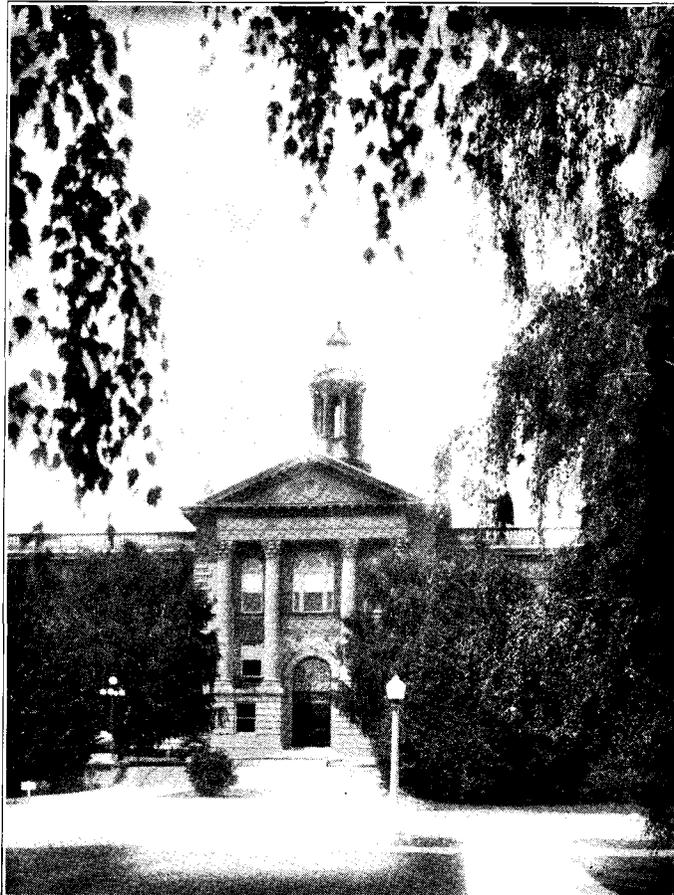


The  
**S i g m a**  
**Z e t a n**

Vol. 9

EARLHAM COLLEGE, RICHMOND, IND., APRIL, 1938

No. 1



**WESTERN ILLINOIS STATE TEACHERS COLLEGE  
MACOMB, ILLINOIS**

## PAST CONCLAVES AND OFFICERS, 1926-1938

- 1926, May 22. Shurtleff College, Alton, Illinois  
 Grand-Master Scientist, Lester Meyer; Vice-Grand-Master Scientist, Margery Fish;  
 Grand-Recorder-Treasurer, Prof. E. E. List; Grand Historian, Mary Helen Walton.
- 1927, May 21. Shurtleff College, Alton, Illinois  
 G. M. S., Lester Meyer; V. G. M. S., Margery Fish; G. R. T., Prof. E. E. List; G. H.,  
 Mary Helen Walton.
- 1928, May 19. Shurtleff College, Alton, Illinois  
 G. M. S., Mary Hughey; V. G. M. S., Prof. R. K. Carleton, G. R. T., Prof. E. E. List.  
 Prof. List resigns and Gertrude Humphrey becomes G. R. T.
- 1929, May 18. Northeast Missouri State Teachers College, Kirksville, Missouri  
 G. M. S., Prof. W. J. Bray; V. G. M. S., J. A. Bailey; G. R. T., Prof. R. K. Carleton;  
 G. H., Elbert Ruple.
- 1930, April 11-12. Otterbein College, Westerville, Ohio  
 G. M. S., Prof. W. J. Bray; V. G. M. S., Prof. E. W. E. Schear; G. R. T., Prof. R. K. Carle-  
 ton; G. H., Prof. S. M. McClure.
- 1931, April 10-11. Central State Teachers College, Stevens Point, Wisconsin  
 G. M. S., Prof. E. W. E. Schear; V. G. M. S., Prof. F. W. Shaw; G. R. T., Prof. R. K.  
 Carleton; G. H., Prof. S. M. McClure; Grand Editor, Homer R. Duffey.
- 1932, April 16. Southeast Missouri State Teachers College, Cape Girardeau, Mo.  
 G. M. S., Prof. T. A. Rogers; V. G. M. S., Prof. H. W. Olson; G. R. T., Prof. R. K. Carle-  
 ton; G. H., Prof. S. M. McClure; G. E., Prof. F. A. Hanawalt.
- 1933, **No Conclave held in 1933**  
 Officers same as for 1934.
- 1934, May 19. Otterbein College, Westerville, Ohio  
 G. M. S., Prof. H. W. Olson; V. G. M. S., Prof. E. E. List, G. R. T., Prof. T. A. Rogers;  
 G. H., Prof. S. M. McClure; G. E., Marvin C. Meyer.
- 1935, April 12-13. Jointly at Shurtleff and McKendree Colleges, Lebanon, Ill.  
 G. M. S., Prof. H. W. Olson; V. G. M. S., Prof. E. E. List; G. R. T., Prof. T. A. Rogers;  
 G. H., Prof. S. M. McClure; G. E., Marvin C. Meyer.
- 1936, April 17-18. Southeast Missouri State Teachers College, Cape Girardeau,  
 Missouri  
 G. M. S., Prof. E. E. List; V. G. M. S., Prof. H. R. Bolen; G. R. T., Prof. T. A. Rogers;  
 G. H., Prof. S. M. McClure; G. E., Marvin C. Meyer.
- 1937, April 16-17. Central State Teachers College, Stevens Point, Wisconsin  
 G. M. S., Prof. F. A. Hanawalt; V. G. M. S., Prof. Edwin W. Schreiber; G. R. T., Prof.  
 T. A. Rogers; G. H., Prof. E. W. E. Schear; G. E., Prof. George A. Scherer.
- 1938, April 14-16. Western Illinois State Teachers College, Macomb, Illinois  
 G. M. S., Prof. Edwin W. Schreiber; V. G. M. S., Prof. H. R. Bolen; G. R. T., Prof. T. A.  
 Rogers; G. H., Prof. E. W. E. Schear; G. E., Prof. George A. Scherer.

Compiled by Edwin W. Schreiber.

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## THE SIGMA ZETAN

Published in the interest of Sigma Zeta, National Honorary Society.

George A. Scherer, Grand Editor

Earlham College, Richmond, Indiana

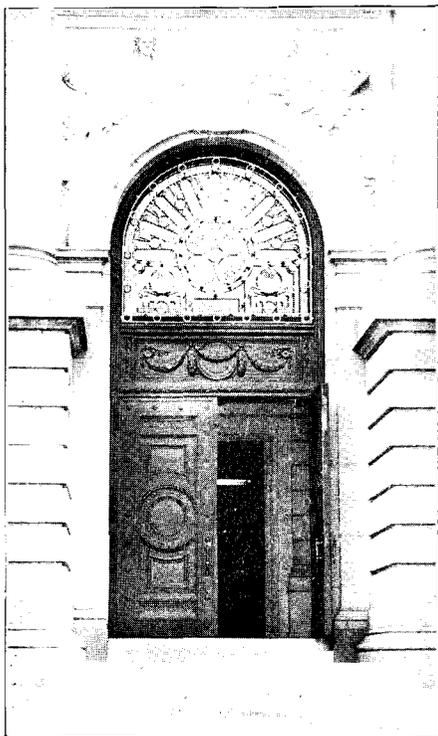
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### WE ARE TWELVE

Sigma Zeta was born in Illinois twelve years ago, and now there are included in the society twelve chapters, located in seven states from Pennsylvania to Minnesota and from Virginia to Wisconsin. This indicates a steady growth, yet the policy of Sigma Zeta has been one of slow, substantial development rather than of rapid expansion. This has been well.

Sigma Zeta might be compared to a child. At about the age of twelve the child enters that period of life which we call adolescence. During adolescence the individual develops quite rapidly into his full possibilities. Yet we all know that this time is fraught with disastrous consequences if it is not founded on a sound childhood and if there is not adequate guidance during the period.

Sigma Zeta is old enough for adolescence. The early years are well founded. It is up to us to guide her into her fuller possibilities in the years just ahead of us. The challenge should not be overlooked.




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### WESTERN'S OPEN DOOR WELCOME!

Sigma Zeta is happy to meet for its annual conclave at Western Illinois State Teachers College, Macomb, Illinois. The success of the conclave is due to the untiring efforts for several weeks of the members of the Kappa Chapter and the Grand Master Scientist, Professor Edwin W. Schreiber. Thanks for the hearty welcome!

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### SUGGESTED HANDSHAKE

Lambda chapter has suggested the following: "Since the opposable fore-finger or thumb is a unique characteristic of the human race and one which has done a great deal to put the human being above all other animals, our Society has decided that we would do well to adopt the handshake suggested below. We would like to have it suggested as a national handshake. The participants clasp thumbs of the right hand and at the same time cover the clasped hands with their left hands." What do you think?

### NEW CHAPTER

The conclave will act on a letter from Ball State Teachers College at Muncie, Indiana, stating that the faculty members of the science and mathematics departments have voted to make application for establishing a chapter of Sigma Zeta.

## THE FUNCTION OF MATHEMATICS IN GENERAL EDUCATION

By Edwin W. Schreiber



PROF. EDWIN W. SCHREIBER  
Grand Master Scientist

To better appraise the function of mathematics in general education it would be desirable to define as best we can—general education. Dr. Charles A. Beard in his "The Unique Function of Education in American Democracy" has aptly defined it thus: "The primary business of education, in effecting the promises of American democracy, is to

advance, and make available in the life of coming generations the funded and growing wisdom, knowledge, and aspirations of the race. This involves the dissemination of the knowledge, the liberation of minds, the development of skills, the promotion of free inquiries, the encouragement of the creative or inventive spirit, and the establishment of wholesome attitudes toward order and change—all useful in the good life for each person, in the practical arts, and in the maintenance and improvement of American society, as our society, in the world of nations. So conceived, education seems to transcend our poor powers of accomplishment. It does in fact, if perfection be expected; but such is the primary business of public education in the United States; theory supports it; practice inadequately illustrates and confirms it."

What part does the science of mathematics contribute to this picture of general education? Space and time forbid a detailed account of the role of mathematics as an educative factor. Let it suffice for the present to consider only five foundation stones as contributed by the "queen of the sciences."

1. **The Decimal Number System.** The significance of our number system as a universal vehicle of human progress can hardly be overstated. The numbers which we use so constantly in counting underlie the world's commercial computations. They make possible the scales and measuring instruments of science and industry. These numbers indicate the hours of the day, the days of the month, the successive years of the calendar. They dominate the pages and chapters of our books, the houses on our streets, the front and rear of our automobiles, the telephones in our houses. We find our way across trackless water and air only by a system of latitude and longitude and by steering devices resting ultimately on the scientific use of numbers. All statistical and economic research and all graphic representations have a numerical foundation. Hence number is one of mankind's great unifiers. The numerals represent humanity's one universal language. Professor Charles H. Judd says: "It is literally

true in modern life that an individual cannot maintain himself socially or physically unless he can share in the general social use of number. He who is master of the number system has a way of thinking that the race has worked out with infinite labor. He will never again fall back into the confused and inexact ways of viewing the world which are characteristic of his childhood. He has grown intellectually by assimilating the number system. Precision shows the contrast between primitive and civilized.

2. **Form, a Universal Bond of Civilization.** The second great basic unifier contributed by mathematics is the study of form. For we are living in a world, as even the ancients realized, which rests forever on the dual foundation of number and form. Primitive peoples were driven to a knowledge of this potential reservoir of form not merely by curiosity, but by sheer necessity. They all had to have food, clothing, shelter, weapons, tools, and simple household implements. All of these fundamental needs led to the gradual discovery and perfection of such practical arts as building, farming, weaving, the making of pottery and baskets. Each of these arts and their related activities necessitated an ever increasing knowledge of shape, size and position, and so prepared the way of our present science of geometry. As Professor William Betz so succinctly stated: "Even a moderate acquaintance with the origin and spirit of mathematics serves to bring out the fact that this great science has a universal background. It is anchored in the very nature of things. It is as indestructible as the force of gravitation and as permanent as hunger, being coextensive with nature, science, and technology. Hence the language of mathematics is part of the language of humanity. It is understood everywhere because the world is incurably mathematical."

3. **Mathematics as a Universal Mode of Thinking.** Let us briefly examine those essential habits of thought which mathematics contributes and which should be incorporated in the educational programs of every citizen of the modern world. Even elementary mathematics involves a continuous emphasis on at least three basic types of thinking which may be described as relational thinking, postulational thinking, and symbolic thinking. To a large extent modern civilization is their product. No one has stated this connection with greater clearness than Professor C. J. Keyser of Columbia University: "Everyone knows that one of the outstanding facts of our world is the great fact of change. The world of events, whether great or small, mental or physical, is a flowing stream. Transformation, slow or swift, visible or invisible, is perpetual on every hand. But events are interdependent so that change in one thing or place or time

(Continued on page 8)

## THE CHAPTERS

### ALPHA

Shurtleff College  
Alton, Illinois

The year 1937-38 has been very successful for Alpha chapter. Although we had only six active members who came back to college last Fall, we had twelve associate members back who were "ready, willing, and able" to back us up and to help us launch the year's program.

Among the program's presented this year were the following: Prof. E. E. List, biology and geology professor, presented some films put out by the State Health Department. Dr. J. A. Lewis, our chemistry professor, presented a lecture on "The Future of Science." Prof. W. F. Plymale, professor of mathematics, enlightened us on the subject "Artificial Radio Activity." Mr. Norvell Wilson, Research Director of the Alton Box-Board Co. presented a lecture on "The Making of Paper."

We are now looking forward to our Spring initiation and the annual Sigma Zeta picnic.

Membership: Officers—Ferdinand Meyer, Master Scientist; Beulah Zarecor, Vice-Master Scientist; Grace Toomey, Recorder-Treasurer.

Active: Prof. E. E. List, Prof. W. F. Plymale, Dr. J. F. Lewis, Dr. E. Ritchie, Betty Blair, Gordon Haxel, Dan Margenroth.

Associate: Kenneth Hornbuckle, John Stewart, Katheryn Stephenson, Harold Huck, Fern Dey, Virginia Archer, Chas. Keck, Willard Miller, Ralph Hall, Charlotte Beiser, Helen Ankershiel, Dorothy Clark.

### BETA

McKendree College  
Lebanon, Illinois

The Beta chapter, at McKendree College, in Lebanon, Illinois, began the 1937-38 school year with but three student members on the roll. Three faculty members on the campus brought the total to six as nucleus for the present year.

Three seniors were lost by graduation. B. H. Baldridge, retiring Master Scientist, is teaching at Mounds, Illinois; Velma Hamilton, assistant recorder, is also teaching, at the Vandalia High School. Ralph E. Whitson, Akers scholar in chemistry, obtained leave of absence from the research laboratory of the Aluminum Ore Company in East St. Louis to attend the graduate school at the University of Iowa.

Two juniors also failed to return. Roger Zeller entered the University of Indiana for special work in his field, and Mrs. Dorothy Eaton Reed, winner of the Waggoner Award in 1937, is at Karnak, Illinois, where her husband is teaching.

The chapter lost two of the faculty members also. Dr. Josephine Hummel-Bittner, instructor in physiology, is now in Kansas, where her husband is teaching in the university. Professor W. R. Schmidt is on leave this year for

work toward the doctorate at Washington University in St. Louis.

Dr. C. J. Stowell, professor of mathematics, a charter member of Beta and delegate to several conclaves, was appointed dean of the College and assumed the duties of that position last Autumn. During the year, the curriculum for the bachelor of science degree has been revised and the new science courses will become effective in September, 1938. A department of geology has been added to the science group and a station for field study in that subject is planned. The members of Beta have been much interested in these developments and expect a somewhat larger enrollment in the science subjects in future years.

New officers, chosen from the three remaining seniors are: Eldon E. Bauer, Master Scientist; Harold N. Hertenstein, Vice-Master Scientist; and Gwendolyn Jo Yost, Assistant Recorder-Treasurer.

Bauer is student assistant in geology and Hertenstein, in mathematics, while Miss Yost, who completed degree requirements at mid-year, is now in graduate school at Washington University.

New members initiated during the year include one senior, Charles L. Hortin of Albion, Illinois, a mathematics major and the third member of the Hortin family on the Beta rolls. Two juniors, Lester C. Wilson of Louisville, another mathematics major, and Ralph G. Ruth, of Lebanon, a chemistry major, were also taken in during the year.

On account of her limited membership, Beta does not hold meetings for presentation of scientific papers and lectures but endeavors to attain some of the objectives of the fraternity in other ways. For the past two years, the chapter has sponsored a memorial to the late Professor Edward Baker Waggoner, pioneer science teacher at McKendree.

### ZETA

Central State Teacher's College  
Stevens Point, Wisconsin

Zeta chapter opened the year with a picnic at Rib Mountain followed by a business meeting. The chapter has sponsored a homecoming float, a photo contest, a Mardi Gras concession, as well as regular programs. The programs have included "A Walk in the Autumn Woods" by Dr. Horton, "Television" by Mr. Jacobowski, "Electrotheapeutics" by Dr. Fisher and "The History of Education" by Dr. Nixon. Dr. Horton gave an interesting lecture on the various species of plants found in the local woods.

### DELTA

Northeast Missouri Teachers College  
Kirksville, Missouri

Delta chapter of Sigma Zeta held its first meeting of the year October 13, 1937. The first meeting was a supper. The meal was so thoroughly enjoyed that it was decided to have a supper meeting every fourth Monday with a

business meeting on the second Monday of each month.

Programs for the year have been very interesting. Mr. Frank Trimble, Physics instructor, gave a lecture on colored moving pictures. He also took some moving pictures of the group. Mr. Cloy Whitney gave a lecture on "The Newer Theory of Ionization." Dr. Barrett Stout, music instructor, gave a talk on "Quality of Vocal Tones."

Other activities for the Chapter consisted of a motion picture of the campus activities. A tentative list consists of campus scenes, shots of sports, debates, plays, social activities, class room and laboratory activities. Actual filming has begun and interest in the project is becoming more vital.

The administration of Kirksville State Teachers College has asked all organizations on the campus to plant a tree this Spring. Sigma Zeta has complied with this request.

Delta chapter of Sigma Zeta voted membership to the Junior Missouri Academy of Science.

Roy Simpson, a Sigma Zeta member, is to give a demonstration lecture on the micro-variety at the Missouri Academy of Science meeting. The meeting is to be held at Rolla, Missouri. Mr. Simpson is doing this work under the direction of Mr. Trimble.

We have initiated three new members this year. This brings our membership to a total of eleven active, four faculty, and ten associate members.

### LAMBDA

Mansfield State Teachers College  
Mansfield, Pennsylvania

The latter part of last year, the Science Club of Mansfield State Teachers College became the Lambda chapter of Sigma Zeta National Honorary Science Society. Then came the task of really getting it established on the campus.

This year we have accomplished quite a bit and have derived much benefit from our organization. Members of the faculty have spoken at some of the meetings and one especially interesting lecture on birds was given by Professor Beyer of the Biological Department. His talk was given in conjunction with colored bird slides which he himself had taken. Current events was the topic of discussion for one meeting. New members furnished the program for another meeting by writing papers on amusing and serious topics on science assigned to them.

This year we have tried something new. Seniors have written papers of a thousand words or more on some phase of science in which they were particularly interested. To do this it has been necessary for them to do much reading and cut that reading down to a clear, concise paper. Not only have these papers been beneficial to the writers, but they have also been a source of interest to other members of the fraternity.

The fraternity members have not confined themselves to indoor activities. Field and bird trips have been arranged and attended by many

Sigma Zeta members. The fraternity has had many good times together with its more serious moments. Last Fall, Sigma Zetas held a picnic supper at the local golf course and everyone had a most enjoyable time.

The initiatory team has been worked up to a point of perfection this year. The initiation is formal and is perhaps the most impressive and beautiful ceremony on the campus. A handshake for the fraternity has been worked out and suggested by Vice-Master Scientist Eugene McDonald, and accepted by the members. It will be used at the conclusion of the initiation exercises this Spring.

Very soon the annual Spring banquet will be held and it is expected from information at hand that over thirty members will attend (seniors who graduated; new members and faculty). The banquet will be formal and should be a huge success because all committees have worked hard for some time.

New and competent officers for the fraternity for the next school year have been elected and will take charge at the Spring banquet. A successful year is predicted for the fraternity in 1938 and 1939.

In conclusion, the fraternity owes much of its success to its co-sponsors, Dr. Steele and Professor Alger.

### NU

Northern State Teachers College  
DeKalb, Illinois

Nu chapter has planned three outstanding activities for this year. In January Dr. Gable, an eminent authority on radium, was sponsored by our chapter. About three hundred people were present for this meeting.

At various times throughout the year, members of our chapter gave talks and demonstrations on the different phases of science to science clubs and groups throughout our vicinity.

Plans are now under way for our annual exhibit and open house. This exhibit has become the climax of events for our science club.

This year we added four people to our active membership and four associate members.

### GAMMA

Medical College of Virginia  
Richmond, Virginia

Gamma chapter began the year 1937-38 with a nucleus of eight seniors from the school of medicine: Master Scientist, S. G. Page; Vice-Master Scientist, M. E. McRae; Recorder-Treasurer, H. J. Williams; members, H. W. Caldwell, Garland Dyches, Dr. Claudio Rodriguez, W. P. Terry, W. T. Thompson.

In November, 1937, additional members were elected from the top ten per cent of the seniors and juniors in medicine, selection being made mainly on scholarship with leadership and personality also considered. This brought the total up to twenty-three members as follows: seniors elected—E. C. Bryce, Jr., H. D. Crow, Meyer

Goldschmidt, A. A. Hoffman, A. W. Holmes, Thomas Holt, E. G. Sharp, G. R. Tyler; juniors elected—B. B. Clary, T. S. Ely, A. B. Gathright, Jr., Catalino Scarano, W. M. Smethie, Jacob Wexler.

In December, 1937, feeling the need of a fraternity which would knit our four schools—medicine, dentistry, pharmacy, and nursing—closer together, and to lead and encourage them in scientific endeavor, plans were laid to extend Sigma Zeta and make it a four-school fraternity to meet this so obvious need.

Therefore, in February, 1938, additional members from the schools of dentistry, pharmacy and nursing were elected, the requirements specified were that the candidates must have at least a B average for the first two years and only the top ten per cent of each class as judged by personality and leadership were elected from the above restricted number. New members selected were: Dentistry—seniors, E. D. Baker, R. A. Daniel; juniors, J. C. Kanter, H. S. Moon, P. R. Milton. Pharmacy—seniors, R. L. Richardson, W. H. Joyner, Pearl Eberhard; juniors, Z. I. Blachman, D. D. Gray. Nursing—seniors, Barbara Drixon, Juanita Loppe, Mary P. Kuykendall; juniors, Jessie Jeffers, Julia Jones, Pauline Wood, Helen Popovich.

Gamma chapter has thus strengthened its position and made itself more useful and of more vital importance in the life of our school.

Next year, we hope to make even greater strides in leadership and encouragement—progress which will measure up to these important changes that we have made on the one hundredth anniversary of our school.

Gamma chapter expresses its hope for the continued growth and development of Sigma Zeta.

### EPSILON

Otterbein College  
Westerville, Ohio

There are six active faculty members and fifteen active student members. Of this fifteen, eight are senior. The members are: Master Scientist, Elmer Funkhouser; Vice-Master Scientist, John Flanagan; Recorder-Treasurer, Emerson Shuck; Program Chairman, Mary Musser; Berle Babler, Mary Beth Cade, Ralph Ernsberger, Sally Shuck, Dorothy Steiner, John Wilson, John Winkle, George Curtis, Richard Grimm, Charles Harding, Floribel Lambert.

The Epsilon chapter has held regular meetings through the year at which were presented papers on "Winter Birds," "Glacial Action," "Regeneration of Life By Freezing," "Cyclonic Movements," "The Distillation of Coal," "Scientific Oddities," "Fundamental Theories of Atomic Structure," and "Alchemy."

The McFadden Science Club, sponsored for the first time last year by Epsilon chapter, continued in its action this year. It has grown in both interest and membership and is proving a fine associate organization to the Epsilon chapter. Membership in it is regarded as associate membership in Sigma Zeta, and members for Sigma Zeta are taken from its roll.

### THETA

Elizabethtown College  
Elizabethtown, Pennsylvania

During the past year, the Theta chapter has been a new club in its activities as compared to other years. We have had monthly meetings similar to those of last year; that is, each department had its turn at presenting a program in its particular field.

Besides this we have attempted to hold project meetings on fortnights alternating with our regular monthly meetings. At these meetings we planned and worked on projects that we felt would be an aid to the study of science at Elizabethtown College in the future. Thus we started a collection of animal skulls, and converted an unused storeroom into an excellent developing room. At present some of the members are working on the construction of a permanent, satisfactory micro-projector for the biology department. Other things have also been planned but they will have to be deferred until next year because of the lack of time.

The club is also expecting to sponsor a trip to Franklin Institute in Philadelphia on April 23, to which the entire school will be invited if they are sufficiently interested. We will also hold a picnic near the end of the school year.

Membership: Officers—Master Scientist, Roy E. Pfaltzgraff; Vice-Master Scientist, Aaron B. Herr; Secretary-Treasurer, Samuel Geyer; Faculty Adviser, Dr. C. D. Howell. Active: John R. Glass, William L. Shaefer, Herman Leister; Associate, Henry K. Oberholtzer, and Lester Manbeck.

### MU

State Teachers College  
Mankato, Minnesota

The Mu chapter was granted its charter on April 16, 1937. The membership is drawn from the Sigma Zeta sponsored Science Club which will continue to serve as a source of membership. There are no restrictions as to membership in the Science Club.

Various instructional programs of a scientific nature have been presented throughout the year. The chapter sponsored a college assembly program consisting of sound motion pictures of various science subjects, and participated in the college homecoming by constructing a float which attracted much attention.

At the present time there are sixteen active members and three associate members. The officers of the chapter are: Master Scientist, Ernest Thompson; Vice-Master Scientist, Mabel Bloom, Recorder-Treasurer, Finn Larsen, and Historian-Editor, Duane Seaquist.

As provided for in the chapter's constitution, the member who submits the best original scientific paper, to be read at the May meeting, will be given a Sigma Zeta key or the equivalent.

The Mu chapter will hold its first homecoming banquet at commencement time. Most of the eight members lost through graduation or transfer last year, have asked that the homecoming banquet be made an annual affair.

## TWELFTH ANNUAL CONCLAVE

April 14-16, 1938

DR. COMPTON ON "COSMIC RAYS"

### PROGRAM

#### THURSDAY, APRIL 14

8:00 p. m. Meeting of National Officers

#### FRIDAY, APRIL 15

8:15- 9:00 a. m. Registration  
 9:00- 9:45 a. m. Concert by Western Band  
 10:00-10:50 a. m. "Cosmic Rays" by Dr. Arthur H. Compton, University of Chicago  
 11:00-11:45 a. m. Science Movies  
 1:00- 3:00 p. m. Field trip to one of Macomb's chief industries  
 3:30- 4:30 p. m. Science Exhibits  
 6:00- 8:00 p. m. Annual Banquet, Hotel Lamoine  
 9:00 p. m. School Dance — Delegates invited

#### SATURDAY, APRIL 16

8:00- 9:00 a. m. Sigma Zeta Breakfast  
 9:00- 9:30 a. m. Lecture  
 9:30-10:00 a. m. Lecture  
 10:00-11:30 a. m. National Business Meeting  
 12:00 m. Farewell Luncheon

#### THE FUNCTION OF MATHEMATICS

(Continued from page 4)

produces changes in other things or places or times. With the process of change every human being must deal constantly or perish. The processes of change are not haphazard or chaotic, they are lawful. To deal with them successfully, which is a major concern of man, it is necessary to know their laws. To discover the laws of change is the aim of science. In this enterprise of science the ideal prototype is mathematics for mathematics consists mainly in the study of functions and the study of functions is the study of the ways in which changes in one or more things produce changes in others."

4. **Mathematics as a Humanizing Element in Education.** It is customary to speak of cold figures and of cool logic. If this means that facts as such are independent of sentiment or personal whim, such phrases contain an undeniable truth. The propositions of mathematics are objective. They are of the form "if p, then q." But the whole universe is built on relations. Obviously, then, the attribute of coldness is not an inherent quality of truth or of natural phenomena. Is a sunny landscape cold? To science it is a complex assemblage of molecular aggregates or vibrations, totally devoid of color, beauty, purpose, and the like. To the artist and the poet, it is a source of rapture and of endless inspiration. Just so, mathematics, as a vast system of ideas, principles, and processes, may be viewed from the

standpoint of emotionless, critical analysis, or from that of the artist who beholds with delight a finished masterpiece.

5. **Mathematics as a Portrayer of Art.** We find in nature an all-pervading principle of order, a definiteness in the structure of all material things, a symmetry that often extends to minute details: "Nature's attention to a very small detail is well known in the case of the crystal, for if we examine the octohedron we find it a figure bounded by eight equilateral triangular plans meeting one another at 12 edges at an angle of  $109^{\circ} 28' 27''$ , not, be it noted,  $108^{\circ}$  or  $109^{\circ}$  or  $110^{\circ}$ . The symmetry and beauty of the various snow-crystals are perfect, and the number of different designs that can be wrought on the basis of the six-rayed figure is surprising indeed. To the production of the exquisite pattern of a crystal there go many more minutely nice arrangements than to the construction of a watch. We can understand the natural philosopher, Sir David Brewster, being so impressed with this precision that he would sometimes exclaim in his laboratory, "Oh God, how marvelous are Thy works!" When we turn to the realm of the living, we find so much that shows design, end in view, aim to be achieved, order, method and system that the real difficulty is to decide what to speak of first."

(Fraser-Harris, D. F. "Unity and Intelligence in Nature.")

Thus mathematics is a necessary part of general education!