

of the school of forestry, State University, Missoula, Montana, on the subject, "Some Aspects of Present Day Research in the Inland Empire." Following the address members engaged in a general discussion.

In the afternoon the general session was devoted to a program presented by the medical section.

The annual dinner of the association was held the same evening in the Hall of the Doges, Davenport Hotel. The annual address of the retiring president was given by Dr. John A. Kostalek, University of Idaho, Moscow, Idaho, on the subject "The Utilization and Conservation of our Carbon Resources."

The general sessions of the second day included a business meeting and a luncheon of the association. At the former meeting, in addition to other matters of business, the association instructed the secretary to arrange for affiliation with the American Association for the Advancement of Science as an academy, retaining the present name. At the latter meeting an address was given on the subject "The Advent of the Railroads into the Pacific Northwest," by Dr. E. A. Bryan, State College of Washington, Pullman, Washington.

At this meeting, also, in addition to the customary resolutions, a resolution was passed commemorating the services of Dr. M. F. Angell, deceased, a valuable member of the organization and its first president.

In addition to the general sessions, section meetings were held by the following groups on both days of the meeting: Botany-zoology, chemistry-physics, education, psychology, engineering, forestry, geology-geography and social science.

*Northwest Science*, the official publication of the association, is now entering upon its fourth year of existence and has conclusively demonstrated its usefulness as an avenue for publication in this region.

The following officers were elected:

*President*, President E. O. Holland, Washington State College, Pullman, Washington; *Vice-president*, Carl Von Ende, University of Idaho, Moscow, Idaho; *Secretary-treasurer*, J. W. Hungate, State Normal School, Cheney, Washington; *Councilor*, President C. H. Clapp, State University, Missoula, Montana; *Trustee*, J. W. Hungate, State Normal School, Cheney, Washington.

#### Section Officers

*Botany-Zoology: Chairman*, Charles W. Waters, State University, Missoula, Montana; *Secretary*, Charles E. Cone, Ephrata High School, Ephrata, Washington.

*Chemistry-Physics: Chairman*, B. C. Neustel, Whitworth College, Spokane, Washington; *Secretary*, Rudolf Meyer, Lewis and Clark High School, Spokane, Washington.

*Education: Chairman*, R. F. Hawk, State Normal School, Cheney, Washington; *Secretary*, I. N. Madsen, State Normal School, Lewiston, Idaho.

*Engineering: Chairman*, Richard McKay, Washington Water Power Company, Spokane, Washington; *Secretary*, Ellery Fosdick, Washington Water Power Company, Spokane, Washington.

*Forestry: Chairman*, J. H. Ramskill, State University, Missoula, Montana; *Secretary*, K. D. Flock, U. S. Forest Service, Missoula, Montana.

*Geology-Geography: Chairman*, Otis W. Freeman, State Normal School, Cheney, Washington; *Secretary*, F. B. Laney, State University, Moscow, Idaho.

*Medicine-Surgery: Chairman*, C. M. Anderson, Spokane, Washington; *Secretary*, Clarence Lyon, Spokane, Washington.

*Social Science: Chairman*, T. S. Kerr, State University, Moscow, Idaho; *Secretary*, Louis E. Livingstone, Lewis and Clark High School, Spokane, Washington.

J. W. HUNGATE

SECRETARY-TREASURER,  
CHENEY, WASHINGTON

## SPECIAL ARTICLES

### ON THE MONOMETHYL-GLUCOSE OF PACSU

For an investigation now in progress in this laboratory, 4-methyl-glucose was required, and as Pacsu<sup>1</sup> had prepared a substance to which he ascribed this structure, we undertook its preparation by his procedure. However, in a recent paper, Brigl and Schinle<sup>2</sup> describe 2-methyl-glucose with physical properties practically identical with those given by Pacsu for his methyl-glucose. Moreover, the 2-methyl-1, 1-diethylmercapto-d-glucose of Brigl and Schinle is apparently identical with the methyl-1, 1-diethylmercapto-d-glucose which resulted when we extended

<sup>1</sup> E. Pacsu, *Ber. chem. Ges.*, 58, 1455 (1925).

<sup>2</sup> P. Brigl and R. Schinle, *Ber. chem. Ges.*, 63, 2884 (1930).

Pacsu's procedure to diethylmercaptoglucose. These considerations led us to subject the methyl-glucose of Pacsu to more rigorous test.

On treatment with phenylhydrazine in methyl alcohol solution, the methyl-glucose gave a methyl-hexose phenylhydrazone which had the same properties as the corresponding derivative of the 2-methyl-glucose of Brigl and Schinle. Moreover, like their 2-methyl-glucose, on heating with excess phenylhydrazine in dilute acetic acid solution, it lost the methyl group and gave glucosazone, and not a methyl-hexosazone, as reported by Pacsu. Additional supporting evidence was obtained from the study of the glucoside formation and from the study of the products of oxidation.

Thus, the identity of the methyl-glucose of Pacsu

with the 2-methyl-d-glucose of Brigl and Schinle has been definitely established.

P. A. LEVENE  
G. M. MEYER  
A. L. RAYMOND

THE ROCKEFELLER INSTITUTE  
FOR MEDICAL RESEARCH,  
NEW YORK

# THE EFFECT OF PHYSICAL AND CHEMICAL AGENTS ON THE OOCYSTS OF *EIMERIA TENELLA*

Coccidiosis in the domestic hen, *Gallus gallus*, represents a typical parasitological picture. The reservoir is the adult bird acting as a chronic carrier and disseminating a few oocysts. These oocysts under favorable conditions sporulate, and become infective to new hosts. Once the infection is established in younger birds, acute coccidiosis usually results and can only be checked in two basic ways: first, by removal of the infected birds, either by death, isolation or therapeutic measures; and secondly, by preventing the access of uninfected birds to the infective oocysts by sanitation or the creation of conditions unfavorable to the extra-corporal stages of the parasite.

Isolation or death of the infected birds is a costly and generally impractical method of control and, to date, no effective therapeutic agent has been found.

Unless sanitation is rigidly and thoroughly employed, an undercurrent of acute coccidiosis results, which may at any time break out into a devastating epidemic. In large poultry establishments, strict sanitation represents a large economic factor which depletes the net profits to the concern.

The exact conditions necessary for the development of the freshly passed, unsegmented oocyst into the mature, infective stage are but vaguely known, and practically nothing has been reported regarding the lethal limits of the oocysts. With this in mind, the writer has been directing his work toward a possible weak link in the parasitological cycle which will be of economic significance in the control of coccidiosis in poultry.

The results reported in this paper represent a progress report of the work now being undertaken in this laboratory. All work has been done on *Eimeria tenella*, the pathogenic species of coccidium in hens, isolated and described by Tyzzer<sup>1</sup> in 1929.

The prepatent period of coccidiosis produced by *Eimeria tenella* is approximately 165 hours regardless of the number of infective oocysts ingested by the host. There seems to be no correlation between the size of the infecting dose and the height and duration of the patent period. This is not surprising

<sup>1</sup> E. E. Tyzzer, "Coccidiosis in Gallinaceous Birds," *Am. Journ. Hygiene*, X, No. 2, 1, 1929.

since, as Tyzzer has shown, many factors may enter into the situation before oocysts are produced in the host.

There appears little, if any, difference in the susceptibility of the segmented and unsegmented oocysts to heat as shown in the following table:

TABLE I

Temperature	Segmented oocysts, infections produced				Unsegmented oocysts, mortality percentages
51° C.	+	+	+	+	23.5
53° C.	-	+	+	o	100.0
54° C.	+	-	-	-	100.0
55° C.	-	-	-	-	100.0
Controls uninfected	-	-	-	-	
Controls unheated	+	+	+	+	0.0
Time of exposure, 10 minutes					

The criterion used for viability of segmented oocysts was their ability to produce infections when fed in large numbers to chicks known to have been coccidia-free since hatching. The criterion used for viability of unsegmented oocysts in all experiments was their ability to segment when placed in a 2½ per cent. solution of potassium dichromate at 20° C. for 72 hours. All figures, in this and succeeding experiments, are exclusive of natural death and hence represent the mortality due to experimental conditions only.

The time required to kill washed, unsegmented oocysts is inversely proportional to the degree of heat used. Tabulated, the time required for 100 per cent. mortality of unsegmented oocysts is:

TABLE II

Temperature	Time required
45° C.	24 hours
50° C.	1½ hours
55° C.	3 minutes
60° C.	15 seconds
70° C.	15 seconds
80° C.	5 seconds
90° C.	5 seconds

Unsegmented oocysts do not show high resistance to ultra-violet rays. Washed oocysts, exposed to rays produced by a mercury vapor lamp, succumbed as shown in Table III.

The unit of ultra-violet rays used was the zinc sulfide unit of Clark.<sup>2</sup>

Certain reagents were also used in attempts to kill washed, unsegmented oocysts. Briefly, the technique

<sup>2</sup> J. H. Clark, "The Zinc Sulfide Method of Measuring Ultra-violet Radiation and the Results of a Year's Observations on Baltimore Sunshine," *Am. Journ. Hygiene*, IX, No. 3, p. 646, 1929.