in the human disease, multiple sclerosis, was discussed by Pette and Kuwert (Hamburg).

Antibodies to the alcohol-soluble brain hapten were described by Niedieck (Hamburg). The hapten itself is cerebroside but requires cholesterol and lecithin as auxiliary factors. Both precipitating (7S γ_2) and complement-fixing (19S γ_1) antibodies were demonstrated. The antibodies paralleled the development of encephalomyelitis induced with whole tissue, but could hardly be the critical antibody since no disease resulted when rabbits were sensitized to cerebroside.

In spite of the fact that experimental studies cannot be translated directly to clinical situations, an optimistic atmosphere was created by papers on specific immunologic prevention, suppression, and therapy of encephalomyelitis (Alvord), and suppression and treatment of this disease with antimetabolites (Brandriss, Bethesda) and steroids (Kibler). The paper presented by Bunge (New York City) on the possibility of remyelination in the central nervous system after certain types of experimentally induced demyelination is also pertinent to the possible reversal of demyelinating processes in human beings.

Although experimental allergic encephalomyelitis is interesting in itself as one of the most extensively studied examples of autoimmune pathology, the fact remains that it is the closest experimental model for the greater neurological enigma, multiple sclerosis. With the recent development of skin tests and serologic reactions to the specific encephalitogenic proteins of the myelin of the central nervous system, it is anticipated that critical tests will soon be made of the hypothesis that encephalomyelitis and multiple sclerosis are in fact related.

In addition to the large amount of new data on the experimental disease, additional information was also provided on the etiology and treatment of multiple sclerosis. Yokoyama (Bethesda) reported β_{2A}- and three new components of γ_2-globulins in the CSF in multiple sclerosis, but the antigen to which these antibodies react remains unknown. Chemical studies on tissue obtained at autopsy from the central nervous system were described by two groups of investigators. Barron (Hines, Illinois) reported that the esterase profile of multiple sclerosis plaques differed from that of normal white matter. Gerstl (Palo Alto) described a chemical abnormality in the lipids of grossly normal samples of white matter from cases of multiple sclerosis and its ultracentrifugally separated myelin. These reports, if substantiated in a large number of cases, should give investigators important leads for metabolic studies. In this regard it is of interest that Smith (Palo Alto) demonstrated an increased uptake of glucose and acetate in certain brain lipids in rats developing encephalomyelitis. The increase coincided in time with clinical and histologic evidence of the disease (12 to 14 days) but persisted into the recovery phase (22 to 26 days).

The status of clinical investigations in multiple sclerosis was reviewed by Scheinberg (New York) as an introduction to the final session of the symposium. Problems that still remain are accurate diagnosis (Poser, Kansas City) and assessment of the patient's physical condition during the variable disease course (Tourtellotte, Ann Arbor). The relation of such problems to experimental trials of therapy was discussed by Schumacher (Burlington, Vt.). Bauer (Göttingen) reviewed the long-term prognosis of 1200 multiple sclerosis patients on the basis of their capacity to carry out remunerative work. Of the patients studied for 20 years or longer, 30 percent were still gainfully employed.

The search for new etiologic leads has continued without much success. A slightly higher titer of measles antibodies has been reported by several laboratories, but Sibley and Foley (Cleveland) could find no correlation between relapses of multiple sclerosis and infections by measles or any of several other viruses and bacteria.

The extent of interest in research on demyelination was evident from the papers presented at the symposium and from the size of the audience. Although the scheduled program left little time for discussion, the combination of experimental and clinical papers in a single large meeting brought together scientists of exceedingly varied research interests and provided opportunity for much discussion after meeting hours.

The symposium proceedings will be published by the New York Academy of Sciences. This publication will complement a similar monograph soon to appear in the *Zeitschrift für Immunitätsforschung*, which resulted from a colloquium on "Experimental Contributions to the Pathogenesis of the Demyelinating Diseases" held in August 1962, at the Institute for Research on Poliomyelitis and Multiple Sclerosis, Hamburg, Germany.

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Cave Ecology

The special interest of the ecologist for life in caves lies not so much in the fact that many obligate cavernicoles (troglobites) are eyeless and depigmented, but rather in the comparative simplicity of the cave community. Relatively few metazoans and a limited selection of microorganisms are able to adapt to an aphotic environment in which food must be imported from the surface or manufactured *in situ* by chemosynthetic autotrophs (sulfur and iron bacteria). The deep cave is an essentially isothermal environment in which food and vapor pressure deficit (for terrestrial cavernicoles, which are usually stenohygrobic) become the principal limiting factors.

Cave ecology was the main theme of a symposium held at the Cleveland meeting of the AAAS on 27 December 1963. The fact that the majority of the participants dealt directly with, or referred frequently to, the Mammoth Cave region of Kentucky is indicative of the significance which this major karst region has assumed in North American biospeleology. There are two reasons for this. (i) The Mammoth Cave fauna is exceptionally rich, incorporating elements from at least four cave regions of the Interior Low plateaus (Thomas Barr, University of Kentucky). (ii) About 90 percent of the species of the fauna have been described. A conservatively estimated 50 percent of the cavernicoles of the United States remain taxonomically unknown, thus complicating or delaying ecological research in most other cave systems.

Biological research in caves of the

United States is handicapped not only by lack of prior taxonomic work, but also by the physical difficulties of the caves themselves. In rough subterranean passages, instrumentation is limited to what is portable and relatively shockproof. A further complication is introduced by the extreme sensitivity of most cavernicoles to even slight changes in many environmental parameters (light, temperature, vapor pressure deficit, rate of flow of air and water, dissolved oxygen, and so forth). Control of bias in laboratory studies of animals taken from caves is thus exceptionally difficult to achieve. In France, Hungary, and elsewhere in Europe, the establishment of cave laboratories has partially alleviated these procedural problems. No such facilities are yet available in the United States.

Seasonal fluctuation of both physical factors and food supply was emphasized by several participants. Cave flooding and seasonal variation in the water table of karst regions were reviewed by T. L. Poulson (Yale) and P. M. Smith (Cave Research Foundation). R. A. Kuehne (Kentucky) reported the results of a 2-year limnological study of Mammoth Cave, where the Echo and Styx rivers rise 6 to 15 meters above their late fall minimum level during the winter or spring. Following a winter flood, temperature is minimal; *p*H, total alkalinity, and dissolved oxygen attain their observed maxima; plankton density is minimal. Consumer "blooms" of zooplankton (predominantly epigean species of copepods and cladocerans) follow but lag behind rises during the late spring and midsummer. The rivers develop from surface streams sinking on the Pennyroyal plateau 15 to 25 kilometers from Mammoth Cave. The waters of Green River back up into the cave during flood stage. In Mammoth Cave's Crystal Lake, fed by seepage waters, physical changes occur more regularly and are less drastic. There is almost no plankton, but a sparse bottom fauna—chiefly testacid rhizopods, nematodes, and tardigrades—occurs sporadically.

In terrestrial environments, cold, dry air flowing into caves lowers the temperature and increases the vapor pressure deficit except in the most remote areas. In Tennessee and Kentucky, the guano of large colonies of cave crickets (*Hadenoecus subterraneus* and related species) is an important link in the food chain for obligate cavernicoles. Orlando Park and David Reichle (Northwestern) discussed feeding habits and circadian activity rhythms in *H. subterraneus,* and pointed out that the crickets feed outside the caves at night during suitable weather. There is thus a reduction in cricket feeding and in the supply of fresh guano during the winter. Eggs and first instar nymphs of the crickets are a major food source for an eyeless carabid beetle, *Neaphaenops tellkampfii.*

Seasonal peaks in reproduction were discovered by Thomas C. Jegla (Minnesota) in a troglobitic crayfish population in an Indiana cave. Males in reproductive molt (form I) and females with distended ovaries were most numerous from September to November.

The extreme geographic isolation which a troglobitic existence forces upon cavernicoles of low mobility is of interest to the speciationist and zoogeographer. Barr showed that the Pennyroyal plateau, extending northward from Mammoth Cave to the Ohio River and southward to the Tennessee border, is a major avenue of dispersal for troglobites. The eastern margin of the plateau represents a sharp distributional boundary beyond which the character of the cave faunas is markedly altered. J. R. Holsinger (Kentucky) compared geographic ranges of Appalachian cave invertebrates. He related the discontinuous distribution of limestone in the sharply structured Appalachian valley to the limited ranges of troglobites, which are geographically far more restricted than those of related species in the Mammoth Cave region.

George Claus (New York University School of Medicine) discussed the recent surprising discovery that algae (green, yellow-green, blue-green, and red) are widespread and abundant in caves and form small patches on wet walls and stalactites or filamentous masses in gelatinous matrices on rotting wood. Independent investigations of the taxonomy and ecology of cave algae are being conducted in the United States, Hungary, and Israel. Energy sources for growth and the possible role that algae may play in the food web of the cave community are still incompletely known.

Use of caves in Mammoth Cave National Park by bats was reported in separate papers by J. S. Hall (Albright College) and W. H. Davis (Kentucky). Hall showed that the area is important for hibernation of *Myotis sodalis, M. grisescens,* and *M. lucifugus.* The first two species form large colonies in a small number of caves, where they hibernate in densely packed clusters in a narrow temperature zone. *M. lucifugus* occurs in smaller, looser clusters in areas of very low vapor pressure deficit, and is distributed more widely in a large number of caves. Davis presented a preliminary report on the phenomenon of late summer swarming of bats in Dixon Cave near Mammoth. Thousands of bats enter the cave at night, fly around for a short time, and then leave. Species represented include not only the common cave hibernators but also species seldom recorded from caves (*Lasiurus borealis* and *Nycticeius humeralis*). Apparently the bats converge on the cave from their summer roosts, which may be hundreds of miles distant, then return to the summer area. The evolutionary significance of this late summer movement and the extent to which these same bats hibernate in caves of the Mammoth Cave region are still unanswered questions.

Although two symposiums on systematics of American cavernicoles have been held at AAAS meetings in recent years (1957 and 1959), the 1963 session represented the first attempt to focus attention on primarily ecological studies in caves. As might have been anticipated, the initial work has been largely descriptive ecology, but a sound descriptive basis is a *sine qua non* of future research on physiological ecology of cavernicoles and community dynamics in cave systems.

This symposium, arranged by Thomas Barr, was cosponsored by the Ecological Society of America and the National Speleological Society.

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Antimicrobial Agents and Chemotherapy

Various aspects of microbiology were discussed at the 3rd Interscience Conference on Antimicrobial Agents and Chemotherapy, held in Washington, D.C., 28–30 October 1963. Foreign participants included a group of 12