sented by this structure, but what was to be done with the electro-magnetic phenomena which play an exceedingly important part in the world of physics?

In order to introduce these phenomena and to take them up in the general scheme of relativity it was found necessary to add to or impose upon the metric structure or Rummbey-Riff structure further terms which could account for electro-magnetic phenomena. Logically this structure had nothing to do with that which had been deduced from the elementary law of propagation of light. This duality in the geometrical structure of space leaves us in a rather indistinct state.

Professor Einstein feels that it should be possible to get a further form of this metrical space which will at one stroke comprise all phenomena in one set of equations, so that we shall not have a double metric structure of geometry and gravitation, on the one hand, and electro-magnetics on the other.

We want a system of equations which will take in all physical phenomena. This would be an enormous gain in the picture of the uniformity of physical nature.

As to the way in which the problem may be solved Professor Einstein says that it is a very difficult question to answer, and it has not yet been finished. His colleagues regard his view as a particular craze and do not support it. Nevertheless, he has faith in the path along which he is proceeding, and although the theory is not yet quite finished, he has evidence that so far as he can judge the end is very near.

He says that there is a metrical structure of space, but that a full-time structure has yet to be determined. Then he wishes to find what conditions have to be made in the older structure or what modifications in electro-magnetic phenomena may be included. He emphasizes that he is in no way taking notice of the results of quantum calculation because he believes that by dealing with microscopic phenomena these will come out quite by themselves. Otherwise he would not support the theory.

Then he says that a new idea which has occurred to him and on which he has been working is that the two elements in space should also be compared with direction. So far we have compared them only as regards size. This idea may give a clue. It occurred to him suddenly during a severe illness two years ago that by introducing the idea of direction he would be able to get the additional terms that are required in regard to space to allow electro-magnetic phenomena to be included with those of gravitation and geometry.

Professor Einstein's object now is to get mathematical conditions which will satisfy all his expressions and will comprise electro-magnetic equations as well. The problem is nearly solved, and to the first approximations he gets laws of gravitation and electro-magnetics. He does not, however, regard this as sufficient, though those laws may come out. He still wants to have motions of ordinary particles come out quite naturally.

This does not finish the program by a long way. It has been solved for what he calls "quasi-statical motions," but he also wants to derive elements of matter (electrons and protons) out of the metric structure of space. No doubt much work will have to be done before this is achieved. Professor Einstein thinks, however, that the way in which he has sketched the evolution of physical ideas is the only possible one—at least to him.

The strange conclusion to which we have come is this—that now it appears that space will have to be regarded as a primary thing and that matter is derived from it, so to speak, as a secondary result. Space is now turning around and eating up matter. We have always regarded matter as a primary thing and space as a secondary result. Space is now having its revenge, so to speak, and is eating up matter. But that is still a pious wish.

THE IOWA ACADEMY OF SCIENCE

THE forty-fourth annual meeting of the Iowa Academy of Science was held at Iowa State College at Ames on May 2 and 3, with 330 members and visitors in registered attendance.

The president's address, "The Ether Concept in Modern Physics," was given by Professor L. B. Spinney. The academy address, "Methods of Space Determination," was presented by Dr. C. C. Crump, professor of astronomy at the University of Minnesota. Professor Crump took the place of Dr. R. A. Gortner, of the University of Minnesota, who was detained on account of the serious illness of his son. Dr. Crump also acted as the American Association representative at this meeting. Other papers of the general meeting were: "A Statistical Test of Experimental Technique," G. W. Snedecor; "X-ray Diffraction in Water 2° to 98° C.: The Nature of Molecular Association," G. W. Stewart; "A Note on the Transneptunian Planet," D. W. Morehouse; "Some Recent Modifications of the Geological Map of Iowa," A. O. Thomas, and "Soil Bacteriology as a Science," P. E. Brown.

Grants from the academy research fund[1] were made

[1] The academy research fund is made possible by the refund of the American Association for the Advancement

to Professor Ben H. Peterson, of the department of chemistry, Coe College, for the purchase of special equipment for use in the study of the adsorption and coagulation of colloidal suspension by electrolytes, and to Professor L. D. Weld, of the department of physics of Coe College, for assistance in computations in an analysis of cosmic-ray observations.

Dr. R. E. Buchanan, dean of the Graduate School; Mr. R. I. Cratty, curator of the herbarium, and Dr. W. E. Loomis, associate professor of plant physiology, all of Iowa State College, were appointed delegates to represent the academy at the Fifth International Botanical Congress to be held at Cambridge, England.

Officers and section chairmen for the year 1930–31 were elected as follows:

President, H. L. Rietz, Iowa City; *vice-president*, J. H. Lees, Des Moines; *treasurer*, A. O. Thomas, Iowa City; *editor*; G. H. Coleman, Iowa City; *secretary*, J. C. Gilman, Ames; *press secretary*, F. J. Lazell, Iowa City; *A. A. A. S. representative*, H. W. Norris, Grinnell.

Bacteriology, B. W. Hammer, Ames; *botany*, E. W. Lindstrom, Ames; *chemistry, inorganic and physical*, R. M. McKenzie, Fairfield; *chemistry, organic and biological*, L. C. Raiford, Iowa City; *geology*, L. W. Wood, Ames; *mathematics*, G. W. Snedecor, Ames; *physics*, A. Ellett, Iowa City; *psychology*, E. O. Finkenbinder, Cedar Falls; *zoology*, H. E. Jaques, *Mt. Pleasant*.

BACTERIOLOGY SECTION
(R. H. Walker)

Twenty-one papers, representing many phases of bacteriology, were presented at the meeting of the bacteriology section. Among the papers dealing with general bacteriology were: "Factors Influencing the Production of Acetic Acid from Corn Stalks by Thermophilic Bacteria," by C. H. Werkman and R. H. Carter; "Further Observations on Bacteria Digesting Agar," by H. E. Goresline; "Some Notes on the Purification of Packing House Wastes," by Max Levine; "Bacteriological Studies of Freshly Broken and Frozen Eggs," by D. Q. Anderson; "Dimethyl-alpha-naphthylamine for the Determination of Bacterial Reduction of Nitrates," by C. H. Werkman, and "Some Bacteriological Problems to be Considered at the International Botanical Congress, at Cambridge, England, 1930," by R. E. Buchanan. The papers dealing with veterinary bacteriology were: "Notes on the Bacterial Flora of the Snake," by Roger Patrick and C. H. Werkman; "The Effect of the Brucella Group of Micro-organisms on Chickens," by S. H. McNutt and Paul Purwin; "The Hemoglobin Content of the Blood of Wild Fowls," by H. H. Dukes, L. H. Schwarte and F. D. Patterson, and "Coccidiosis in Swine," by Charles Murray and H. E. Biester. The papers dealing with soil and dairy bacteriology were: "Soil Bacteriology as a Science," by P. E. Brown; "Further Studies on the Nitrate Assimilating Power of Soils," by Ray A. Pendleton and F. B. Smith; "Effect of Artificial Manures on Nitrification in Carrington Loam," by F. B. Smith; "Effects of Calcium and Magnesium Limestones on the Bacteriological Properties of Grundy Silt Loam," by Arthur W. Young; "Phosphate Assimilation by *Ozotobacter chroococcum*," by L. G. Thompson; "Studies on Nitrogen Fixation by *Rhizobium meliloti* and *Rhizobium japonicum*," by G. Gordon Pohlman; "Spontaneous Culture Studies of the Non-symbiotic Nitrogen Fixing Bacteria in the Grundy Silt Loam," by John L. Sullivan; "Studies on Nitrogen Fixation in Some Iowa Soils," by R. H. Walker; "Preliminary Observations on the Escherichia-aerobacter group of Bacteria with Reference to Dairy Products," by M. W. Yale, and "Observations on an Unusual Contamination in Butter Cultures," by M. P. Baker.

BOTANY SECTION
(M. Rae Johns)

The botany program was made up of thirty-two papers dealing with plants and plant problems in Iowa. Much interest was shown in C. W. Lantz's discussion of the status of biological sciences in the high schools of Iowa. Other outstanding papers were B. Shimek's discussion on chaparral and savanna in Iowa, R. P. Adams's presentation of some rare Iowa grasses and G. W. Wilson's report on some noteworthy Iowa fungi. New mosses were added to Iowa's list in papers read by Lucy Cavanagh and Betty Blagg. A. R. Stanley reported on Cladonias of Iowa; M. Rae Johns presented the second of a series of papers on Heliantheae of Iowa. In his paper, W. H. Loehwing gave the results of experiments showing the effect of light intensity on tissue fluids in wheat. J. N. Martin discussed crowns and roots of annual and biennial white sweet clover, and also polyembryony in alfalfa and clover. Miss Florence Smith presented a paper on the identification of *Symphoricarpos occidentalis*. A. L. Hershey reported on weeds of alfalfa fields in Iowa, and also discussed the development of the vascular system of corn.

There were other papers of equal interest. The session closed with an illustrated talk by L. H. Pammel on the botany of Cuba, and weeds between Cuba and Iowa. Dr. B. Shimek was the recipient of congratulations for having completed his fortieth year of membership in the academy, and also for his valued services in the interest of conservation in Iowa.

of Science. This refund is granted the academy for the members of the academy who are also members of the association.

CHEMISTRY SECTION

GENERAL AND PHYSICAL

(Ben H. Peterson)

Twenty-five papers were presented before the two divisions of the chemistry section. Separate sessions were held Friday afternoon, and on Saturday morning selected papers were presented to both divisions. President Hughes, of Iowa State College, was the guest of honor at the section dinner.

ORGANIC AND BIOLOGICAL

(J. B. Culbertson)

The organic and biological chemistry section began its meetings with a large attendance. Twelve papers were presented, two of which were given before a brief joint meeting with the inorganic and physical chemistry section on Saturday morning. There was a good distribution of papers from the state schools and colleges of Iowa. The papers presented represented researches which had been carried on in the various schools during the past year. Professor L. Charles Raiford, of the State University, was elected chairman of the section for the ensuing year.

GEOLOGY SECTION

(C. S. Gwynne)

For the geology section, the paper of most general interest was that by A. O. Thomas, in which the newest ideas with regard to the geological map of Iowa were outlined. Papers dealing with the Chemung of New York and a possible Chemung of Iowa were presented by Lowell R. Laudon, H. D. Curry and A. C. Testor. James H. Lees described the section at the Clarinda oil prospect and compared it with other sections across the state. The road materials from the Des Moines series of south-central Iowa were described by L. W. Wood, and data on maximum precipitation in short periods of time were presented by Charles D. Reed. The faunal facies of the Fort Riley limestone was described by Donald B. Gould. Other papers were presented by title.

MATHEMATICS SECTION

(John F. Reilly, Secretary)

The nineteenth regular meeting of the Iowa Section of the Mathematical Association of America was held in conjunction with the forty-fourth meeting of the Iowa Academy of Science. A program of eighteen papers was presented, including both pure and applied mathematics. In addition the retiring chairman, Professor E. W. Chittenden, gave an address on "General Topology." Officers for the coming year were elected as follows: *Chairman,* G. W. Snedecor, Iowa State College; *vice-chairman,* E. C. Ingalls, Iowa Wesleyan College; *secretary,* J. F. Reilly, University of Iowa.

PHYSICS SECTION

(E. Hobart Collins)

The physics section held two meetings at which thirty-one papers covering a wide range of topics were presented. A selected group of papers includes three papers by Thos. C. Poulter and students on the effect of high pressure on the index of refraction of paraffin, oil and glass, studies of zinc fluorescent screen under pressure and recent developments in high pressure windows. There were four papers concerning the improvement of research and teaching apparatus and equipment. William Kunerth presented two papers on skyshine and sunshine at Ames, Iowa, and minimum lighting intensities required for reading. Students of A. Ellett presented two papers on optically excited cadmium spectrum and reflection of zinc atoms from NaCl crystals.

PSYCHOLOGY SECTION

(W. E. Slaght)

The attendance at the recent meeting of the psychological section of the academy was the largest since its reorganization some five years ago. In all, nineteen papers were presented. Five were in the field of educational psychology, six in experimental and two in applied psychology. Three papers dealt with problems of child study. A very interesting presentation dealing with the abnormal was a study of "The Relationship between Recent Impressions, and Factors Occurring in Dreams Induced by Them," by William Malamud. At the dinner of the psychological section an able address was given by C. A. Ruckmick on "Present Trends in Psychology." Those attending the section meetings were delightfully entertained by the members of the psychological staff of Iowa State College.

ZOOLOGY SECTION

(J. E. Guthrie)

The zoological program ranged from the protozoan rôle in ruminant stomachs by E. R. Becker and R. E. Everett, who find that they seem neither markedly harmful nor useful to their hosts; to the bison in Iowa by L. H. Pammel, who records its presence in the fifties, and its former abundance. Text-books have long taught error regarding the shark's ear, as H. W. Norris showed. The goldfish development of ovary and oviduct was beautifully illustrated and described by Frank A. Stromsten. R. G. Anderson reported interesting studies of rates of regeneration in mutilated *Daphnia magna.* The little-known insects known as springtails are shown by H. B. Mills to have some economic importance, both positive and negative. Another white grub distribution paper by H. E. Jaques showed records for 1929. Two studies

of winter bird records in Iowa by T. C. Stephens and William Youngworth showed a larger winter list than expected. Walter W. Bennett emphasized what should be studied and recorded about birds in Iowa now. George O. Hendrickson's "Teaching of Biology in Iowa Schools" awakened keen discussion.

JOSEPH C. GILMAN,
Secretary

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN APPARATUS FOR THE PREPARATION OF SMALL ORGANISMS

THE apparatus herein described permits the preparation of micro-organisms and small whole mounts in such a manner that (1) the change in concentration of a reagent and from one reagent to another is gradual, (2) the organisms remain on the same cover glass without the application of an adhesive agent from the time they are killed until the process of mounting is completed and (3) the objects may be viewed under the microscope during any stage of the process.

DESCRIPTION

A block of wood (Fig. 1) supports three vertical cylindrical rods each ¼ in. in diameter and 20 cm

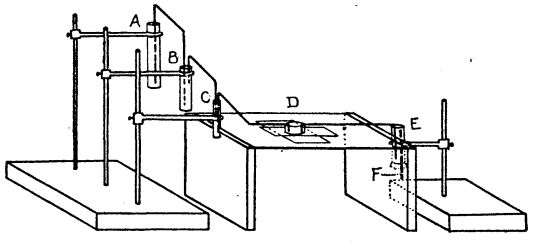

FIG. 1

long. An arm 11 cm long extends horizontally from each rod. One end of the arm bears a spring clamp for the securing of a small shell vial, the other is fitted with a collar and set screw permitting easy adjustment of its position on the vertical rod. The three shell vials *A, B, C,* of a size appropriate to the demands of the technique used, are connected by small capillary tubes. From vial *C* a capillary leads into the chamber *D* containing the organisms. The glass capillary which serves as an outlet from this chamber leads into the constant level device at *E*. The latter consists of a glass cylinder 1.5 cm in diameter and 5 cm long. At the bottom is a cork through which is inserted the capillary shown at *F* which is somewhat greater in diameter than that of the outlet capillary from *D*. The height of the top of the capillary *F* is equal to the fluid height desired in the chamber. The chamber *D* is elevated on a glass-topped table, the dimensions of the latter being adequate to permit the insertion of a microscope stage so that the preparation may be within the field of the objective.

THE REAGENT CHAMBER

This part of the apparatus (Fig. 1, *D* and Fig. 2) consists of a clamp formed of two brass plates 4 cm

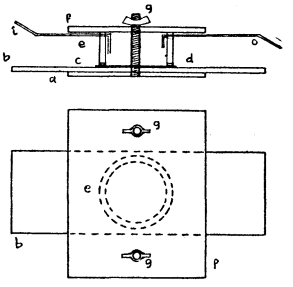

FIG. 2

by 5 cm, each of which is drilled through the center with a circular hole 21 mm in diameter. Two pillars, shown at *g,* fashioned from No. 8–32 by ⅞ in. brass machine screws are set 3.5 cm apart on the median long axis of the lower plate *a,* and corresponding holes at *g* are drilled in the upper plate so that it may be slipped over the pillars and clamped by wing nuts. A 1 in. by 3 in. glass slide *b* is placed on the bottom plate between the pillars; at *c* is a 22 mm square cover glass over which lies a thin circular cork washer *d* with internal and external diameters of 20.5 mm and 22 mm respectively. Upon this washer is placed a glass cylinder *e* 8 mm high, the circular dimensions being the same as those of the cork washer. The upper and lower surfaces of the cylinder are ground in order that the faces may be smooth and parallel. At opposite ends of a diameter, on the upper surface of the cylinder, areas are filed away sufficiently large enough to permit the intake *i* and outlet *o* capillaries to enter the chamber without extending above its surface. The intake and outlet capillaries are sealed to the chamber at their points of entrance with dental cement. The chamber is made fluid tight by adjusting the upper brass plate over the cylinder and firmly and evenly clamping it by means of the wing nuts at *g*.

METHOD OF OPERATION

The organisms are introduced into the chamber and the killing agent applied with a pipette. The reagent to follow is placed in vials *A, B, C* (Fig. 1). From then on, changes in reagents or concentrations are made in vial *A*. Vial *B* is a preliminary mixing chamber, and vial *C,* usually much smaller than the