commenced our studies and are indebted for our results largely to the kindly patience and help of Dr. Pike.