X-rays although no other evidence of acceleration is evident in the experiments, *e.g.*, earlier hatching out of offspring of X-rayed flies. A more striking difference is that while the effect of temperature lasts for a time corresponding to the period of time treated and then disappears abruptly the effect of an X-ray treatment which lasted only 3 minutes and 15 seconds starts on the third to sixth day, reaches a maximum on the sixth to ninth day, and then gradually falls off, the effect being still evident after fifteen days.

The effect of X-rays on crossingover in the second chromosomes may be compared with the effect of X-rays on crossingover in the first or sex chromosome already recorded by one of us.[4] Here it was found that X-rays decrease the crossover value for eosin eyed and miniature winged, the effect increasing with the dose. After a dose approximately the same as that given in the first of the experiments on the second chromosome the crossover value for eosin and miniature was decreased from approximately 25 per cent. to less than 10 per cent. and the effect continued from the sixth to the twelfth day after the treatment. We see, then, that X-rays produce opposite effects on crossingover in the first and second chromosomes of Drosophila. This and the duration of the effect suggest that X-rays act on the individual chromosomes affecting them in such a way that crossingover, when it occurs, is modified.

JAMES W. MAVOR
HENRY K. SVENSON

UNION COLLEGE,
SCHENECTADY, N. Y.

THE IOWA ACADEMY OF SCIENCE

THE academy met at Cornell College, at Mount Vernon, on April 27 and 28. The opening session was held on Friday afternoon, the 27th, and included, besides the transaction of preliminary business, addresses by three invited speakers. The sections of the academy met at 3 P. M. for reading of papers and at 6 o'clock held their group dinners. President Wylie gave his address on "Experiences in Fiji and New Zealand" at the evening session, after which the faculty of the college held an informal reception for the visitors.

On Saturday morning the sections completed their programs, after which the academy convened for the final business session. The academy took some forward steps in adopting resolutions looking towards an extensive biological survey of the state, in establishing a committee on coordination of scientific research, and in endorsing the plan to establish a national museum and aquarium of fishes in honor of Spencer Fullerton Baird. In adopting the report of the committee on the secretary's report the academy provided for the appointment of a permanent committee on publication which should report to the academy a set of rules and suggestions for preparation and publication of papers. The academy transferred eighteen Associates to the class of Fellows and elected nine new Fellows and sixty Associates. It voted to meet with the State College at Ames in 1924, when Dr. L. H. Pammel, who has been a Fellow of the Academy since 1889, will have completed thirty-five years of service with the State College.

The following were elected officers for the ensuing year: *President,* L. H. Pammel, State College, Ames; *vice-president,* O. H. Smith, Cornell College, Mount Vernon; *secretary,* James H. Lees, Iowa Geological Survey, Des Moines; *treasurer,* A. O. Thomas, State University, Iowa City. *Chairmen of Sections: Botany,* J. N. Martin, State College; *chemistry,* Anson Hayes, State College; *geology,* E. J. Cable, Teachers College, Cedar Falls; *mathematics,* F. M. McGaw, Cornell College; *physics,* J. W. Woodrow, State College; *zoology,* F. M. Baldwin, State College.

After luncheon the academy took a trip to the Palisades of the Cedar, one of the most beautiful localities of central Iowa and a delight to geologists and botanists in particular.

PROGRAM

Teaching and learning a local flora: HENRY S. CONARD. An account of progress in preparing and using keys and manuals to the flora of Grinnell and urging the need of local manuals for several districts of the state.

The field of ornithology: T. C. STEPHENS.

The application of laboratory methods to the study of mental diseases: SAMUEL T. ORTON.

Mathematics

Iowa Section Mathematical Association of America

Abstracts of these papers will be found in the journal of the American Mathematical Association.

On the correction of a common error in the calculation of the mean deviation from a given frequency distribution: H. L. RIETZ.

On the geodesic in four space: CORNELIUS GOUWENS.

A general expression for the schediastic function for the generalized double frequency distribution: E. R. SMITH.

Leibnitz's contribution to the history of complex numbers: R. B. MCCLENON.

Some curves met with in the conformal representation of integral transcendental functions: R. B. MCCLENON.

The definite integral in a first course in calculus: J. V. MCKELVEY.

Certain preliminaries in the calculus: C. W. EMMONS.

The Cochleoïde: ROSCOE WOODS.

On the theory of wave filters with an application to the theory of acoustic wave filters: E. W. CHITTENDEN.

Some functional equations suggested by the mean value theorem: W. H. WILSON.

The differentiation of the trigonometric functions: W. H. WILSON.

What is mathematics? J. S. TURNER.

An application of finite differences: JOHN F. REILLY.

The cycloid and its companion: ELMER E. MOOTS.

[4] *Proc. Soc. Exp. Biol. and Medicine,* Vol. 20, p. 335.

Physics

A new method for stereoscopic projection: JAY W. WOODROW.

Diffusion of alkali salt vapors in the Bunsen flame: GEORGE E. DAVIS.

The progress of research in the Coe College radiological laboratory: SCOTT W. SMITH, JR. The aim of the laboratory has been to investigate such problems in the physics of X-rays as are of vital importance in the medical science. The important problem in deep therapy is to produce a beam of X-rays of such penetration that it will reach a desired depth within a medium without injury to the skin and intervening tissue, and to determine the intensity of that radiation after it reaches the desired depth. Five factors enter into this problem: Increase in *voltage* increases the penetration of the ray, but even with the use of high voltages the beam contains many harmful soft rays which must be absorbed by a suitable *filter*. After a beam is produced which is as homogeneous in penetrating rays as possible, it is further found that increasing the *distance* from the tube to the skin, also increasing the *area* radiated, increases the percentage of the beam which reaches the desired depth. However, increasing these factors beyond a certain limit is neither desirable nor profitable, as the increase in penetration beyond that point would be more than offset by the increase in *time* to give a certain amount of radiation. A detailed study of the distribution of the radiation under the variation of these factors has been undertaken by this laboratory.

Calibration of a gold leaf electrometer for ionization work: LEROY D. WELD. In the ordinary types of ionization electroscope having a straight scale, the scale intervals are not proportional to the discharge. A simple quadratic calibration formula is here developed, containing only one constant, whereby the readings can be transformed into those of a scale of equal discharge intervals, and the method of obtaining the constant is explained. Rates of fall on the actual and corrected scales are also compared by means of a linear formula. The calibration is of particular importance in the case of shortlived radioactive products, with which the usual method of fall between fixed points can not be applied, because there is not time to recharge the electroscope. Numerical examples are given illustrating the theory.

Acoustic wave filters in solid media: V. C. HALL.

An extension of acoustic wave filter theory: G. W. STEWART.

New vibrations within a conical horn: VICTOR A. HOERSCH.

The "K" and "L" X-ray spectra of tungsten: C. B. CROFUTT. This paper is a partial report on the complete investigation of the X-ray spectra of tungsten, both emission and absorption. It deals only with the emission and absorption spectra of the "K" and "L" regions. The "M" region is being investigated by Mr. R. V. Zumstein. The X-ray spectra of tungsten have been the most extensively investigated of any element. However, the work has been done at different times by experimenters using different apparatus and methods. For this reason it seemed advisable to make a complete investigation, using as near as possible the same apparatus and conditions throughout. Previous work has been done either on the emission spectra or the absorption spectra and no attempt has been made to get both at the same time under the same conditions. In the present work both have been obtained on the same photographic plate at the same exposure. This furnishes a very accurate method of measuring relative wave lengths. The apparatus used in the work consisted of a high voltage transformer, Coolidge tube and X-ray spectrometer. A few improvements in the method of rotation of the crystal made it possible to greatly prolong the time of exposure. When this work was begun there were twenty-two lines known in the "L" series of tungsten. Out of these twenty-two lines one had been found only by Siegbahn and Duane, three by Dershem and Overn and one by Overn. In the present work all of the above lines except the one found by Siegbahn and Duane have been obtained. In addition, three new lines have been found and two others have been resolved into two components. The most important result of the work on the "L" series is the slight shift obtained in the result given by Duane on the absorption wave lengths, which have been considered as the most accurate. This shift is sufficient to change the relative positions of two of the absorption lines with respect to that of the emission lines. Since both the emission and absorption spectra are obtained on the same plate at the same exposure there can be no question as to the relative positions of the lines. The results to date on the "K" series show that the line is made up of two components. The "K" absorption band has been obtained in the third order on the same plate with the emission lines.

Scattering of homogeneous X-rays by liquid benzene, mesitylene and octane, and by diamond splints: C. W. HEWLETT. I. Scattering curves for liquid benzene, mesitylene and octane. The X-radiation from a molybdenum X-ray tube was filtered through a ZrO_1 screen which reduced the Mo K α (.710Å) line very little but cut the other lines and the general radiation to a very small amount. The intensity of the radiation scattered by the liquids contained in a small capsule placed at the center of a spectrometer was measured by the ionization method for angles 8° to 16° on each side of the principal maximum which these liquids show. The principal maximum for octane due to the K α line is 8.12Å, for benzene 8.45Å, for mesitylene 6.45Å and 10.08Å. The spacing of the planes of atoms responsible for these maxima in octane is 5.0Å, in benzene is 4.8Å and in mesitylene is 6.3Å and 4.1 Angstroms. For each liquid a hump is noticed at an angle less than the angle of the principal maximum, but this is shown to be due to the general radiation which gets through the filter. II. The temperature effect of the scattering of X-rays by diamond splints. The intensity of X-radiation scattered by diamond splints at room temperature and at 300°C. was measured for the angles 2° to 165°. There is a shift of the maxima due to the expansion of the crystal. The results, however, would indicate that the expansion is not

the same in all directions. The total scattered radiation at the two temperatures was found to be the same within one per cent.

Demonstration of the variable character of the vowel e: G. W. STEWART.

Production of high amperage in a low voltage Coolidge tube: R. V. ZUMSTEIN.

The traces left by a helical beam of electrons on a plane perpendicular to its axis: C. J. LAPP.

A new high frequency alternating current generator: C. J. LAPP.

A summary of recent experiments on the relation between direct and calculated reflecting powers of crystals of tellurium: L. P. SIEG.

A report of progress on the determination of the optical constants of selenium and tellurium in the ultra-violet region: R. F. MILLER.

The light-energy of 2536A required to render developable a grain of silver bromide: P. S. HELMICK.

The natural ultra-violet frequency of silver bromide: P. S. HELMICK.

The reflecting and the absorbing power of a photographic emulsion: P. S. HELMICK.

The torques and forces between short cylindrical coils carrying alternating currents of radio frequency: W. A. PARLIN.

Magnetic and natural rotatory dispersion in absorbing media: E. O. HULBURT.

The distribution of intensity in the broadened balmer lines of hydrogen: E. O. HULBURT.

The deflection of a stream of electrons by electromagnetic radiation: E. O. HULBURT.

On super-regeneration: E. O. HULBURT.

Standards of capacity: J. B. DEMPSTER, E. G. LINDER and E. O. HULBURT.

Zoology

The genus Empoasca in North America: ALBERT HARTZELL. A systematic and biologic study of Empoasca of the Nearctic region with descriptions of new species. A detailed study of the biology of *Empoasca unicolor* and a summary of the life history and habits of *E. mali* are discussed. The phylogeny, geographical distribution and economic importance of the genus are emphasized.

On the function of the paddle of the paddlefish: H. W. NORRIS.

A new apparatus for measuring deep water temperatures: FRANK A. STROMSTEN.

Temperature measurements of Lake Okoboji for August, 1922: FRANK A. STROMSTEN.

A zoological park in New Zealand. DAYTON STONER.

The 1918 outbreak of sod web worms in Iowa: R. L. WEBSTER. An account of the general conditions surrounding this outbreak. Relations between precipitation and severity of the losses from the insect.

Observations on Sphenodon punctatum in captivity: WENDELL KRULL.

Parthenogenesis, sex-determination and patrocliny in the wasp, Habrobracon: ANNA R. WHITING and P. W. WHITING.

An instance of polymely in the frog: ALBERT KUNTZ. A supernumerary fore limb located in the right sternal region is described. The humerus was movably articulated with a supernumerary pectoral girdle consisting of three components. The manus and the distal portion of the radioulna were reduplicated. Probably the humerus also represents fusion of two bones. The limb contained neither muscles nor nerves and exhibited no spontaneous movements. This limb probably arose from a portion of the right anterior limb bud which became separated and displaced from the remaining tissue in the limb bud area.

Check list of birds of Wapello county, Iowa: CHAS. J. SPIKER.

Foods of fishes and the relation to fish culture: WILLIS DERYKE. The conclusions as presented are based on data secured by examinations of fishes of Winona Lake, Indiana. It is quite evident that fish of the same species require different foods at different ages, that fish are somewhat selective as to their food and that these habits make necessary a long food chain. This food chain must then be produced for the successful and most efficient method of fish propagation and culture. While the raising of fry to stock our streams and lakes is a very valuable and necessary work, it is also true that the study of what fish do eat and an attempt to establish the required natural food chain is equally important.

Some modern tendencies in zoological collections and exhibits: F. L. FITZPATRICK.

The food of the short-nosed gar-pike (Lepisosteus platostomus) in Lake Okoboji, Iowa: GEORGE E. POTTER. Collections of these fish were made, stomachs dissected, the contents examined and described. The hour of the day, temperature of air and water, region of the lake in which taken and method of taking are all given from records made for several individuals at the time of collecting. The results show that, in this lake, this fish feeds upon 60 per cent. other fish and 40 per cent. crayfish. Mention is made of the findings of several men who have worked on the food of fish. A short bibliography is appended.

The relation of vitamine deficiency to muscle fatigue in rats: V. E. NELSON and F. M. BALDWIN, in cooperation with ANNA R. RIGGS and MARJORIE CUNNINGHAM.

Comparative rates of oxygen consumption in certain marine forms: F. M. BALDWIN.

Some food reactions of snails: ERWIN W. JOHNS.

The rôle of vagi on gastric motility in Necturus maculatus: T. L. PATTERSON.

The banana snake, Boa imperator: J. E. GUTHRIE. The small boa often found in bunches of bananas is the Central American boa, *Boa imperator,* closely related to *Boa constrictor* of South America. These "banana snakes" are non-poisonous, and are very gentle, at least when young. The young ones found in banana bunches are usually from two to four feet long. Adults are said to reach nine feet. Notes are given on a captive specimen kept under observation for about nine months.

The terrestrial isopods of Iowa: MAYNE LONGNECKER.

JAMES H. LEES,
Secretary

(To be concluded)