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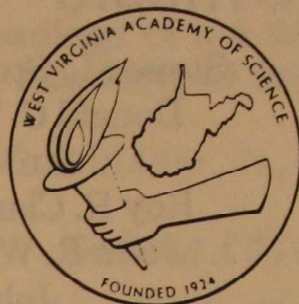
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Abstracts  
for  
the Sixty-Fifth  
Meeting



# Biology

DAVID L. BRANT, ROBERT K. RILEY, WILLIAM J. VAIL, WAYNE A. YODER, and JAMES W. PERRY, Biology Department, Frostburg State University, Frostburg, Maryland 21532. Hymenoscyphus monotropae With Monotropa uniflora In A M. uniflora-Oak Association.

When the holotype specimen for Hymenoscyphus monotropae was found on the roots of Monotropa uniflora from a M. uniflora-maple association, a question was raised as to whether this fungus was actually the mycorrhizal symbiont or a parasite. The controversy centered around the fact that the apothecial fruiting bodies of H. monotropae arose from mycelium within the cortex, rather than the ectomycorrhizal fungus mantle. Seasonal studies carried out in our laboratory have identified a similar apothecial development from an M. uniflora-oak association. Light microscope sections show an outer ectomycorrhizal fungus mantle and Hartig net, with mycelium penetration no further than one or two cortical cell layers into healthy roots of Monotropa throughout the year. During the late fall and winter, if a root dies, mycelium invades the deeper cortex cells in the dead root, and it is this mycelium that gives rise to the fruiting bodies of Hymenoscyphus. Mycelium from the dead roots invades dead stems and dead vegetative buds, and apothecia also appear on these structures in late fall and winter. Apothecia were never found on living roots, stems, or vegetative buds. These results suggest that if Hymenoscyphus is not the mycorrhizal associate, then it is a possible saprophyte of Monotropa rather than a parasite.

LISA BURGESS and DONALD TARTER, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. Discovery of Potamanthus myops (Walsh), a new state record mayfly, in Indian Creek, West Virginia, with discussion on the questionable status of P. distinctus Traver in the state.

The mayfly Potamanthus myops (Walsh) is reported for the first time in West Virginia. Adults and naiads were collected from Indian Creek, a third order stream, in Monroe County. Naiads were found in shallow water over gravel substrate. Adults were attracted to a black light trap on 28 June 1989. This species has been reported from 11 central and northeastern states. The questionable status of P. distinctus in West Virginia is resolved. Adults and naiads were collected from Indian Creek on several occasions. Additionally, taxonomic characters used to separate the adults and naiads of the two species will be reviewed.



WM. HOMER DUPPSTADT, Department of Biology, West Virginia University, PO Box 6057, Morgantown, WV 26506-6057. Updates on the Vascular Flora of West Virginia. VI.

On-going studies at the West Virginia University Herbarium have uncovered the following species of vascular plants as new or noteworthy additions to the flora of West Virginia: Zigadenus elegans subsp. glaucus (Nutt.) Hulten, Iris versicolor L., Gypsophila elegans Bieb., Lobularia maritima (L.) Desv., Lunaria annua L., Croton capitatus Michx., Helianthemum bicknellii Fern., Linaria maroccana Hook. f. and Hieracium florentinum All.

DAN A. CINCOTTA, THOMAS E. OLDHAM, Dept. of Natural Resources, Elkins, WV 26241, GERALD E. LEWIS, Dept. of Natural Resources, Romney, WV 26757 and JAMES E. REED, JR., Dept. of Natural Resources, MacArthur, WV 25873. Fishes of the Atlantic slope drainages of West Virginia.

Forty-one fishery surveys were conducted on the West Virginia portions of the Potomac and James Rivers between August 1976 - May 1986 by West Virginia Department of Natural Resources personnel. In the Potomac drainage, a total of 21,979 specimens representing 53 species were collected at 30 locations. The most common species by total percent occurrence were the Catostomus commersoni (67%), Rhinichthys cataractae (67), Rhinichthys atratulus (60), Semotilus atromaculatus (57), Hypentelium nigricans (53), Etheostoma flabellare (53), Cottus bairdi (53), Campostoma anomalum (50), and Notropis spilopterus (50). The most abundant species by total percent were Rhinichthys atratulus (16.9%), Moxostoma erythrurum (9.8), Notropis spilopterus (8.8), and Cottus bairdi (5.9). A total of 1499 specimens representing 30 fish species were collected at 11 stations in James River drainage. The most common by total percent occurrence were Cottus bairdi (100%), Moxostoma rhothoecum (91), Clinostomus funduloides (91), Nocomis leptocephalus (82), Notropis cornutus (64), Rhinichthys atratulus (64), Campostoma anomalum (55), Etheostoma flabellare (55) and Etheostoma longimanum (55). The most abundant species by total percent were Notropis cornutus (14.1%), Nocomis leptocephalus (14.1) and Clinostomus funduloides (9.6). A literature review and list of known fishes in the West Virginia portion of the basins are included. Discussion will include the introductions of Salvelinus namaycush (i.e. addition to state fauna), Alosa pseudoharengus, Dorosoma petenense, Notropis atherinoides, Labidesthes sicculus, and other significant records of fishes.



DAN A. CINCOTTA, Dept. of Natural Resources,  
Elkins, WV 26241, KERRY D. BLEDSOE and FRANK A.  
JERNEJCIC, Dept. of Natural Resources, Fairmont,  
WV 26554. The addition of *Fundulus catenatus*  
(Storer) to West Virginia's ichthyofauna and an  
update on the fishes of the state.

On 14 August 1987, while conducting a rotenone survey on Middle Grave Creek (Moundsville, Marshall County) of the Ohio River drainage, seven specimens (4.06 - 8.38 cm TL) of *Fundulus catenatus* (northern studfish) were collected. This account represents the first record of this species from West Virginia. The survey was one of three recent efforts to gather baseline data to evaluate the effects of a proposed U.S. Soil Conservation Service flood control project within the watershed. Two 1982 electrofishing surveys collected within the 1.6 km project area did not reveal the presence of the northern studfish. Since this species occurrence is a significant range extension from the nearest Ohio River drainage populations of central Kentucky and Indiana, it is presumed that this record is the result of a bait-bucket or aquarium hobbyist introduction. Several other fishes have been introduced or discovered in West Virginia in recent years thus increasing the known number of fauna to 169. A brief update on the fishes of the state is presented.

DAVID W. GROFT, RANDI B. WEISS, and PATRICIA E.  
GALLAGHER. West Virginia University, Department  
of Biology, Morgantown, WV 26506. PURIFICATION  
AND CHARACTERIZATION OF A PLANT DNA  
GLYCOSYLASE THAT RECOGNIZES METHYLATED BASE  
DAMAGES.

All cells are exposed to constant assault by chemical agents from our environment, from our diet, and from intermediary metabolites that cause alterations in the structure of DNA. Methylation, one type of damage, results in numerous DNA lesions of potential biological significance. Methylating agents mediate their biological activities by covalent bonding of methyl groups to cellular molecules. It has been proposed that the biological effect of a particular methylating agent correlates with the specificity of its chemical reaction with DNA, since each different methylating agent produces characteristic reaction products. Simple alkylating agents, such as methyl methanesulfonate (MeMs) or dimethyl sulfate, react with DNA bases to yield 7-methylguanine as the major product, with 3-methyladenine and 0<sup>6</sup>-methylguanine in lesser amounts, as well as 1-methyladenine, 7-methyladenine and 3-methylguanine, as minor products. It has been shown that several of these alkylated bases are actively repaired *in vivo* in both bacteria and mammalian cells; however, limited information exists on the effects of alkylation damage to plant DNA and its *in vivo* repair by cellular mechanisms.



We have now isolated from Brassica oleracea (cauliflower) a DNA glycosylase which recognizes alkylated DNA. The enzyme was partially purified by DEAE cellulose- and phosphocellulose-ion exchange chromatography followed by double-stranded DNA Sepharose affinity chromatography. Glycosylase-produced base loss sites were detected by a nitrocellulose filter-binding assay using MeMs-treated PM2 viral DNA as the substrate. The enzyme is specific for alkylation damage, showing no activity against undamaged or UV-irradiated PM2 DNA. It is active in buffers containing EDTA and  $\beta$ -mercaptoethanol. The enzyme is relatively stable, retaining greater than 90% of its activity for several months at  $-80^{\circ}\text{C}$ . Further enzyme characterization, including identification of the specific damaged lesion released by the enzyme, is currently under investigation. A comparison of the properties of the plant, bacterial and mammalian enzymes will be presented. (Supported by NIH grant CA-47457 and WVU Senate Grant).

LEONORA J. GROVES, RANDI B. WEISS, and PATRICIA E. GALLAGHER. West Virginia University, Department of Biology, Morgantown, WV 26506.  
CHARACTERIZATION OF AN ENZYMATIC ACTIVITY THAT INCISES UV-IRRADIATED DNA.

The deleterious biological effects caused by ultraviolet (UV) irradiation of living cells have been attributed to alterations of pyrimidines. It is thought that the formation of pyrimidine dimers can result in lethality, mutagenicity, or transformation, while 6-4'-(pyrimidin-2'-one)-pyrimidine photoproducts in DNA act as mutagenic lesions. It is generally assumed that DNA purines are relatively inert to photochemical modifications.

An enzyme which recognizes DNA damaged by UV light has been purified from *E. coli* strain BW434, a bacterial mutant which lacks both exonuclease III and endonuclease III activities. It has been shown that *E. coli* exonuclease III and endonuclease III initiate the repair of apurinic/apyrimidinic lesions and cytosine photoproducts, respectively. Throughout purification, the activity against UV-damaged DNA was detected using a nitrocellulose filter binding assay and PM2 viral DNA as substrate. Nucleic acids were removed from the crude extract by streptomycin precipitation. The enzyme was isolated by phosphocellulose ion exchange chromatography and further purified by gel filtration chromatography. Enzyme activity against UV-irradiated PM2 DNA is linear with increasing amounts of enzyme or increasing incubation time. The molecular weight, determined by gel filtration on Sephacryl-S200, is approximately 26,000 daltons. In addition, the phosphocellulose fraction incised a UV-irradiated polymer, polydA-polydT which was radiolabeled with  $^{32}\text{P}$ -dATP. This suggests that the enzymatic activity is directed against a photoproduct distinct from cyclobutane dimers, 6-4'-(pyrimidin-2'-one) pyrimidines and cytosine photoproducts. The enzyme is being further purified and characterized to determine the specific photoproduct recognition. (Supported by NIH grant CA-47457 and WVU Senate Grant).



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The Prairie Vole, *Microtus ochrogaster*, in West  
Virginia.

The Prairie Vole, *Microtus ochrogaster* is the common vole of the midwestern grasslands. A distinctive eastern subspecies *ohionensis* was named, based on a type specimen from Symmes Creek, Chesapeake, Ohio in 1942 (Bole and Moulthrop). Hall and Cockrum (1953) listed a record for *M. o. ohionensis*, for Cabell county collected near Huntington by Gene Frum. Dotson and Griffith (1969) found prairie voles to be fairly common, reporting 31 captures from seven different sites in Cabell county.

While examining museum specimens of voles collected in West Virginia we found some specimens of *M. ochrogaster* misidentified as the more common Meadow Vole (*Microtus pennsylvanicus*). Therefore, we undertook a study of all known museum specimens of voles collected in West Virginia to assess the status of this species.

We examined 72 specimens of *M. ochrogaster* from Cabell, Wayne, Putnam, Mason, Lincoln and Roane and Ritchie counties. Pelage characters distinguishing Prairie from Meadow Vole are subtle: whitish tips on belly hairs, and coarser grizzled dorsal hairs. The Prairie Vole also has a shorter tail and smaller foot than the Meadow Vole. A dental character was better at separating the two species; infoldings of enamel on the last upper molar form 4 islands of dentine in Prairie Vole and 5 in the Meadow Vole.

Standard body measurements of adults taken from the collector's tags were averaged for females (n=36) and males (n=45) respectively: total length 144.6 mm, 145.5 mm; tail length 36.6 mm, 36.8 mm; hind foot 18.4 mm, 18.1 mm; ear length 12.2 mm, 12.2 mm; weight 32 g, 33.4 g. The average condylobasal length for both males and females is 25.5 (range 24.1 - 27.6). Pregnant or lactating females were captured in every month except August, September and December. Thirteen gravid females carried an average of 3.6 (2-5) embryos; one female contained 2 embryos, five carried 3, five carried 4 and two carried 5. Body and cranial measurements of West Virginia specimens fall within the range of variation of the subspecies as indicated in the original description. When compared to specimens from Lawrence County, Ohio the West Virginia specimens are indistinguishable, as predicted by W. G. Frum in a personal communication.

The Roane County specimen now properly identified as *M. ochrogaster* from a station approximately 60 miles east of Huntington becomes the first preserved specimen of the Prairie Vole from West Virginia. It and the Ritchie County record represent an eastward extension of the known distribution for this species in North America.

Prairie Voles in West Virginia inhabit dry fields, often ones formerly cultivated or grazed. They appear to prefer well-drained rather than moist situations characteristic of the Meadow Vole. Most specimens from Cabell, Wayne and Putnam counties were taken in or near dense stands of broom sedge at elevations of 550 - 1000 feet. With rapid reversion of former agricultural and grazing land to woodland and housing developments we predict that the eastern range of this species is likely to contract.



JEZERINAC, RAYMOND F., Dept. of Zoology, The Ohio University at Newark, Newark, Ohio, 43055 and G. WHITNEY STOCKER, 13773 Bodle Rd., NE, Newark, Ohio, 43055. Distributions of the crayfishes (Decapoda: Cambaridae) of West Virginia. Part I: The genus Orconectes.

During the summer and fall of 1988 and 1989, field surveys of the crayfishes of West Virginia were undertaken. Approximately 432 sites were investigated and about 6,400 specimens were captured and preserved. Additional specimens were examined at The Ohio State University at Newark Crayfish Museum (80 sites; about 400 specimens), the Marshall University, Huntington, West Virginia crayfish collection (70 sites; about 350 specimens), and the United States National Museum, Smithsonian Institution, Washington, D.C. (250 sites; about 1,600 specimens). Twenty taxa belonging to three genera were discovered. The distributions of the seven members of the genus Orconectes, all of which are stream forms, were as follows.

Orconectes (C.) obscurus was captured from the Ohio, Tygart Valley, Cheat, Potomac, Greenbrier, Williams, and upper New River basins. Orconectes (C.) sanbornii sanbornii was captured from Ohio River tributaries south of Fishing Creek, the lower Guyandot, Kanawha, New, Greenbrier, Elk, Coal, and Little Kanawha River basins. Orconectes (C.) s. erismophorous was captured from a total of 11 sites in the Little Kanawha, the Kanawha, and the Greenbrier River systems. Orconectes (P.) spinosus was captured from the Big Sandy, upper Guyandot, upper Coal, Elk, Greenbrier, East, Bluestone, New, and James River basins. Orconectes (F.) limosus was found at four sites in the Potomac River basin in Berkeley and Jefferson Counties. Orconectes (G.) virilis was captured from the Potomac, Greenbrier, New, and Kanawha River basins. Orconectes (P.) rusticus was found in the Kanawha River and Fourpole Creek basins in Cabell and Kanawha Counties. The latter two species probably have been introduced into the state.

JEZERINAC, RAYMOND F., Dept. of Zoology, The Ohio State University at Newark, Newark, Ohio, 43055 and G. WHITNEY STOCKER, 13773 Bodle Rd., NE, Newark, Ohio, 43055. Distributions of the crayfishes (Decapoda: Cambaridae) of West Virginia. Part II: The Genera Cambarus and Fallicambarus.

During the 1988 and 1989 field surveys, nine species of crayfish belong to the genus Cambarus and one species of Fallicambarus were captured. Based upon habitat preference, the cambarid crayfishes can be divided into two groups: the stream forms and the primary burrowers. The distributions of the nine stream forms were as follows.

Cambarus (C.) bartonii bartonii was captured only from the Potomac River drainage. Cambarus (C.) b. carinirostris was found in the Monongahela, upper New, upper Little Kanawha, and Ohio River tributaries north of, and including, Fish Creek. Cambarus (C.) b. cavatus occurred in streams of the Ohio River basin south of Fish Creek. Cambarus (C.) sciotensis occurred in the Big Sandy, Guyandot, and upper New River drainages. Cambarus (H.) longulus occupied the James River drainage in



Monroe County. Cambarus (H.) chasmodactylus was found in the Greenbrier River. Cambarus (P.) nerterius, a species associated with cave streams, was captured at 18 sites in Greenbrier County. Cambarus (P.) veteranus, was captured at 11 sites in the Guyandot River drainage. Cambarus (P.) robustus was captured in most streams of the Ohio River drainage excluding the Big Sandy River drainage. In the Kanawha River basin, C. (P.) robustus was found at a number of sites below the falls, then disappeared, then reappeared in the Greenbrier River system and one site in the Upper New River drainage.

The distributions of the three primary burrowing cambarids were as follows. Cambarus (L.) diogenes was captured at 33 sites on the Appalachian Plateau. Cambarus (J.) monongalensis occurred at 43 sites. These sites were north of the Elk River on the Appalachian Plateau and at high elevations in the Appalachian Mountains. Cambarus (J.) dubius, captured at 73 sites, occupied the Appalachian Plateau and the valley floors in the Appalachian Mountains.

Fallicambarus (C.) fodiens, also a primary burrower, was found at two sites on the Ohio River floodplain in Mason and Cabell counties.

WENDY KADY and E. C. KELLER, JR., Department of  
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Trends of Genetic Traits in West Virginia.

Trends were determined for each West Virginia county for ten genetic traits: bent little fingers, Darwin's ear point, free ear lobe, freckles, widow's peak, hair type, tongue rolling, mid-digit hair, pigmented iris, and long palmar muscle. The data were collected from 1983 - 1989 by students from West Virginia and Marshall Universities. High and low incidences of the traits were examined by county. There were groupings of high frequencies in the lower Northern Panhandle (Marshall, Wetzel, and Tyler counties) for mid-digit hair, free ear lobe, and bent little fingers traits. For the freckles trait, there was a grouping of high gene frequencies in the southern part of the state. The genetic traits, Darwin's ear point, hair type, and tongue rolling had high gene frequencies of occurrence in the northern part of the state and low gene frequencies along the lower part of the Ohio River. For the genetic trait, widow's peak, there was a clustering of high gene frequency in the south east region of the state including Pendleton, Randolph, Webster, and Pocohontas counties. The genetic traits, long palmar muscle and pigmented iris showed no general groupings at all.

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The Star and asteroid genes of Drosophila

The normal development of the Drosophila compound eye is due to the proper interpretation of developmental decisions directed exclusively by positional signals. The small number of cells that compose the adult ommatidium can be used as a model system to



study the the nature of positional signals, the mechanism that cells use to receive them, and the molecular events that follow signal reception. Mutations that alter normal eye development can be recovered, and the expression of the genes studied to determine the role of a particular gene product in the signal or reception side of cellular communication. Molecular analysis of a number of genes and their products can be used to dissect the components of positional information in development. Toward this end, we are investigating the Star (S) and asteroid (ast) genes of *Drosophila*. Mutations of these genes disrupt the highly ordered facet arrangement of the eye by the occasional inclusion of a small ommatidium or the absence of an ommatidium from the array. We have produced eighteen ast mutations by P element transposon tagging. The eighteen mutations can be divided into three classes based on their interaction with S: Class 1 mutations show a severely reduced and roughened eye when heterozygous with S; Class 2 mutations have no interaction with S; Class 3 mutations are lethal in combination with S. We are presently using these P element insertion mutations to clone the ast gene and we are also isolating mutations that interact with S and ast in order to genetically dissect the higher order pathways of eye development.

SAMANTHA KUPERSMITH and E.C. KELLER, JR.  
Department of Biology, West Virginia University,  
Morgantown, WV. Associations among county human  
mortality profiles and land forms in West Virginia.

This project examines the relationships among causes of mortality and land form in the fifty five counties of West Virginia. The five mortality variables examined were: homicide, premature birth, digestive/peritoneal cancer, ureo-genital cancer and pneumoconiosis. The six land form variables examined were: the proportion of the county having slopes greater than 40%, 50%, 60%, and 70% inclinations; the standard deviation of the % slope inclinations and the average slope inclination. The mortality data were obtained from the West Virginia Department of Health from the years 1959 - 1982 inclusive. The land form data were obtained from: "Land Slope in West Virginia" by Mingteh, Hill, and Lee.

The incidence of homicide and the average slope inclination for the county and the proportion of land with 40%, 50%, 60%, and 70% slope inclinations showed significant positive relationships.

Premature birth mortality showed significant positive relationships with the average % slope inclination and 40%, 50%, 60%, and 70% slope inclinations. There was an inverse relationship between pneumoconiosis mortality and the average % slope inclination for the counties.

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25543, STEVEN L. STEPHENSON, Dept. of Biology,  
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26554, and ALAN J. ISKRA, USDA Forest Service,  
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26505. The use of dictyostelid cellular slime  
molds as biomonitors to assess changes in the  
soil microflora of forest ecosystems.

Dictyostelid cellular slime molds (CSM) are amoeboid, soil-inhabiting bacterial predators. These organisms represent a normal



component of the soil microflora of forest ecosystems and apparently play an important role in influencing or maintaining the natural balance that exists between bacteria and other microorganisms in the soil environment. Populations of soil bacteria are not usually amenable to study under field conditions, but techniques to isolate and quantify cellular slime molds in soils are relatively simple and reproducible. Since CSM population sizes and community composition are regulated by the quality and quantity of soil bacteria at a given site, changes in the soil bacteria are reflected by changes in the CSM present. Moreover, such changes may take place in a relatively short period of time (usually no more than 2-3 days). As a result, cellular slime molds offer an opportunity to investigate short-term responses of the soil microflora to experimental perturbation. (This research was supported by funds provided by the USDA Forest Service.)

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26506. ISOLATION OF AN ENZYMATIC ACTIVITY  
SPECIFIC FOR UV-IRRADIATED DNA.

Most of the solar wavelengths that are known to be harmful to biological systems are filtered by the ozone layer; however, as stratospheric ozone is depleted, more and more of these deleterious wavelengths will reach the surface of the earth. As a consequence of this breakdown, an increase in the amount of DNA damage caused by ultraviolet irradiation (UV) can be expected. This damage, if not accurately repaired, can be mutagenic, carcinogenic, or lethal. Therefore, organisms have evolved mechanisms to repair numerous types of DNA damages; while these DNA repair systems have been well characterized in bacteria and to a lesser extent in mammalian cells, surprisingly little is known about repair of potentially harmful DNA lesions in plants.

An enzyme that recognizes and incises UV-irradiated DNA has been partially purified from the leaf tissue of Brassica oleracea (cauliflower). The enzyme was isolated by DEAE-cellulose and phosphocellulose ion-exchange chromatography followed by double-stranded-DNA Sepharose affinity chromatography. A nitrocellulose filter binding assay using UV-irradiated PM2 viral DNA as a substrate was employed to detect enzymatic incision of damaged DNA. The enzyme is specific for UV-irradiated DNA, showing no activity against undamaged DNA or DNA treated with alkylating agents. It is relatively stable, retaining activity for several days at 4°C and several months at -80°C. Enzymatic activity against the UV-irradiated substrate is linear with increasing enzyme concentration and time of incubation. The enzyme retains activity in millimolar concentrations of EDTA, suggesting that metal ions, such as Mg<sup>++</sup> or Mn<sup>++</sup>, are not required. The nature of the UV-induced lesion recognized by this enzyme is currently under investigation. (Supported by NIH grant CA-47457 and WVU Senate Grant).



SCOTT F. MORRISON, Dept. of Natural Resources,  
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of Natural Resources, Elkins, WV 26241.  
A fishery survey of Middle Island Creek, Ohio  
River drainage, West Virginia.

Twenty-five fish population surveys were conducted in the Middle Island Creek drainage basin from 1980 through 1985. A total of 6,146 specimens representing 57 fish species was collected. The most common species by percent occurrence were striped shiner (88%), northern hog sucker (88%), golden redhorse (88%), bluntnose minnow (84%) and smallmouth bass (80%). The most abundant species were striped shiner (17.8%), golden redhorse (13.1%), bluntnose minnow (7.7%), stoneroller minnow (4.3%), and northern hog sucker (4.3%). Gamefish species, which primarily include muskellunge, smallmouth bass, spotted bass, channel catfish, and flathead catfish, comprised 4% to 50% (average 24%) of the standing crop per survey. Age and growth analysis for smallmouth and spotted bass indicated a rate comparable to other West Virginia streams. Data from the survey are compared to existing information. Information on water quality, watershed problems, fish stocking, and fishing effort is summarized.

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Cloning and analysis of the cubitus interruptus  
gene of Drosophila melanogaster.

The cubitus interruptus (ci) gene has been shown to be a segment polarity gene by the defects caused in Drosophila embryos. The posterior half of each body segment is replaced by a mirror image copy of the anterior half. Thus, the segment polarity gene ci helps to define the posterior half of the body segments. In addition, ci resides in an area of highly compacted DNA known as heterochromatin. Since ci functions in a highly condensed region different from other cloned genes, it may possess a unique gene structure. In addition, the ci gene should show some similarity to other segment polarity genes and DNA binding proteins. I have identified the ci cDNA, and have found that it is nearly 4.8 kb long. Using the cDNA as a probe to genomic clones demonstrates that ci has at least four exons, and is contained within 10 kb of genomic DNA. 2.6 kb of the cDNA has been sequenced. Comparison of the ci cDNA with other sequenced genes shows no significant homology to any other gene. There appears to be nothing unusual about the structure of the ci gene. Other fragments of the cDNA, when sequenced, may show homology to other genes that control pattern formation.

JAN SYKORA, University of Pittsburgh, Graduate  
School of Public Health, Pittsburgh, PA and  
DONALD TARTER, Dept. of Biological Sciences,  
Marshall University, Huntington, WV 25755. New  
records of caddisflies (Trichoptera) from West  
Virginia.

Nine species of caddisflies from three families are added to the known fauna of West Virginia. Known ranges of Ceraclea ancylus



Vorhies, Hydroptila amoena Ross, H. waubesiana Betten, Ochrotrichia shawnee (Ross), Orthotrichia aegerfasciella (Chambers) O. cristata Morton, Oxyethira coercens Morton, Polycentropus centralis Banks, and Stactobiella palmata (Ross) are extended into the state. The number of caddisfly species now known from West Virginia is 185.

TRACY WITT and E.C. KELLER, JR., Dept. of Biology,  
West Virginia University, Morgantown, WV 26506.  
Associations of Human Genetic Traits with County  
Characteristics in West Virginia.

Correlations were determined for 10 genetically inherited traits (freckles, pigmented iris, bent little finger, Darwin's ear point, widows peak, free ear lobe, long palmar muscle, tongue rolling, mid-digit hair, and hair type) with selected county socio/economic, environmental, and mortality variables. The genetic data were gathered throughout the state from 1983 to 1989 by students from Marshall and West Virginia Universities and date.

In order to examine the most significant associations, only those relationships showing a probability of .001 or less were utilized. Of the 10 traits tested, only hair type, tongue rolling, and Darwin's ear point had probabilities in this range. Ten of the socio/economic, environmental, and mortality variables were found to be correlated with these three traits. Further, correlations were also computed to determine any relationships among the non-genetic variables.

The gene frequency for tongue rolling and the amount of aid to exceptional children in the public school system resulted in the highest positive correlation observed (.57). The largest negative correlation (-.47) was found between the gene frequency of hair type and the proportion of mentally impaired individuals in the county. The number of individuals with mental disorders served by the Department of Vocational Rehabilitation was another variable correlated to the gene frequency of hair type.

Other correlations of gene frequencies to other county variables ranged from  $r = -.47$  to .47. Among the three gene frequencies listed above, correlation values ranged from  $r = -.47$  to .67.

MINDY YEAGER, TOM JONES, DONALD TARTER, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755 and DAN CINCOTTA, Dept. of Natural Resources, Elkins, WV 26241. Discovery of the central mudminnow, *Umbra limi* (Kirtland), in West Virginia.

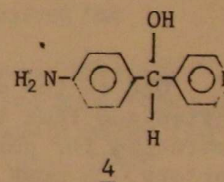
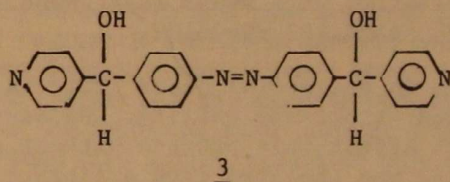
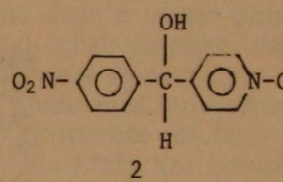
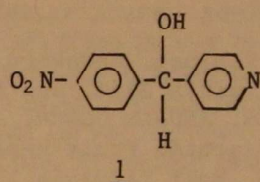
The central mudminnow, *Umbra limi* (Kirtland), is reported for the first time from West Virginia. The mudminnow was discovered in the Greenbottom Wildlife Management Area in Cabell County. This account represents a significant range extension from the nearest Ohio records and the first from southern Ohio River drainages east of the Tennessee River. It was collected in shallow waters of Greenbottom Swamp over a muddy substrate in submerged vegetation.



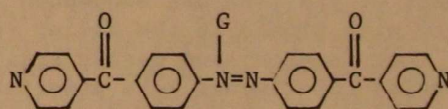
# Chemistry/Biochemistry

KARON KOBAYASHI, TIMOTHY B. MILEY, JEFFREY M. NAGY, SCOTT S. SANTIBANEZ AND CHESTER W. MUTH, Dept. of Chemistry, West Virginia University, Morgantown, WV 26506-6045. Hydroxide-Promoted Redox Reactions of  $\alpha$ -(4'-Pyridyl)-4-Nitrobenzyl Alcohol and its N-Oxide (1 and 2).

Treatment of  $\alpha$ -(4'-pyridyl)-4-nitrobenzyl alcohol (1) with NaOH and NaBH<sub>4</sub> in i-C<sub>3</sub>H<sub>7</sub>OH yielded mainly azo 3, whereas 2 with the same reagents yielded 3 and 4.



Also, when 1 was treated as above but without NaBH<sub>4</sub>, a mixture of compounds 5 and 6, and 4-(4'-nitrobenzoyl)pyridine were produced.



5, G = 0

6, G = nothing

Thus it is possible that 5 and 6 are intermediates in the formation of 3 when NaBH<sub>4</sub> is present. Efforts are being made to learn the pathways of these reactions.

CHARLES L. BILES and FRED B. ABELES, USDA-ARS, Appalachian Fruit Research Station, 45 Wiltshire Road, Kearneysville, WV 25430. Peach peroxidase. Distribution of isoenzymes between fleshy mesocarp and lignified endocarp tissue.

Lignin formation is due to the oxidative polymerization of para-coumaryl, coniferyl, and sinapyl alcohols in cell walls by peroxidase. Many peroxidase isoenzymes have been isolated from plant tissues, making it difficult to identify which of these enzymes are associated with lignification and which are associated with other



processes. Peach fruit have a lignified stony endocarp and fleshy meso- and exocarps which makes this tissue well suited for lignin biosynthesis studies. The work reported here was designed to see if the peroxidase isoenzymes isolated from peach endocarp differed from isoenzymes isolated from the mesocarp. The appearance of a unique peroxidase in endocarp tissue as opposed to flesh could be used as evidence in support of the hypothesis that certain basic peroxidases play a role in lignification. This would also suggest that other peroxidase isoenzymes are involved with some other aspect of cellular metabolism. This report describes the isolation of an enhanced basic peroxidase associated with peach endocarp development.

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CALLAHAN, PETER MORGENS, REUBEN COHEN, and PAUL  
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Characterization of a peach fruit cDNA expressed  
during softening and wounding.

One of the major problems in commercial peach fruit is that they soften too fast to be harvested at optimum quality. We have begun searching for genes that might affect this process without affecting quality. A cDNA clone, pch313, was isolated from a library constructed from ripe peach fruit RNA. The clone detects a RNA that is at very low abundance in fruit development until the fruit begins to soften. During this period there is a 400 fold increase in abundance of the RNA that correlates with softening as measured with a penetrometer. The insert of the cDNA was sequenced and found to have 78% sequence identity with pTom13 in the coding region. pTom13 represents a tomato gene that is expressed during fruit ripening and also upon wounding. Wounding experiments were undertaken to see if pch313 responded to wounding. In both leaf and fruit tissue, RNA homologous to pch313 was detected within 30 min of wounding and peaked in accumulation by 4 hours. Wound ethylene was measured at the same time and paralleled the accumulation of the RNA. Antisense constructions are in progress for use in peach and plum transformation/regeneration systems to see what effect variable blockage of the translation of this gene will have on wounding responses and fruit softening.



# Ecology

ROBERT E. ACCIAVATTI, Research Associate, Section of Invertebrate Zoology, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania 15213.  
Microhabitat occurrence of West Virginia tiger beetles.

Tiger beetles, family Cicindelidae, genus Cicindela, are diurnal, terrestrial arthropod predators as both adults and larvae, often dominating certain microhabitat types. Adults hunt live prey visually by running rapidly to chase it down. Once captured, the prey is chewed with elongated, multiple-toothed mandibles. Larvae build vertical soil tunnels in which they wait to strike out at nearby prey, usually dragging it into their tunnels for feeding. Larvae exist in only a narrow range of microhabitats because of their limited tolerance to physical factors such as soil moisture, texture and temperature. Adults of most species occur over a wider range of microhabitats than larvae because of adult dispersal, prey capture, and escape from predators; however, frequent adult occurrence in certain microhabitats often reflects conditions most favoring successful oviposition and subsequent larval survival. While a few species constitute the only tiger beetle found in certain microhabitats, most microhabitats are occupied by more than one species, suggesting that differences in adult behaviors, morphological characteristics, and seasonal activities can affect the abundance of sympatric species in certain communities.

Fourteen Cicindela species have been recorded from West Virginia. Adults of these species can be characterized by their exclusive occurrence in one or more of the following microhabitat types: dry open sand; moist open sand; open eroded clay slopes; vegetated clay slopes; forest floor; moist gravel near water. In microhabitats where prey is limited and of different sizes, sympatric species adults differ significantly in mandible length thereby permitting partitioning of available prey. In microhabitats where prey is abundant and of uniform size, sympatric species adults have similar mandible length. In West Virginia, two distinctive species specific periods of adult seasonal activity exist: a bimodal spring-fall and a unimodal summer. Clearly, an understanding of these factors is essential for researchers to know when and where to search for species as study specimens or as indicators of degradation in habitat or as the focus of faunal diversity preservation.

LISA BURGESS and DONALD TARTER, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755  
Effects of temperature and pH on oxygen consumption rates of naiadal Potamanthus distinctus Traver (Ephemeroptera: Potamanthidae).

A Gilson differential respirometer was used to measure the oxygen consumption rates of naiadal Potamanthus distinctus Traver at two temperatures (10, 17 C) and two pH's (5.4, 7.4). Naiads were collected from Indian Creek, Monroe County, West Virginia. Following the experiment, an average oxygen consumption rate in  $\mu\text{l}/\text{mg}$  dry weight/hr was calculated. Analysis of variance was used to determine if temperature or pH had a significant influence on oxygen consumption. Data were plotted to determine the influence of body weight on oxygen consumption for both pH's. Slopes of the two regression were compared with a z-distribution to determine if they were significantly different.



RONALD A. CANTERBURY, Dept. of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Breeding ecology of the Golden-winged Warbler in Raleigh County, West Virginia.

The breeding ecology of the Golden-winged Warbler (Vermivora chrysoptera) was studied in Raleigh County, West Virginia during April through August for three consecutive breeding seasons starting in 1987 and ending in 1989. First-seen spring dates and last-seen fall dates as well as number of breeding pairs were recorded in the study area during each breeding season. Data were collected on habitat availability and preference, nest building, egg laying, length of incubation period, care of fledglings, location of nests, nest dimensions, feeding habits, behavior after young leave nest, locality of birds after breeding and nesting activity, if unpaired birds exist in a population, and effects on the breeding activity caused by habitat destruction.

MEE. Y. CHOI, CAROLYN CULP, THOMAS E. WEAKS and DOSHIA J. WEBB, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755.  
Changes in periphyton community structure of Beech Fork Lake resulting from artificial circulation.

Factors affecting biological systems of Beech Fork Lake in West Virginia were evaluated following the initiation of artificial destratification. The methods applied have had immediate and far-reaching effects on biological habitats and community structure. These changes have resulted from the manipulations of the chemical and physical environment as well as the immediate modification of organism survival and distribution. Similarity index values for periphyton during the summers of 1986 and 1987 were relatively high and not substantially different for all combinations of water column strata. The degree of similarity suggests high habitat homogeneity for the two years. However, similarity index values for 1988 were less uniform than those of the two previous years indicating changes in habitat structure. The broad range of index values for summer 1988 suggests a shift to high habitat heterogeneity. This shift in the direction of heterogeneity is believed to be related in major part to the differential effects to artificial destratification on the widely diverse habitats of the water column within the lake. Greater habitat heterogeneity in 1988 was reflected in the appearance of increased numbers of periphyton species.

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MINE DRAINAGE BIOREMEDIATION -  
THE EVOLUTION OF THE TECHNOLOGY FROM  
MICROBES TO BIO-CARB

Mine drainage, normally acidic by nature, is the usually unavoidable discharge of metallic waste products in water from mine disturbed lands. The indigenous flora and fauna



of the aquatic and terrestrial systems receiving this discharge are more times than not adversely affected. The advent of the phenomena of acid precipitation in the last 20 years has further complicated the problem, and even stricter N.P.D.E.S. effluent standards further restrict conventional treatment methods. Bioremediation, the use of natural, harmless, environmental microbes to both achieve and maintain enforced standards, has proven to be a viable alternative in those areas where it is presently being used. It is an old technology that nature has used successfully for untold millions of years and one that I observed over 20 years ago on a mine site in West Virginia. Today, that technology can be successfully implemented at any mine site to clean the water and soil and/or extract more metals from tailings ponds. It is effective and appears to be a permanent solution to mine drainage and the affects of acid precipitation environmental alterations.

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Studies on Seasonal Occurrence of Aquatic Fungi  
of Hanumantal Pond. JABALPUR (INDIA)

The phenology of 22 fungal taxa was studied and identified in Hanumantal pond at JABALPUR in 1978 & 1979. The relationship of their frequency with parameters such as pH, temperature and dissolved oxygen was studied. The water was alkaline throughout the study with an average minimum pH of 7.4 to 9.07 (an average maximum pH). Temperature was minimum (18.5C) in December and maximum in June (30.8C). DO content of water varied from 7.4 ppm in June to 17.9 ppm in December as an average. Maximum frequency of species was observed in the peripheral zone and primarily chytrids were present in bottom mud. Occurrence of large numbers of fungi indicative of their tolerance to wide alkalinity and temperature ranges. Maximum frequency was recorded during fall (July-September) and lowest frequencies occurred in summer (June). Phytophthora erythroseptica, Phytophthora gonapodadis and Pythium tenue were recorded as dominant forms occurring in all seasons. Nowakowskiella hemisphaerospora showed lowest frequency, while other chytrids were most frequent in maximum temperatures and pH values coupled with minimum DO content. Phycomycetous fungi exhibited poor growth and restricted life cycles in the warm seasons. Saprolegnia diclina formed oospores in low temperature and gemmae in high water temperature. A moderate range of DO content was most favorable for maximum fungal occurrence, however, temperature seemed to be the dominant governing factor in seasonal variations of aquatic fungi.



RONNIE D. JEWELL and THOMAS K. PAULEY, Dept. of Biological Sciences, Marshall University, Huntington, West Virginia 25755. The reproductive cycle of the ravine salamander (Plethodon richmondi) in West Virginia.

Plethodon richmondi Netting and Mittleman is a small, eastern Plethodon that may attain a total length of 12.7 cm. Its total range extends from western Pennsylvania south to northern Tennessee, northern North Carolina and southern Indiana. In West Virginia, its range includes the western edge of the Allegheny Plateau in the north and counties west of the New River in the south. Although the holotype was taken from Ritter Park, Huntington, West Virginia in 1938, the reproductive cycle in West Virginia has not been described. Ninety-two specimens from 17 northwestern counties in West Virginia representing every month except November, December, and January were examined to determine the time of mating and egg deposition. Time of mating was determined by doing spermatogenic waves and by examining female spermathecae for sperm. The time of egg deposition was studied by examining ovarian egg sizes and the occurrence of sperm in the spermathecae.

MICHAEL LITTLE and THOMAS PAULEY, Dept. of Biological Sciences, Marshall University, Huntington, West Virginia 25755 and JAMES KOCHENDERFER and PAMELA EDWARDS, Fernow Experimental Forest, Parsons, West Virginia 26287. The association of forest maturity with salamander abundance.

The surface abundance and estimated population size of two terrestrial species of salamanders (redback salamander [Plethodon cinereus] and mountain dusky salamander [Desmognathus ochrophaeus]) were compared in two mature and two early successional watersheds in the Fernow Experimental Forest. In each watershed, surface abundance and population size were determined monthly by capturing and marking salamanders under five natural and five artificial objects in 28 plots (25 m<sup>2</sup> each). The plots were arranged in parallel transects 20 and 40 meters on either side of the creek. The Schnabel method was used to convert numbers of recaptured individuals into an estimate of total population size. The watersheds supporting mature trees are composed of Appalachian hardwoods, primarily sugar maple (Acer saccharum Marsh.), various species of oak (Quercus spp.), American beech (Fagus grandifolia Ehrh.), and yellow-poplar (Liriodendron tulipifera L.) with scatter black cherry (Prunus serotina Ehrh.). The dominant species on the two successional watersheds are black cherry, red maple (Acer rubrum L.), and yellow-poplar with scattered stems of hercules club (Aralia spinosa L.) and American beech. Of the two early successional watersheds, one was clearcut in 1969-70, the other was clearcut in 1967 and kept barren with herbicides until 1969. Beginning with the 1970 growing season, both watersheds were permitted to grow undisturbed. Desmognathus ochrophaeus was the dominant terrestrial species in the mature stands, and P. cinereus was the dominant terrestrial species in the early successional stands. Plethodon cinereus constituted 65 and 66% of the captured salamanders (of these two species) in the early successional stands but made up only 13 and 20% of captured salamanders in the mature stands.



BETH ANNE PAULEY and THOMAS K. PAULEY, Dept. of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Competitive interactions between two sympatric Plethodon salamanders.

Interspecific interactions were studied between two sympatric species of woodland salamanders to determine if competition is important in regulating population sizes and species distribution. One species, Plethodon nettingi (Cheat Mountain salamander), is on the federally threatened list and is found only above 3,100 ft in four counties of eastern West Virginia. There are just 66 disjunct populations known. The other species, Plethodon cinereus (redback salamander), is a common species throughout the central and northern sections of the eastern United States. To test competitive interactions between these species, five specimens of each were placed in separate glass, gallon jars with a soil substrate. Each specimen was given two weeks to acclimate to its surroundings and establish its territory. The experiment was conducted in a dark room under red lights at a temperature of 22°C and on a 12 hr cycle of light/dark. Competitive interactions were tested by placing the mouths of jars of different species together and observing the behavior of each. Plethodon nettingi was the aggressor in the majority of trials in that it threatened to attack more often. Plethodon cinereus exhibited conflicting results as it bit more frequently and attempted to escape more often when in confrontation.

THOMAS PAULEY and MICHAEL LITTLE, Dept. of Biological Sciences, Marshall University, Huntington, West Virginia 25755 and PAMELA EDWARDS and JAMES KOCHENDERFER, Fernow Experimental Forest, Parsons, West Virginia 26287. The effects of the 1988 drought on surface abundance of terrestrial salamanders.

The effects of drought on two species of terrestrial salamanders (Plethodon cinereus and Desmognathus ochrophaeus) were compared on two watersheds of the Fernow Experimental Forest. In each watershed, surface abundance and population size were determined monthly by capturing and marking salamanders under five natural and five artificial objects in 28 plots (25 m<sup>2</sup> each). The plots were arranged in parallel transects, 20 and 40 meters on either side of the creek. The Schnabel method was used to convert numbers of recaptured individuals into an estimate of total population size. These species of salamanders are active on the forest floor from May through October. During this period, 27.60 and 38.69 inches of precipitation were recorded in the drought year (1988) and nondrought year (1989), respectively. The effects of the drought were most pronounced from June through July. During 1989 (nondrought year), D. ochrophaeus was most active during the relatively wet months of June, July, and August. Populations of P. cinereus declined during this same period and peaked in October. However, during the drought of 1988, D. ochrophaeus abundance decreased concomitantly with precipitation as populations of P. cinereus atypically increased. The capacity of P. cinereus to remain active during periods of drought was substantiated by laboratory studies in which P. cinereus was significantly more tolerant of desiccation than D. ochrophaeus.



JONATHAN REID, GREG MCKAY and DONALD TARTER, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. The effects of artificial destratification on age, growth, and feeding habits of the gizzard shad, *Dorosoma cepedianum* (Le Sueur), in Beech Fork Lake, West Virginia.

Artificial destratification fans were installed in Beech Fork Lake, a 291 ha impoundment, by personnel from the U. S. Army Corps of Engineers in 1987. Detrital movement, combined with inflow of water that is predominantly non-calcareous, caused the ionic concentration and buffering capacity to be very low making the lake susceptible to pH and suspended particle problems. Gizzard shad were sampled monthly from April through October in 1987 and 1988. The scale method of age and growth was used to compare 1988 data with baseline data collected in 1987. Young-of-the-year shad attained an average of 76.4 and 119.4 mm, 1988 and 1987, respectively. Shad belonging to Age Classes I, II, and III attained average lengths of 149.7, 167.4, and 227.1 mm, respectively, in 1988 compared to 184.0, 209.4, and 218.0 mm, respectively, in 1987. The greatest growth fell within the 140 and 170 mm size ranges, 1988 and 1987, respectively. Forage size shad will be available longer for the predatory fishes (e.g. hybrid striped bass) due to the slower growth rate. Generally, stomach analysis showed that diatoms dominated the diet for most age classes in 1988. These data represent a shift in feeding habits since blue-green and green algae dominated from June through July in 1987. The shift in the feeding habits and the slowdown in the growth rate is most likely the result of the artificial destratification of Beech Fork Lake.

JUDITH RODD and E. C. KELLER, JR., Department of Biology, West Virginia University, Morgantown, WV. Associations among West Virginia Salamander Species and West Virginia Geology and Physiography.

About 25,000 records on West Virginia salamanders were compiled from the records of Marshall University, the Smithsonian Institution, and the investigators Richard Highton and Thomas Pauley. These sightings were recorded between 1880 and 1988. Salamander data were correlated with geologic and landform data in West Virginia, county by county.

Eleven salamander species showed specific correlations with unique geologic characteristics of the state. The salamanders *Desmognathus monticola monticola*, *Gyrinophilus porphyriticus duryi*, and *Pseudotriton ruber ruber* show specific correlations with landforms in West Virginia. *D. monticola* and *G. porphyriticus duryi* are positively associated with the average slope and the incidence of higher degrees of slope (30-60% slope) found in West Virginia counties. *Pseudotriton ruber* was found to be associated with steeper slopes (40 - 70% slope). *Desmognathus quadramaculatus*, an aquatic species, is significantly correlated with the presence of large bodies of water.

JUDITH RODD and E.C. KELLER, JR., Department of Biology, West Virginia University, Morgantown, WV, and THOMAS PAULEY, Department of Biology, Marshall University, Huntington, WV. Associations of Salamander Distributions in West Virginia.

Salamander data from about 25,000 records of West Virginia populations were examined using linear correlations. Sixteen salamander species showed



significant associations. Most correlations were one-on-one between two species. However, there is a grouping around *Plethodon cinereus*. This species is negatively associated with *Desmognathus fuscus fuscus* and *Eurycea longicauda longicauda* while *D. fuscus* and *E. longicauda* have a high positive correlation with one another. *P. cinereus* is also associated negatively with *Desmognathus monticola monticola* and *Plethodon hoffmani*. The individual correlations between *Gyrinophilus porphyriticus duryi* and *Pseudotriton ruber ruber* were extremely high as were the correlations between *Ambystoma maculatum* and *Gyrinophilus porphyriticus porphyriticus*.

KIMBERLY RUGGLES and DONALD TARTER, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. Leaf shredding, under laboratory conditions, by naiadal *Peltoperla tarteri* Stark and Kondratieff (Plecoptera: Peltoperlidae).

Naiadal *Peltoperla tarteri* were placed in containers with aerated stream water at 15 C and twelve species of autumn-shed leaves (American beech, ash, basswood, cucumber magnolia, pignut hickory, red maple, red oak, sugar maple, sycamore, tulip polar, white oak, and yellow birch). Additionally, naiads were exposed to different leaf combinations to determine preferential consumption. After two weeks, the naiadal *Peltoperla* were weighed and ashed in a muffle furnace at 550 C. The leaves were dried in an oven and weighed. The tannin and lignin content of the water was determined after the experiment. The ranking of leaves according to consumption (or shredding) by *P. tarteri* naiads will be discussed along with the tannin and lignin analyses.

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554, SUSAN MOYLE STUDLAR, Dept. of Botany and Microbiology, Oklahoma State University, Stillwater, Oklahoma 74078, and PAMELA J. EDWARDS, USDA Forest Service, Timber and Watershed Laboratory, Parsons, West Virginia 26287. Composition and structure of the communities of bryophytes associated with West Virginia mountain streams.

Various species of bryophytes (mosses and liverworts) are the major primary producers in many mountain streams, which are often virtually free of vascular plants. However, these stream bryophyte communities have received relatively little study. During the 1989 field season, in an effort to characterize the structure and composition of the communities of bryophytes associated with West Virginia mountain streams, quantitative data were obtained for the bryophytes present in the streams of two watersheds [3 and 4] on the Fernow Experimental Forest near Parsons in Tucker County. Twenty-four species of bryophytes (19 mosses and 5 hepatics) were encountered in the 50 line transects used to sample the two streams. *Scapania nemorosa*, *Sciaromium lescurii*, *Thuidium delicatulum*, and *Fissidens bryoides* were the most widely distributed species present in the two streams; each was recorded from more than 30% of the transects.



Scapania nemorosa was particularly abundant and occurred in 82% of all transects. Although all 50 transects contained at least some bryophytes, the number of species present varied rather widely (ranging from as few as one to as many as eight). Values for bryophyte cover (expressed as a percentage of the total length of a given transect) ranged from 0.2 to 44.9%, with a mean value of 13.4%. (This research was supported by funds provided by the USDA Forest Service.)

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554 and  
GARY A. LAURSEN, Dept. of Biology and Wildlife, University of Alaska, Fairbanks, Alaska 99775.  
Plant communities of central and northern Alaska.

The plant communities of central and northern Alaska can be classified within two broadly defined vegetational types: (1) spruce forests and (2) tundra. The forest vegetation of the central portion of the state consists of a mosaic of mixed and pure stands of black spruce (Picea mariana) and white spruce (P. glauca), with paper birch (Betula papyrifera), quaking aspen (Populus tremuloides), and balsam poplar (P. balsamifera) present (and sometimes dominant) on some sites. The climate of central Alaska is continental, with warm summers and winters that are long and severely cold. Alpine tundra occurs at higher elevations throughout central Alaska and arctic tundra is present over virtually all of the northern portion of the state. Arctic tundra consists of several different ecological subtypes, including wet lowland tundra (found on the arctic coastal plain) and moist upland tundra (such as that covering much of the northern slopes of the Brooks Range). Most areas of tundra are characterized by long, severe winters and short, cool summers. (Supported by a grant from the National Geographic Society.)

STEVEN L. STEPHENSON and LISA V. MCCUE, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554. Communities of coprophilous Myxomycetes associated with herbivore dung in the northern Rocky Mountains.

Although it has long been known that Myxomycetes (plasmodial slime molds) sometimes occur on dung, few actual studies of these "coprophilous" Myxomycetes have been carried out. During the 1989 field season, samples of herbivore dung were collected from Yellowstone National Park in Wyoming and the National Bison Range in Montana and used to prepare a total of 114 moist chamber cultures. The majority of the samples were from bison (Bison bison), but at least some samples were from antelope (Antilocapra americana), elk (Cervus canadensis), deer (Odocoileus hemionus), and horse (Equus caballus). In every instance, the samples were from animals having access to native vegetation only. Values of pH determined for the moist chambers ranged from 5.4 to 7.8 (mean = 7.0). Both the total number of species recorded and the percentage of "positive" cultures were higher for the set of cultures from Montana. Licea fimicola and Perichaena cf. liceoides, two species that have rarely been isolated from substrates other than dung, were the most commonly encountered Myxomycetes in this study, but at least eight other species were represented by one or more collections. The latter include Arcyria cinerea, Didymium difforme, D. trachysporum, Fuligo cinerea, and Perichaena depressa. (Supported by a grant from the National Geographic Society.)



STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554 and JOHN C. LANDOLT, Div. of Science and Mathematics, Shepherd College, Shepherdstown, West Virginia 25443. Notes on dictyostelid cellular slime molds from Peruvian rain forests and Alaskan tundra.

Previous studies of the distribution and occurrence of dictyostelid cellular slime molds (CSM) in different parts of the world have indicated that the species richness of these organisms decreases with an increase in either elevation or latitude. During the 1989 field season, soil samples for CSM isolation were collected from a number of study sites in Alaskan tundra (including examples of both subarctic alpine tundra and arctic tundra) and in areas of tropical rain forest along the Amazon River in eastern Peru (which is situated just a few degrees south of the equator). At least 12 and possibly as many as 15 different species of cellular slime molds were isolated from rain forest soils. Several of these, including Dictyostelium laterosorum and D. rhizopodium, have only been reported from the tropics. In contrast, only two species (D. sphaerocephalum and D. mucoroides), both of which are rather cosmopolitan, were recovered from Alaskan tundra soils. (Supported by a grant from the National Geographic Society.)

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554 and HAROLD S. ADAMS, Dabney S. Lancaster Community College, Clifton Forge, Virginia 24422. A comparative dendroecological study of spruce forests in four different areas of the world.

Coniferous forests in which some member of the genus Picea (spruce) is present as a canopy dominant or codominant species occur throughout the Northern Hemisphere. During the period of 1985-89, increment growth cores were collected from red spruce (Picea rubens) in the mid-Appalachians of West Virginia, Engelmann spruce (P. engelmannii) in the Swan Mountains of northwestern Montana, white spruce (P. glauca) in interior Alaska, and Himalayan spruce (P. smithiana) in the Himalayan Mountains of northwestern India. In addition, quantitative data were obtained for composition and structure of the vegetation and soil chemical and physical characteristics at each study site. Mean number of rings  $\pm$  SE for cored trees ranged from  $96 \pm 6.5$  to  $220 \pm 13.3$ . Total radial growth for the period 1900-79 varied considerably (7.6-21.8 cm), with the highest value recorded for Himalayan spruce and the lowest value for white spruce. Radial growth for the period 1960-79 represented more than 20% of the total growth since 1900 for all but red spruce. As such, our data are consistent with the results of other studies, which seem to indicate that red spruce in eastern North America has exhibited a recent growth-trend decline. (Supported by a grant from the National Geographic Society.)



STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554 and JAMES W. AMRINE, Div. of Plant and Soil Sciences, West Virginia University, Morgantown, West Virginia 26506. Associations of mites with Myxomycetes.

Various mites, particularly members of the Oribatei (the moss or beetle mites), are commonly found in association with the fruiting bodies of Myxomycetes (plasmodial slime molds), but very little is known about the ecological relationships that may exist between these two groups of organisms. Since mites are often exceedingly common in many of the same microhabitats (e.g., decaying logs) occupied by Myxomycetes, at least some of the associations observed in nature are undoubtedly coincidental. However, mites have been reported to feed upon the fruiting bodies of Myxomycetes, and some of our own observations would seem to suggest that Myxomycetes may represent a more important food resource for mites than previously realized. Although the consumption of Myxomycetes by mites probably represents nothing more than fortuitous feeding by species that are ordinarily mycophagous, the possibility that at least some species exhibit a specific preference for Myxomycetes cannot be dismissed. Mites may also play some role in the dissemination of myxomycete spores as a result of their feeding activity, since spores often adhere to the surface of the exoskeleton and one published study has reported that some spores remain viable after passing through the mite digestive tract.

DONALD TARTER, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. Recolonization of benthic population from the effects of a catastrophic flood in Seneca Creek, Pendleton County, West Virginia.

In early November 1985, high waters resulting from five days of steady rain (13.5 inches) from Hurricane Juan and another storm system roared down Seneca Creek, Pendleton County, West Virginia. The functional feeding group structure was dominated by collectors (gatherers and filterers) after the flood. Predators declined sharply after the flood and never returned to preflood percentages. In addition to the old channel of Seneca Creek, a new channel was formed after the flood in a nearby floodplain area. Collectors also dominated the functional feeding groups in the new channel. Species richness remained constant after the flood in the old channel. Species diversity and equitability increased slightly following the flood but returned to preflood conditions within one year. The number of plecopteran and dipteran taxa recolonized rapidly and were fairly constant in pre- and postflood samples. Ephemeropteran taxa increased immediately after the flood but returned to preflood numbers within two years. However, the mayfly Epeorus was never found in the samples two years following the flood. Trichopteran taxa recovered fairly rapidly. The caddisfly genera Chimarra and Polycentropus were never found after the flood. The coefficient of community similarity was lowest immediately after the flood and increased over the following 18 months. Overall, these results indicate a high degree of resiliency of benthic populations in Seneca Creek.



DONALD TARTER, Dept. of Biological Sciences,  
Marshall University, Huntington, WV 25755 and  
DIANE NELSON, Dept. of Biological Sciences, East  
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An altitudinal comparison of the tardigrade fauna  
(Phylum: Tardigrada) from mosses on Spruce Moun-  
tain, West Virginia.

Seventeen species of tardigrades, representing 10 genera (Diphascon, Hypechiniscus, Hypsibius, Isohypsibius, Itaquascon, Macrobiotus, Milnesium, Minibiotus, Pseudechiniscus, Ramazzottius) were collected from Spruce Mountain, Pendleton County, West Virginia. Five species (28%) Hypechiniscus gladiator, Pseudechiniscus suillus, Macrobiotus occidentalis, Hypsibius maculatus, Diphascon scoticum) were found only at the low altitude of 2800 ft (853 m). Ramazzottius oberhaeuseri and Diphascon prorsirostre were collected only at the highest altitude of 4800 ft (1481 m). Seven species (39%) (Macrobiotus hufelandi, M. harmsworthi, M. richtersi, Minibiotus intermedius, Hypsibius convergens, Isohypsibius macrodactylus, and Milnesium tardigradum) were found at 2800 ft (853 m), 3800 ft (1158 m), and 4800 ft (1481 m). Hypechiniscus gladiator, Pseudechiniscus suillus, Minibiotus intermedius, and Hypsibius maculatus were found only on the north slope. Based on the Fisher Exact Probability one-tailed test, the distribution of Milnesium tardigradum was significantly ( $p < 0.05$  CL) different between 2800 ft (trees) versus 4800 ft (trees), 3800 ft (trees) versus 4800 ft (trees), 4800 ft (trees) versus 2800 ft (non-trees), 4800 ft (trees) versus 3800 ft (non-trees) and 4800 ft (trees) versus 4800 ft (non-trees). The distribution of Isohypsibius macrodactylus was significantly different from 2800 ft (trees) to 3800 ft (trees).



# Education/Sociology/ Psychology

STEVE BECKELHIMER

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West Virginia's Criterion-Referenced Tests in  
Science

West Virginia's criterion-referenced tests in science are designed to assist teachers in producing better classroom tests. This material permits teachers to assess mastery of selected objectives, topics, content areas and cognitive levels. The criterion-referenced test items are aligned with West Virginia's science curriculum.

Criterion-referenced tests may be easily generated by teachers using the parTEST software from National Computer Systems. These teacher-made tests can be entered and stored on computer disks for future use.

Test results obtained through the use of West Virginia's criterion-referenced tests should not be used to make final decisions regarding student or school performance. Detailed feedback reports can provide valuable information to teachers concerning each student's content mastery and performance.

The purpose of the criterion-referenced testing program is to increase efficiency of teachers in the production of instructional tests. Multiple forms of a test are particularly easy to generate.

Test questions or items have been entered into a pool or bank. Teachers may withdraw items as needed. These test items may be selected by content, difficulty, objective, question format or other descriptors. The advantage of computerized item banking is that educators may select from a large number of items.

All test items in the item banks were written by West Virginia educators who were trained in item writing. The items were reviewed by science teachers and supervisors for content validity, accuracy and bias. These science items are currently being field tested. The ParTEST item format selection includes true-false, multiple-choice, matching, essay/problem or fill-in. Teachers may use any or all of these question formats.

The ParTEST software and item banks are available from the West Virginia Department of Education free of charge to every public school in West Virginia in both Apple II and IBM format. Science item banks are available from WVDE at grades 3-6, Life Science 7, Earth Science 8, and General Physical 9. Biology I, Chemistry and Physics item banks may become available if continued funding permits.

ALATHEIA COOK, JOSEPH MANZO, Dept. of Geography,  
Concord College, Athens, West Virginia 24712.

An Exploratory Look At Aspects Of Health Care In  
Belize.

Belize, formerly British Honduras, is located on the east coast of Central America. As with other developing countries, there is a myriad of problems at hand such as communications, the economy, political stability, the environment and a heretofore underserved population. The focus of this paper is an aspect of the latter, health care. On a macro scale, the government is concerned with reducing the impact of its leading illnesses, the distribution of health services, increasing access to safe water, increasing life



expectancy, reducing infant mortality and improving its image in this vein. On a local scale, a poor infrastructure, inadequate supplies for health centers, local attitudes and a lack of a support network for professionals become major concerns.

Data were gathered for this study through archival research and field work. Archival research consisted of a catalog and computer search. Field work, sponsored in part by Concord College, included opportunities for observation and interviews with health officials.

WILLIAM E. DAVIES, Falls Church, Virginia.  
Nineteenth century flood warning and damage  
Mitigation, Potomac basin.

Construction of the Chesapeake and Ohio Canal and the Baltimore and Ohio Rail Road, starting in 1828, was the beginning of systematic interest in floods in the Potomac Basin. Construction of these facilities was based on the high water level of 1810. Improvements in the canal undertaken in 1852 reflected the flood levels of 1847. The rebuilding of the railroad in 1867 and 1893 took into account the 1852 and 1889 floods. The canal and railroad provided good buffers against flood damage to other structures along much of the main part of the river. Bridges across the river, which were required to have 17-foot clearance above the canal, escaped destruction from all but extremely high floods. Measurements of flood levels were started in 1843 by the canal company. In 1879 the U.S. Weather Bureau took over these measurements. Somewhat later the U.S. Geological Survey established gaging stations in the basin. Flood warnings, at first, were carried by railroad trains and men on horseback along the canal. After 1852 the railroad telegraph was used as an effective warning system to keep flood deaths and property damage to a minimum. The early Weather Bureau warnings in the late 1800's were specific and strongly worded providing notice to inhabitants and businesses along the river to move themselves and their goods to safe levels.

EDWARD DAVIS, Dept. of Geography, Concord College, Athens, West Virginia 24712. Evaluating the Nicaraguan political system: Justice and Democracy in the late 1980s.

While the governments of some nations accuse the Nicaraguan government of being undemocratic, others claim it is at least as democratic as the government of the United States. The author has examined the political system of Nicaragua, and recently met with representatives of various political factions in that country, and with the United Nations mission observing the nation's electoral system. The results of that examination are presented in summary, and provide the basis for a discussion of the differing interpretations of democracy. The elections of February 1990 are an important element of the political system, and are therefore included in the study as a key focus.



JOHN H. HULL and MICHAEL C. MCGOWN, Dept. of Psychology, Bethany College, Bethany, West Virginia 26032. The Effect of Masculine and Feminine Descriptors on College Students' Ratings of Individuals.

College students read paragraphs describing an individual -- gender unspecified -- then rated that individual on dimensions of masculinity-femininity, active-passive, weak-strong, emotionally healthy-emotionally unhealthy, dependent-independent. Paragraphs read varied systematically in the proportion of stereotypically masculine or feminine descriptors of the individual they contained. Analyses of variance showed that individuals described in paragraphs with only masculine descriptors were rated significantly more masculine, more active, stronger, more emotionally healthy, and more independent than were individuals described in paragraphs with only feminine descriptors. Individuals described in paragraphs with mixed masculine/feminine descriptors were rated intermediately on the first three dimensions, and rated least independent but most emotionally healthy.

KENNETH E. GREEN, Dept. of Sociology, Frostburg State University and Richard S. Little, Dept. of Geol/Geog WVU, Regional Equity and Urban-Rural Information Flows

A common thread in the social scenarios described by Daniel Bell's "postindustrial society" (1973), Alvin Toffler's "third wave", and John Naisbitt's "megatrends" (1982) is a shift from the production of goods and services to the generation of technology produced information. Historically, rural hinterlands have been dominated by policies relating to the expansion and intensification of urban spheres of influence, but did have some power by controlling material resource bases essential to nearby urban centers. Global trading systems have removed this influence.

A window of opportunity does exist for rural places to regain some direct control and participation in processes of area change and development. Contemporary communication systems do not need to be controlled by urban centers. Evolving regional information systems in the three-county Eastern Panhandle of West Virginia provide an model for rural and suburban knowledge integration.

The current status of regional information systems in the Eastern Panhandle of West Virginia reflects a mix of issues stemming from historical accident and the existing institutional complex. Merging the divergent goals of federal, state and local agencies to serve those of the region provides a difficult political and social issue. Its solution will determine the outcome of this period of transition and future distributions of wealth, power, and community independence.



RICHARD S. LITTLE, Dept. of Geology  
and Geography, West Virginia  
University, Morgantown, West Virginia  
26506. Flood Mitigation and  
Preparedness in West Virginia

What is the organized public response to management of flood plains? Despite an immense investment in study, analysis, structural and non-structural programs, predicted damages from flooding continue to escalate. Political agendas are unable to deal effectively with the infrequent nature of record floods, even though they are the major catastrophic events shaping land and water systems.

Existing federal, state and regional programs dealing with flood plains in West Virginia are summarized. A case study of the Morgantown metropolitan area documents activities in four watersheds.(1)

Effective community preparedness is imperative in West Virginia where catastrophic flooding is a tragic historical fact. The existence of unused and out-of-date or non-existence of flood prone community evacuation plans sets the stage for another Buffalo Creek disaster. The early recognition of a flood threat by the public is critical for successful action. Most fatalities have occurred by persons ignoring warnings or failing to exercise prudent judgement in a deteriorating situation. A theory of information flow through a community by both formal and informal agencies offers a model for those groups interested in reducing future flood fatalities.(2)

Recommendations are made for a more effective agenda in building levels of public awareness to decrease future losses from flooding. The true cost of floods needs to be presented clearly to the people. Until citizens voluntarily in their own best interest, exercise prudent care in personal use of flood prone land and in their movements during flooding events, formal programs of mitigation and preparedness will have only partial success in reducing losses from flooding.

1. U.S. Army Corps of Engineers, Baltimore District, *Local Flood Plain Management in West Virginia and the Middle Atlantic Region*, mimeo, 1990.

2. U.S. Army Corps of Engineers, Baltimore District, *Paw Paw West Virginia, A Report on Flood Warning and Emergency Evacuation*, mimeo, 1989.



FRANCES J. SMITH and EDWARD C. KELLER, JR.,  
Dept. of Biology, West Virginia University,  
Morgantown, West Virginia 26506. Association of  
Early Settlers in West Virginia and the Mortality  
Rates in the Counties of West Virginia.

The purpose of the study was to examine whether ethnic geographical distribution may relate to patterns of mortality that could be due to: (1) cultural dietary uniqueness and (2) the genetic predisposition of certain ethnic backgrounds to human mortality. The different time frames studied were: frontier-early settlers; pre-Civil War - 1800's; mid and late 1800's through 1926 and the later immigrations. Information was gathered through census data from the West Virginia University, University of Virginia, and Marshall University libraries and faculty, National Archives, Washington, D. C., local historical societies and Dorothy Davis, author of the "History of Harrison County." The sources from the libraries and archives gave overviews of immigrants settling in West Virginia including resident population, age, race and sex but did not break down the information into counties. Data collected from Dorothy Davis provided insight into the ethnic groups which settled in Harrison County. In addition, Shepherd College and Gettysburg College were contacted to assist in finding the ethnic distribution of other counties in West Virginia. Neither were able to furnish data which would reveal the migration patterns of the early settlers. Since good geographical distribution statistics have only been located in Harrison County, further research is needed before ethnic composition can be correlated to disease susceptibility. Future investigators may want to focus on genealogical societies who are familiar with migration sources.



# Geology

W. HUNTER LESSER, U.S.D.A., Forest Service,  
Monongahela National Forest, Elkins, WV 26241.  
Preliminary Documentation of the Occurrence and  
Prehistoric Utilization of Chert from the Basal  
Member of the Mississippian Greenbrier Series in  
Pocahontas and Greenbrier Counties, West Virginia.

The basal member of the Mississippian Greenbrier Series limestone in portions of Greenbrier and Pocahontas Counties, West Virginia contains nodular chert which was apparently used by prehistoric populations for stone tool manufacture. Two source locations of chert within the Hillsdale limestone and adjacent prehistoric workshop loci are examined. The regional extent of Hillsdale chert and its potential for prehistoric exploitation in the study area are discussed.

EDWARD M. SNYDER, Division of Science and  
Mathematics, Shepherd College, Shepherdstown, West  
Virginia 25443. Warsaw formation acanthocladid  
bryozoa: taxonomy and distribution along the  
Mississippi River outcrop belt.

Acanthocladid Bryozoa are an abundant fossil component of the Lower Mississippian Warsaw Formation located along the Mississippi River outcrop belt in Illinois, Iowa and Missouri. The Warsaw consists of clastic and carbonate mound and backmound deposits formed on a shallow marine platform, providing an ideal environment for bryozoans, specifically the Cryptostomata. A total of 15 acanthocladid species containing 5 genera are represented in the Warsaw. Redescription of previously described species and description of new species is undertaken applying a modified taxonomic approach by McKinney, 1980, and Snyder, 1984. Descriptive and quantitative numerical study of both exterior and interior zooecial (individual) and zoarial (colonial) characteristics are employed in taxonomic analysis. Through serial sectioning of bryozoan colonies as well as tangential, longitudinal and transverse views a three-dimensional reconstruction of the living chamber of the individual zooid was attained. Employing exterior zoarial characters as well as autozooecial chamber reconstructions species of acanthocladid could be delimited. Species determination has been a major difficulty in this fossil group.

A significant increase in acanthocladid diversification was observed in the study area from the northern portion (near Keokuk, Iowa) to the southern portion (near Valmeyer, Illinois). Several possible reasons or combinations of circumstances could account for such an observation: (1) geographic isolation restricting species communication within the Illinois Basin; (2) speciation of the acanthocladids following a north to south time transgressive infilling of the Illinois Basin; (3) minor environmental differences that affect survival of some species; or (4) inadequate acanthocladid fossil materials available to allow an accurate overview of the Warsaw.



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5. Hall, J. L., and R. Campbell. 1957. Polarization of ethanol in benzene. *Proc. W.Va. Acad. Sci.* 29:53-57.

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