reading of the great droughts, recently ended, which were at their worst in west Texas and the northern Great Plains. The flood of warm, moist air from the Gulf is variable in size and duration. These variations are felt most near its western and northwestern limits, where farmers have learned to look on partial crop failures as normal. This variability, which is the most important aspect of rainfall, aside from the average amount, is clearly brought out by Mr. Kincer in a number of graphs and maps. In drought years as well as in years of plenty, farmers are inclined to believe in stories of progressively decreasing or increasing rainfall: comparisons of rainfall averages by successive 20-year periods show, however, that in this region there is no perceptible progressive change in rainfall.

In years of decreasing rainfall, real-estate agents for the semi-arid lands of western Kansas explain to prospective buyers that although the total rainfall is decreasing, the decrease is mostly confined to the washing and flooding downpours, and that the proportion of rains of beneficial amount is increasing. They are discussing another essential element which must be considered in comprehensive rainfall discussions. Mr. Kincer presents maps showing the average annual number of days with precipitation 0.01 to 0.25 inch, 0.26 to 1.00 inch, and 2.00 inches or more. Further details of rainfall intensity are given on maps showing the average annual number of days with precipitation more than 1.00 inch in an hour, and the maximum precipitation in 24 hours. Two more maps which might be called "drouth maps" show the percentage of years with 30 consecutive days or more without 0.25 inch of rainfall in twenty-four hours from March 1 to September 30, and the greatest number of consecutive days without 0.25 inch of rainfall from March 1 to September 30. These are all based on the rainfall data for the 20-year period, 1895–1914.

There are three snow maps presented. A large one shows the average annual snowfall of the United States, 1895–1914, drawn on a topographic base-map with close attention to the effects of altitude and exposure. The other two maps show the average annual number of days (1) with measurable snowfall, and (2) with snow cover. In the eastern United States (except near the Atlantic) the line of one day with snow cover (the average of several days in one winter, with no days in several years) is near the 33d parallel of latitude; that of 30 days with snow cover lies close to the 39th parallel; that of 60 days near the 42d; that of 90 days near the 43d, and that of 120 from near the 44th in the East to the 47th in Minnesota. As a broad generalization, the number of days with snowfall is about half the number of days with snow cover.

The publication of these interesting precipitation maps with the discussion makes us hope that still another year will not pass before the issue of the long-expected precipitation section of the Atlas of American Agriculture, with its colored maps, carefully made graphs and detailed discussion. Still later, the folio on temperature and the other climatic elements are to come.

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SPECIAL ARTICLES

INTERSEXES IN DROSOPHILA SIMULANS

ON the first day of January, 1920, a stock of *Drosophila simulans* Sturtevant[1] from Rochester, Minn., was found to contain intersexual individuals. Over 200 such intersexual specimens from this stock and derivatives of it have now been examined. About a dozen of them have been dissected and about the same number have been cleared in KOH and examined in balsam. All these specimens apparently belong to a single type. Male and female parts are both present, as will appear from the following table.

The intersexes are sterile, inasmuch as their gonads are almost, if not quite, absent. Their sexual behavior seems to agree best with that of the normal females. They are courted by males, but mating has not been seen.

[1] For a description of this species see *Psyche* (1919), 26, p. 153.

	Males	Females	Intersexes
Sex combs on fore tarsi	Present	Absent	Absent
Number of dorsal abdominal tergites	5	7	7
Ovipositor	Absent	Present	Present
Spermathecæ	None	2	2
Penis	Present	Absent	Absent
First genital tergite	Present	Absent	Present
Anal plates	Lateral	Dorsal and ventral	Lateral
Claspers	Present	Absent	Present
Tip of abdomen	Black	Banded	Black
Gonads	Testes	Ovaries	Very minute if present

Crosses of normals from the intersex stock have made it possible to study the character. The intersexes are modified females—*i. e.*, they have two X-chromosomes. This is shown by the fact that in cultures in which half of the males show sex-linked recessive characters but all the females are wild-type, the intersexes never show these sex-linked characters. This relation has been found to hold true for three sex-linked characters that are not closely linked to each other; and the intersex gene itself has been found not to be sex-linked (see below). Therefore the relation just noted can not be due to linkage between the intersex gene and the sex-linked genes in question.

Numerous crosses of the intersex stock to unrelated stocks have never given intersexes in F_1, but have frequently produced them in F_2. The intersex character is therefore recessive.

Pair matings that have produced intersexes have given a total of 510♀: 165 intersex: 754♂. There is an excess of males, but this is evidently a 3:1 ratio of females to intersexes, indicating not only that the gene is recessive but also that it is not sex-linked. The final proof of the latter point has been obtained through the discovery that the intersex gene is linked to the autosomal recessive gene for "plum" eye-color. Three F_1 pairs from a mating between the intersex stock and the plum stock have given in F_2:

Females		Intersexes		Males	
Wild-type	Plum	Wild-type	Plum	Wild type	Plum
198	91	87	0	293	65

The absence of the intersex plum class shows that the two genes are linked; and plum is known to be an autosomal recessive.

It has been shown by Morgan and Bridges[2] that individuals of *D. melanogaster*[3] that are partly male and partly female are produced, though only rarely, by most stocks. These "gynandromorphs" have been shown, by genetic evidence, to have two X-chromosomes in their female parts and only one X in their male parts. They are sex mosaics, and each part develops as it would in a whole animal of the same genetic constitution. There is strong evidence that the intersexes described here are not of this nature. The male and female parts in them probably both possess two X-chromosomes. This has been shown as follows. A total of 104 intersexes have been produced by females heterozygous for the sex-linked gene for "yellow" hairs and bristles. Half of these intersexes—about 50—must then themselves have been heterozygous for yellow. If the intersexes are really gynandromorphs, the male parts at the posterior end of the abdomen should have contained a single X-chromosome, and in about half of the specimens that were heterozygous for yellow (*i. e.*, in about 25 individuals) this should have been the yellow-bearing X. As Morgan and Bridges have shown, these parts should then have borne yellow hairs and bristles. The 104 intersexes were all carefully examined for this point, and *none of them had yellow male parts.*

We may conclude that the intersexes are females, modified by a recessive autosomal mutant gene that causes them to show male parts, though these parts themselves still have two X-chromosomes. The normal sex-determining mechanism is not affected at all, but the end result is modified by a gene that is not even in the sex chromosomes. It has

[2] Carnegie Inst. Washington (1919), publ. 278, pp. 3–122.

[3] I have unpublished data on exactly similar cases in *D. simulans* itself.

been assumed by Goldschmidt,[4] Hertwig,[5] Banta,[6] and others working with intersexes that in their animals the normal sex-determining mechanism itself was failing to function as usual. The present example shows that such an assumption can not be accepted without proof.

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THE ILLINOIS STATE ACADEMY OF SCIENCE

THE thirteenth annual meeting of the Illinois State Academy of Science was held at Danville, Illinois, February 20 and 21, 1920, under the presidency of Dr. Henry B. Ward, of the University of Illinois.

The principal items of business transacted were the following: The academy voted unanimously to become affiliated with the American Association for the Advancement of Science under the terms adopted by the council of the association at the St. Louis meeting. It was voted that one half-day session of the next annual meeting be devoted to section meetings and the following sections were provided for: medicine and public health; biology and agriculture; geology and geography; chemistry and physics; mathematics and allied sciences; the science of education and education in science. It was voted that the council of the academy be empowered to select chairmen for these sections. The committee appointed last year to secure affiliation of science clubs in high schools with the academy reported five such clubs which had accepted the terms of affiliation, two of these taking national membership under the plan of affiliation with the American Association for the Advancement of Science.

In addition to the regular program of scientific papers, Dr. Henry B. Ward, president of the academy delivered an illustrated lecture on Alaska.

The following officers were elected for the ensuing year: Dr. Henry C. Cowles, University of Chicago, president; Dr. Chas T. Knipp, University of Illinois, vice-president; J. L. Pricer, State Normal University, Normal, secretary; Dr. W. G. Waterman, Northwestern University, treasurer. Dr. A. R. Crook, State Museum, Springfield, is ex-officio librarian of the academy, in charge of the sale of back numbers of the transactions and of the exchange of current issues.

One hundred and five new members were elected to the academy.

The following are the titles of the papers presented at the different sessions:

Development of smokeless fuel from Illinois coal: PROFESSOR S. W. PARR, University of Illinois, Urbana.

Tastes and odors in the Danville water supply in the summer of 1919: DR. EDWARD BARTOW and R. E. GREENFIELD, Illinois State Water Survey, Urbana, and H. N. ELY, Superintendent, Interstate Water Co., Danville.

A new test indicator for water analysis: R. E. GREENFIELD, Illinois State Water Survey, Urbana.

The founding of sanitary districts: DR. EDWARD BARTOW, Illinois State Water Survey, Urbana.

Some comments on the present status of tuberculosis: DR. WALTER G. BAIN, St. John's Hospital, Springfield. During the war, chief of the laboratory service of the U. S. Army General Hospital No. 8.

Statistical study of the incidence and mortality of influenza in Illinois: DR. HENRY B. HEMENWAY, Division of Vital Statistics, State Department of Public Health, Springfield.

Report of progress at Illinois State Museum: DR. A. R. CROOK, chief of Division of State Museum, Springfield.

Gaining and losing power: C. L. REDFIELD, Chicago.

The progress of barberry eradication in Illinois: L. R. TEHON, assistant pathologist, U. S. Department of Agriculture.

Road oil and its uses: DR. A. F. GILMAN, Illinois Wesleyan University, Bloomington.

The absorbtion of oxides of nitrogen formed in silent discharge: DR. F. O. ANDEREGG, Purdue University, Lafayette, Ind.

A possible standard of sound; a further study of wave form and operating conditions: DR. CHAS. T. KNIPP and C. J. LAPP, University of Illinois.

Evidence that catalase is the enzyme in animals and plants, principally responsible for oxidation: DR. W. E. BURGE, University of Illinois, Urbana.

New species of fossils from the Devonian limestone in Rock Island County, Illinois: DR. T. E. SAVAGE, University of Illinois, Urbana.

[4] *Proc. Nat. Acad. Sci.* (1916), 2, pp. 53–58; *Jour. Exper. Zool.* (1917), 22, pp. 593–611, and elsewhere.

[5] *Biol. Zentralbl.* (1912), 32, pp. 65–111, and elsewhere.

[6] *Proc. Nat. Acad. Sci.* (1916), 2, pp. 578–583, and (1918) 4, pp. 373–379.