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

from Japan, 6 from Canada, 6 from England, and scientists from 17 other countries.

Several new antimicrobial agents were described at the meeting. Weinstein *et al.* (Schering Corporation) reported on gentamicin, a new antibiotic which contains deoxystreptamine, is very effective against cultures of *Pseudomonas* and *Proteus*, and is produced by a species of *Micromonospora*. Clinical reports showed the efficacy of gentamicin in urinary infections and in other areas where *Pseudomonas* and *Proteus* were the infectious organisms.

In discussing antibiotic MSD-235, Stapley *et al.* (Merck Sharp & Dohme Research Laboratories) described it as an antibiotic complex which inhibits Gram-negative organisms in vivo and in vitro. One member of the complex is a compound of small molecular weight (MSD-235S) and the other is a protein of large molecular weight (MSD-235L). MSD-235S is active in chemically defined media and inhibits biotin synthesis by Gram-negative organisms. MSD-235L forms biologically inactive complexes with biotin. A combination of the two compounds (MSD-235L given parenterally and MSD-235S given orally) controlled Gram-negative infections in mice.

J. T. Sheehan *et al.* (Squibb Institute) described doricin as a derivative of vernamycin B. The structures of vernamycins B_α, B_β, B_γ, and B_δ were announced by Ondetti and Bodanszky (Squibb Institute) who found them closely related to the previously described ostreogrycin, PA 114, mikamycin, staphylomycin, and streptogramin.

Three cytotoxic agents from streptomycetes noted as extremely active against tumors are BA-17039-A, -B, and BA-90912 (Rao *et al.*, John L. Smith Memorial Laboratory). These antibiotics inhibit growth of tumors in animals and in mammalian cells in tissue culture, and are quite toxic (LD_{50} of 0.5 mg/kg).

Additional discussions included descriptions of (i) antibiotic LL-AE705W, a neutral macrolide antibiotic effective, when it is given orally, in controlling infections associated with Gram-positive microorganisms (Lefemine *et al.*, Lederle Laboratories); (ii) antibiotic LL-AM684B, shown to be a microbiologically produced derivative of tylosin (Whaley *et al.*, Lederle Laboratories); (iii) anthracidins A and B, effective in vitro only against *Bacillus anthracis* (Yoshida and Katagiri, Shionogi and Co., Ltd., Osaka, Japan); (iv) septacidin, a cytotoxic agent yielding on hydrolysis adenine, a 7-carbon amino sugar, a C_{16} branched and straight chain fatty acid, and glycine (Dutcher *et al.*, Squibb Institute).

Clinical reports were presented on the effectiveness of a number of antibiotics, including gentamicin, lincomycin, aminosidin, cephalothin, nafcillin, methicillin, cloxacillin, ampicillin, and oxacillin. (The latter five are "new penicillins" prepared chemically from 6-aminopenicillanic acid and are "penicillinase-resistant.") Ampicillin was of special interest because it is one of the first penicillins having significant anti-Gram-negative potency.

A symposium convened by H. F. Dowling discussed side reactions attributed to antimicrobial agents and included the immunochemical basis for penicillin allergy (C. W. Parker), damage to the eighth cranial nerve due to antibiotic therapy (Martha D. Yow), blood dyscrasias due to antibiotics (C. M. Huguly), and procedures to be used in treating infections with nephrotoxic antibiotics (C. M. Kunin). Although all of these side effects were shown to be common, the value of the antibiotic therapy has been such that it has been necessary to use the antibiotic in spite of the dangers.

Other papers included discussions on the methods of identifying antibiotics by a variety of procedures. Of special interest was a discussion by J. N. Porter (Lederle Laboratories) in which he reported that streptomycetes producing more than 50 known antibiotics were isolated from a single soil sample from a grassy plot near his laboratory. S. A. Waksman (Rutgers University) discussed problems of antibiotic nomenclature and the conference went on record as requesting that the American Society for Microbiology form a group to consider this problem.

This conference, sponsored by the American Society for Microbiology, had a registered attendance of 825, a much larger group than that attending the 2nd interscience conference in Chicago in November 1962. Most of the papers presented at this year's conference will appear in *Antimicrobial Agents and Chemotherapy–1963*, which will be published by the American Society for Microbiology in April 1964. The book will be distributed to all registrants at the meeting and will be available from the Society headquarters in Ann Arbor, Michigan.

Plans for the 1964 interscience conference are already under way. The meeting will be held 26–28 October 1964 in the New Yorker Hotel, New York City. The program will include symposiums on antitumor antibiotics from microorganisms, synthetic antimicrobials, "new" penicillins, and antibiotics effective against infections associated with Gram-negative microorganisms.

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Vertebrate Hard Tissues

The nature of the diverse hard tissues that are unique to vertebrates was discussed at a special symposium of the Section of Vertebrate Morphology of the American Society of Zoologists, held on 28 December during the AAAS meeting. The origin of bone, the development and relations of dental tissues, the ultrastructure of bone, and its place in the homeostatic mechanism were four main topics of discussion. The papers emphasized the essential duality of vertebrate calcifications and their function both as structural materials and in the homeostatic mechanism.

Alfred S. Romer (Harvard) reevaluated our knowledge of the ossification patterns in the earliest vertebrates. The ostracoderms, known in detail from Stensiö's work on the *Cephalaspis* group, show a highly developed external and internal head skeleton. The ossification is interpreted as membrane and perichondral. Various lines show what is regarded as a progressive reduction of bone with increased specialization, a sequence also demonstrated for more advanced groups. Cartilage then has arisen as an embryonic adaptation, while bone is stated to have originated as an armor protecting against eurypterid predation and not as an anti-osmosis mechanism.

In response to Schaeffer's question, Romer agreed that the cartilaginous skeleton of sharks was probably inherited from their Placoderm ancestors after loss of dermal and perichondral bone.

In summarizing recent work on the evolution of dental tissues, Melvin L. Moss (Columbia) interpreted the formation of teeth, scales, and many com-