only data necessary to the computation of the heat production of the standard day are the total heat production, the weight of the animal, the time spent standing and the factor representing increase in heat emission due to standing.

IMPROVEMENTS OF TECHNIC

In addition to the above-mentioned considerations numerous minor improvements of technic have had the effect greatly to increase the accuracy of the experiments upon which the net-energy determinations are based, thus:

(1) The digestion period has been increased from ten to eighteen days, the calorimeter period from two to three days, and the preliminary period in the calorimeter from four and one half to thirteen and one half hours;

(2) The fact that refusal of feed can not be compensated for is now recognized, and the occasion for such corrections is avoided;

(3) The fact that the previously customary shearing of the steers at the beginning and at the end of an experimental program (to account for growth of hair) has the effect to raise the critical temperature of fasting to a point above the maximum temperature attainable with our calorimeter, as now equipped, and consequently that the animal must not be shorn, has been experimentally demonstrated;

(4) An improved insulation of the movable shield, in the calorimeter, which regulates the exposure of the cooling coils to the air of the chamber, has practically eliminated the need for changes in rate of cooling-water flow in the course of a seventy-two-hour calorimeter period, thus increasing, on several accounts, the accuracy of the heat measurement;

(5) A provision for the moistening of the air before it goes into the Bohr meters, thus preventing the lowering of the water-level in the meters, by evaporation, increases the accuracy of the air measurements;

(6) There have been improvements of carbon, nitrogen and moisture control as follows: by the use of refrigeration is prevented (a) the loss of carbon and nitrogen from the daily aliquots of feces during the course of an eighteen-day experiment; and (b) the loss of carbon from feces samples retained for the furnace determination of carbon, in the fresh material; and (c) the preservation of feeds by refrigeration makes possible the analysis of the same from the fresh condition, working to a dry instead of to an air-dry basis;

(7) The use of the new Wiley mill makes possible an improved moisture control in feeds by reason of rapid grinding, with greatly reduced attrition; and,

(8) An improved control of carbon loss from excreta during drying in an air oven, preliminary to bomb estimations of energy and carbon, has been attained by improved conditions of drying, checked by furnace determinations of carbon on the fresh materials.

In view of these very material improvements of understanding and method the idea of determining significant and useful net-energy values of feeding stuffs seems to be in a greatly improved status, and work on this project is going forward rapidly.

The writer is pleased to acknowledge that the credit for these several improvements is largely due to the cooperating members of the staff of the institute, namely, J. August Fries, W. W. Braman, D. C. Cochrane, Max Kriss, C. D. Jeffries, R. B. French, R. W. Swift and J. V. Maucher.

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SOME ECOLOGICAL RELATIONS OF THE HYPOGAEOUS FUNGI

THE following notes were made by the junior author at the suggestion of the senior author in connection with a study of the various types of peridial structure shown by California species of *Hysterangium*. The statements are largely in the form submitted by the junior author. The senior author has edited and added to these statements.

The occurrence of hypogaeous fungi of various sorts (Tuberales, Hymenogastrales, Endogonaceae, Elaphomycetaceae, etc.) in surprising number and variety in the coastal region of western North America from central California northward naturally leads to the query as to why this region is seemingly so particularly adapted to the growth of these organisms. A similar condition has been noted by Thaxter for the coast of South America along the straits of Magellan (*cf.* Thaxter, *Bot. Gaz.*, 50: 432, Dec., 1910).

At the suggestion of the senior author, his co-author made some observations tending to throw light on the climatic-edaphic-biotic complex existing in her collecting district, which is one yielding abundance of material. The following statements prepared by her refer most particularly to her experience with members of the genus *Hysterangium*:

Practically all the collecting reported on was done on King's Mountain in the Sierra Morrena section of the Santa Cruz Mountains, directly west of Redwood City, California.

The vegetation in this region is typical of a mixed forest association, being made up mostly of Redwood (*Sequoia sempervirens*), Fir (*Pseudotsuga taxifolia*), Tan Oak (*Lithocarpus densiflora*), Madrone (*Arbutus Menziesii*), Manzanita (*Arctostaphylos Manzanita*),

Live Oak (*Quercus agrifolia*) and California Lilac (*Ceanothus sorediatus*).

This region is subject to heavy, frequent coast fogs, common to most of the coast localities. It is so situated that the trees catch and hold the fog. These coast fogs usually last three days, during which time the moisture continually drips from the trees in amounts comparable to our very light spring showers. Sometimes the moisture barely penetrates the leafy surface mat, but usually a three-day fog will penetrate an inch or more into the ground.

Hysterangium is found most abundantly under tan oak or a mixed stand of tan oak and madrone. Seldom was a collection made under a pure redwood stand—the oak and madrone seem to furnish the necessary cover mat of decaying leaves. This mat seems to aid in moderating both the temperature and the moisture conditions of the soil. It should be noted here, however, that the mycelium of *Hysterangium*, no matter how near the surface of the ground it may grow, is confined to the soil and is not found penetrating the leafy cover mat. There seems, however, to be an association between the mycelium and the very fine roots found in the ground. Whether or not this may be an indication of parasitism is still an open question. Moisture and temperature conditions seem to determine largely the growth of *Hysterangium*. While I found it continuously throughout the year, the ease in locating a live patch of mycelium or one that was fruiting varied greatly.

As has been intimated, the coast fogs in that locality are frequent and continuous throughout the year. After a so-called three-day fog the mycelium was always snow-white and fruiting. It was in collections of this sort that the young stages of the sporocarp were always found. This proved to be the case, whether the collecting was done in wet April or dry September. Mature sporocarps were available at all times.

Temperature readings were made of both soil and air at the time of collecting. Collections ranged from April, 1924, to May, 1925. The following data were obtained from the readings:

Date	Time	Air	Soil
May 30	7:00 A. M.	60° F.	.....
	8:00	.....	57° F.
31	7:20	59	.....
	8:20	63	.....
	9:20	.....	52
	4:00 P. M.	70	.....
	4:30	.....	56
June 1	7:20 A. M.	69	.....
	8:30	76	.....
	10:00	.....	54
	12:30 P. M.	81	.....
	2:00	.....	57
	4:20	78	.....
July 4	4:30	49	.....
	4:00	.....	54
5	9:45 A. M.	50	.....
6	10:30	60	.....
	10:45	.....	54
Aug. 23	9:30	64	.....
	10:00	.....	56
	1:45 P. M.	.....	56
	2:30	69	.....
	4:30	74	.....
Sept. 27	10:30 A. M.	.....	56
	10:45	68	.....
Oct. 12	9:30	52	.....
	10:00	.....	50
	12:45 P. M.	58	.....
	1:05	.....	50
	1:30	58	.....
	1:50	.....	50
Nov. 30	1:30	50	.....
	2:00	.....	54
Dec. 17	10:30 A. M.	46	.....
	11:00	.....	42
Jan. 2	12:30 P. M.	52	.....
	1:00	.....	48
10	4:00	50	.....
	4:30	.....	44
31	2:00	58	.....
	2:30	.....	56
Mar. 7	4:10	.....	48
	4:30	44	.....
	4:50	.....	48
8	8:30 A. M.	42	.....
	11:20	.....	48
	11:40	46	.....

From the above table the following summary was evolved:

	MAXIMUM			MINIMUM			AVER.
	Temp.	Time	Date	Temp.	Time	Date	Temp.
Air	81°F.	12.30 P.M.	6/1/24	42° F.	8.30 A.M.	3/8/25	59.2° F.
Soil	57	8.00 A.M.	5/30/24	42[1]	11.00 A.M.	12/17/24	52
				48	1.00 P.M.	1/2/25	
					4.50	3/7/25	
					11.20 A.M.	3/8/25	

[1] This low temperature was probably due to the abundance of frost which covered the ground at the time of that collection.

Moisture content of the soil was also determined for a few of the collections. This problem was more difficult to solve with accuracy than that of temperature, because soil samples were necessarily collected on Saturday or Sunday and held over until Monday for weighing. This was done, however, with a great amount of care and the samples kept in a place as free from moisture changes as possible during that time.

Moisture content varied from .0591 to .1792. The average was .10276.

This region varies greatly in the texture of its soil, which belongs to the rough, broken phase of the Altamont series and is made up mostly of loam and clay loam constituents. When there was an abundance of stages of sporocarps of *Hysterangium*, I found that the soil always felt cold and moist.

The experience of the collector, as given in the foregoing statements, seems to indicate with clearness and approximate exactitude the conditions in this one exceedingly favorable locality for hypogaei. The temperature of the soil varies around 52° F., from 42° F. as minimum, to 57° F. as maximum, but largely oscillating between 48° F. and 56° F. (8.9° C. and 13.3° C.).

The production of young sporocarps, as well as seeming invigoration of the mycelium, seem directly connected with variation in the moisture supply and to be associated particularly with fog conditions.

The edaphic conditions, while only incidentally considered, are nevertheless definite, *viz.*, coarse, well-drained soil, protected from too rapid change in temperature and moisture content by a leafy cover mat.

The biotic conditions indicate association with a broad leaf forest association, the oak component probably being particularly influential in the case of the species of *Hysterangium* studied.

While there are doubtless variations from these conditions, at least in small detail, for individual species and genera of the hypogaeous fungi of our region, yet these general conditions are probably approximate for all.

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SOCIETIES AND ACADEMIES

AMERICAN SOCIETY OF NATURALISTS

THE forty-third meeting of the American Society of Naturalists was held in New Haven, December 28 to 30, 1925. The program of the first two days was arranged in cooperation with the joint genetics sections of the Botanical Society of America and American Society of Zoologists, whose official meeting was held in Kansas City. Twenty-nine papers on genetic subjects were presented. On Wednesday the annual symposium was held, the subject being "The Structure of Protoplasm." It included the following contributions:

Some colloidal aspects of protein: PROFESSOR W. A. PATRICK, The Johns Hopkins University.

The physical state of protoplasm: PROFESSOR ROBERT CHAMBERS, Cornell University Medical College.

Newer aspects of the alveolar structure of protoplasm: PROFESSOR E. B. WILSON, Columbia University.

Some physiological aspects of the problem of protoplasmic structure: DR. W. J. V. OSTERHOUT, The Rockefeller Institute for Medical Research.

Elasticity as an indicator of protoplasmic structure: PROFESSOR WILLIAM SEIFRIZ, University of Pennsylvania.

The structure of protoplasm in Amoeba proteus: PROFESSOR S. O. MAST, The Johns Hopkins University.

The physical structure of the protoplasm of sea urchin eggs: PROFESSOR L. V. HEILBRUNN, University of Michigan.

Surface film theory of the function of mitochondria: DR. E. V. COWDRY, The Rockefeller Institute for Medical Research. (By title.)

The Naturalists' dinner was given in the Hotel Taft. After the dinner, the president, Dr. C. Hart Merriam, related many of the beliefs of California Indians about animals.

New members were elected as follows:

C. O. Appleman, University of Maryland; Ralph E. Cleland, Goucher College; F. E. Clements, Carnegie Institution of Washington; E. V. Cowdry, Rockefeller Institute; C. Stuart Gager, Brooklyn Botanic Garden; E. W. Gudger, American Museum of Natural History; Lewis V. Heilbrunn, University of Michigan; S. O. Mast, Johns Hopkins University; H. A. Pilsbry, Academy of Natural Sciences (Phila.); Inez Whipple Wilder, Smith College; A. H. Wright, Cornell University.

Professor J. Arthur Harris, University of Minnesota, was elected president for 1926; Dr. J. A. Detlefsen, editor of *Biological Abstracts*, vice-president; A. Franklin Shull, University of Michigan, secretary, and E. W. Sinnot, Connecticut Agricultural College, treasurer.

A. FRANKLIN SHULL,
Secretary

AMERICAN MATHEMATICAL SOCIETY

THE thirty-second annual meeting of the American Mathematical Society was held in New York City, from Thursday to Saturday, December 31, 1925, to January 2, 1926. The regular sessions were held at Hunter College, preceded on December 31 by the annual meeting of the board of trustees, held at the Faculty Club of Columbia University. This meeting was made especially interesting by the exhibition at Hunter College of an important part of the collec-