

AMERICAN SCIENTIFIC AFFILIATION
48TH Annual Meeting - August 5 -10, 1993
Seattle Pacific University, Seattle, Washington

***“Caring For Creation:
A Christian Perspective On The Environment”***

Keynote Speaker:

DR. CALVIN B. DE WITT

Professor of Environmental Studies at the Institute for Environmental Studies
University of Wisconsin
Madison Campus

Director of Au Sable Institute
Environmental Studies

Editor of *The Environment & The Christian:
What Can We Learn From the New Testament*

Distinguished Scholar and Lecturer



Contributed Papers:

Papers on the general theme and other issues are cordially invited. Deadline for receipt of abstracts is April 15, 1993.

For information on submission of abstracts, please write:

AMERICAN SCIENTIFIC AFFILIATION

P.O. Box 668
Ipswich, MA 01938
(508) 356-5656
FAX: (508) 356-4375

BIOETHICS: PROMISE AND PERILS

ANNOUNCING

AMERICAN SCIENTIFIC AFFILIATION

1994 ANNUAL MEETING

to be held at

Bethel College
St. Paul, Minnesota

Thursday, July 28 - Monday, August 1, 1994



AMERICAN SCIENTIFIC AFFILIATION

48th Annual Meeting - August 6 - 10, 1993, Seattle Pacific University - Seattle, Washington

"Caring For Creation: A Christian Perspective On The Environment"

Keynote Speaker:

Dr. Calvin B. DeWitt

Professor of Environmental Studies of the Institute for Environmental Studies
University of Wisconsin, Madison Campus

Director of Au Sable Institute Environmental Studies

Editor of *The Environment & The Christian: What Can We Learn From The New Testament*

"He described plant life, from the cedar of Lebanon to the hyssop that grows out of walls. He also taught about animals and birds, reptiles and fish. Men of all nations came to listen to Solomon's wisdom, sent by all the kings of the world, who had heard of his wisdom."

1 Kings 4:33-34

Thursday, August 5, 1993

3:00 - 9:00 PM Registration at Hill Hall Lounge
 5:00 - 5:30 PM Dinner

Friday, August 6, 1993

7:00 - 7:30 AM Breakfast (The Olympic National Park Tour includes breakfast, lunch and dinner).
 7:30 - AM Depart for Olympic National Park Tour - return 9:00 PM
 3:00 - 9:00 PM Registration at Hill Hall Lounge
 5:00 - 5:30 PM Dinner

Saturday, August 7, 1993 - Demaray Hall - Room 150

7:00 - 7:30 AM Breakfast
 8:15 - 8:45 AM Praise and Worship lead by Kent and Jani James
 9:00 - 9:15 AM Praising the Lord in Song
 9:30 - 11:00 AM C. B. DeWitt Lecture — Seven Degradations of Creation
 11:15 - 12:00 AM Audience dialogue with C. B. DeWitt - Questions and Answers
 12:00 - 12:30 PM Lunch

| Saturday, August 7, 1993 • Parallel Paper Session IA 1:00 - 4:35 PM - Demaray Hall - Room 258 Contributed Papers on the State of the Planet An Ecological Assessment | | Saturday, August 7, 1993 • Parallel Paper Session IB 1:00 - 4:10 PM - Demaray Hall - Room 353 | |
|--|--|--|---|
| 1:00 - 1:20 PM | Lazarus W. Macior — Learning from the Fernflowers - As They Perish | 1:00 - 1:20 PM | Li-Yang Chang — Pollution Prevention and Waste Minimization: An Engineering Perspective of Environmental Education |
| 1:25 - 1:45 PM | Howard Claassen — Responsible Use of Energy For the Next Fifty Years | 1:25 - 1:45 PM | Walter R. Hearn — Gathering Manna: An Urban Food-recycling Experiment |
| 1:50 - 2:10 PM | Raymond H. Brand — Galapagos Revisited: Darwin not on Trial | 1:50 - 2:10 PM | Edwin A. Olson — Environmental PC - It Ain't Necessarily So |
| 2:15 - 2:35 PM | Joseph K. Sheldon — Ecuador: Red Desert or Green Mansion? | 2:15 - 2:35 PM | Jack C. Swearingen and Carolyn A. Pura — From Defense of the Nation to Defense of the Environment (a Christian Perspective) |
| 2:35 - 3:00 PM | Break | 2:35 - 3:00 PM | Break |
| 3:00 - 3:20 PM | Trevor Lewis — Global Warming, Based on Analyses of Underground Temperatures | 3:00 - 3:20 PM | Jan Decher — The Sacred Grove in Africa: Environmental Challenge for the Christian Church |
| 3:25 - 3:45 PM | Lee E. Branscome — Status of the Earth's Climate: 1993 and Beyond | 3:25 - 3:45 PM | David L. Willis — The U.S.E.P.A. and the Safe Drinking Water Act: An Example of Regulatory Zeal and Scientific Folly |
| 3:50 - 4:10 PM | Harry H. Spaling and Barry Smit — The Farmer's Dream and the Environmentalist's Lament: Drainage and Wetlands in Southern Ontario | 3:50 - 4:10 PM | Robert J. Schier — Is Smaller Better? Human Size, Theology, and the Environment |
| 4:15 - 4:35 PM | Li-Yang Chang, Ang-He Zhang and Mo-Mei Chen — Ecological Engineering and Resource Conservation: An Overview of Chinese Organic Farming Practices | | |

Saturday, August 7, 1993

5:00 - 5:30 PM Dinner
 6:00 - 7:00 PM ASA Business Meeting - Demaray Hall - Room 150
 8:00 - PM Editorial Board - Demaray Hall - Room 255
 8:00 - PM Affiliation meetings
 Christian Biologists - Demaray Hall - Room 360
 Christian Geologists - Demaray Hall - Room 359

Sunday, August 8, 1993

7:00 - 7:30 AM Breakfast
 8:30 & 11:00 AM Worship at First Free Methodist Church, Paul Brand speaker
 12:00 - 12:30 PM Lunch
 1:00 - 2:15 PM C. B. DeWitt lecture — Responding Biblically to Creation's Degradations - Demaray Hall - Room 150

| Sunday, August 8, 1993 Parallel Paper Session 2A - Demaray Hall - Room 258 Contributed Papers on the Theology and Ethics of Creation Care | Sunday, August 8, 1993 Parallel Paper Session 2B - Demaray Hall - Room 353 |
|---|---|
| 2:30 - 2:50 PM Richard H. Bube — Do Biblical Models Need to be Replaced in Order to Deal Effectively with Environmental Issues? | 2:30 - 2:50 PM Philip M. Schafan — Is Mankind the Measure?: Old Testament Perspectives on Mankind's Place in the Natural World |
| 2:55 - 3:15 PM Keith B. Miller — "And God saw that it was good" - Death and pain in the created order | 2:55 - 3:15 PM Raymond E. Grizzle and Michael G. Cogdill — Subduing the Earth While Tending The Garden: A Proposal for a more Balanced Environmental Ethic |
| 3:20 - 3:40 PM Albert L. Truesdale — Last Things First: The Impact of Eschatology on Ecology | 3:20 - 3:40 PM Evelina Ortez y Miranda — Development and a Caring Attitude |
| 3:45 - 4:05 PM David L. Swift — The Gaia Hypothesis: Is It a Useful Paradigm for Environmental Understanding and Action? | 3:45 - 4:05 PM James C. Peterson — What Do We Owe Future Generations in the Condition and Kind of Ecosystem That We Pass On To Them? |
| 5:30 - 11:00 PM Depart for Tillicum Island — Salmon Bake | 4:10 - 4:30 PM Barbara A. Pursey — Human Power and the Created Order |
| | 5:30 - 11:00 PM Departure for Tillicum Island — Salmon Bake |

Monday, August 9, 1993

| | |
|------------------|--|
| 7:00 - 7:30 AM | Breakfast |
| 8:15 - 8:45 AM | Devotions with Paul Brand - Demaray Hall - Room 150 |
| 9:00 - 9:15 AM | Praising the Lord in Song - Demaray Hall - Room 150 |
| 9:30 - 10:45 AM | C. B. DeWitt Lecture — Putting Belief into Practice: A Blueprint for Stewardship** - Demaray Hall - Room 150 |
| 11:00 - 12:00 AM | POSTER PRESENTATIONS - McKenna - Room 117 David L. Dye — Environmental Consequences of a Christian World View Lazarus W. Macior — Anthecology and Biosystematics of Pedicularis (Scrophulariaceae) Demar Vander Zee, Ronald J. Vos, and Christian L. Goedhart — Monitoring and Modeling Cropping System Nitrates for a Sustainable Agriculture Kenneth N. Carter, Jr., Keith Pavlischek, and Lynn Biberdorf — The Ground of Being: A Lithocentric Critique of Deep Ecology Steven E. Fawl — Creation, Evolution, and Taxonomy |
| VIDEO | J. Leon Dennison — The Biblical Flood: A Recent Cosmological Disaster: A Model of the Event and How It Formed Our Aquifers |
| 12:00 - 12:30 PM | Lunch |

Monday, August 9, 1993

| <i>Parallel Paper Session 3A - Environmental Ethics (cont.), Education, Politics, and Economics - Demaray Hall - Room 150</i> | <i>Parallel Paper Session 3B - Non Categorized Environmental, and Other Related Papers - McKenna - Room 117</i> | <i>Symposium: Intelligent Design? Creation? Evolution? Intelligent State Design? - Demaray</i> |
|---|---|--|
| 1:00 - 1:20 PM Terry G. Pence — Ethical Issues in the use of Reproductive Technology to Save Endangered Species | 1:00 - 1:20 PM John W. Haas, Jr. — "John Wesley was both a Highbrow and an Evolutionist" The Myth and the Reality of John Wesley's Views of Origins | 1:00 - 1:40 PM William A. Dembski — Intelligent Design: The Evidence for God |
| 1:25 - 1:45 PM Stanley A. Rice — Bringing Environmental Issues into the General Biology Classroom | 1:25 - 1:45 PM John N. Johnson — On the Scientific Usefulness of the Intelligent Design Paradigm | 1:40 - 1:50 PM Creation Panel |
| 1:50 - 2:10 PM Larry W. Martin — Caring for Creation in Choosing Undergraduate Research Topics | 1:50 - 2:10 PM Joseph H. Lechner — Biblical Commandments with Promise: Is Obedience to Scripture Beneficial to your Cardiovascular Health? | 1:50 - 2:30 PM Stephen C. Meyer — Scientific Creationism: A Response |
| 2:15 - 2:35 PM John R. Wood — Environmental Education: Catching the Second Wave | 2:15 - 2:35 PM Miriam Adeney — Caring for cultures: Verbal Art Genres as Cultural Systems | 2:30 - 2:40 PM Creation Panel |
| 2:35 - 3:00 PM Break | 2:35 - 3:00 PM Break | 2:40 - 3:20 PM Paul A. Nelson — The Purposes and Methods of Intelligent Design |
| | | 3:20 - 3:30 PM |

| | | | |
|----------------|--|----------------|---|
| 3:00 - 3:20 PM | Joseph H. Lechner — The Kokosing River Project: Helping A High School Integrated Environmental Research Into The Science | 3:00 - 3:20 PM | Joseph L. Spradley — Four Examples of Overseas Teaching |
| 3:25 - 3:45 PM | Gerald D. Hess — Local politics and the frustrations of recycling | 3:25 - 3:45 PM | Deryl F. Johnson — Questions about the Environmental Movement |
| 3:50 - 4:10 PM | John C. Munday, Jr. — Government and environment: Limits and needs | 3:50 - 4:10 PM | Harry Cook — Wonderful Life: Burgess Shale and the History of Biology |
| 4:15 - 4:35 PM | Stanley E. Anderson — University Teaching and Research in Oman: Case Study of a Long-term Opportunity for Cooperation | 4:15 - 4:35 PM | Sergei A. Grib — Does Space and Environmental Research Help Us To Feel God's Presence in The World? |
| | | 4:40 - 5:00 PM | Vladimir Kurashov — The Ecology and Scientific Eschatology: The Limitations and Weakness of Ecological Sciences and Christian Sources of Human Optimism |

Tuesday, August 10, 1993

7:00 - 7:30 AM
8:00 - AM

Breakfast
Departure for Mt. Rainier Field Trip returning 6:00 PM

**Dr. DeWitt's last lecture will include an account of his journey of personal involvement from concerned citizen to Tawn Chairman (Mayor)

*"Caring For Creation:
A Christian Perspective on the Environment"*

ABSTRACTS

**48th Annual Meeting
of the
American Scientific Affiliation**

at

**Seattle Pacific University
Seattle, Washington**

August 6-10, 1993

LEARNING FROM THE FERNFLOWERS - AS THEY PERISH

Lazarus Walter Macior
Department of Biology
The University of Akron
Akron, Ohio 44325-3908

For perhaps the last 60 million years, the fernflower (Pedicularis, Scroph-
ulariaceae) have produced about 675 species with an amazaing array of floral
mechanisms pollinated primarily by bumblebees (Bombus Latr.) Studies of the
pollination ecology of this genus over the past 27 years in North America,
Europe, Japan, and the western Himalaya indicate a very close functional
coadaptation between floral mechanisms and the pollen/nectar foraging
behavior of its insect pollinators. In the stress environment of the
montane-alpine zone, where most of these studies were carried out, the
reproductive cycle of the plant requires a specific behavior of a pollinator
foraging for pollen and/or nectar; the reproductive cycle of the pollinator
requires pollen and nectar to complete its annual colony. From a putative
center of origin in the Altai Plateau, the genus Pedicularis has spread
throughout the mountainous regions of the northern hemisphere. Along the
way, bumblebees have functioned as floral architects for the fernflowers.

Unfortunately, today the mountain habitats of the fernflowers are being
systematically destroyed by grazing, lumbering, and man-made erosion. Man's
physical needs overshadow the need for places to learn from the fernflowers,
their insect architects, and the divine plan for creation of which they are
a part. Physically stressful for fernflowers and their pollinators, the
alpine meadows are also the serene fields of meditation on the relationship
of co-evolution and creation.

RESPONSIBLE USE OF ENERGY FOR THE NEXT FIFTY YEARS

Howard Claassen
Prof. of Physics, Emeritus
Wheaton College
3111 Vista Place
W. Tacoma, WA 98466

Some twenty or so years ago our country experienced a gasoline shortage. That forced us to think seriously about energy resources--how long the traditional sources will last, and whether renewable ones can become practical. Then, as oil became easily available again, most of us lost interest in that subject.

A number of developments since the 70's indicate that the topic of energy resources is important again in the 90's. To improve air quality in large cities the states of California, New York, Massachusetts and Maine now have laws requiring that by 1998 two percent of automobiles sold must be zero-emission ones, i.e., powered by batteries. Electric power companies are offering free conservation help to customers so that they will use less of the companies' product. Conservation is cheaper than building new power plants. Finally, developments in renewable energy schemes have made these sources look more attractive.

Considering present rates of energy use, world population growth, and future needs of developing countries, it is clear that in the next fifty years we will have to depend more and more on renewable energy sources. This paper will suggest changes in our energy use, beginning as soon as possible, that will preserve our planet as a good place to live, and that will move us gradually toward dependence primarily on renewable energy.

GALAPAGOS REVISITED; DARWIN NOT ON TRIAL

Raymond H. Brand
Professor of Biology
Wheaton College
Wheaton, IL 60187

Since Charles Darwin's visit over 160 years ago to the Galapagos Island, west of Ecuador, these volcanic origin islands have continued to intrigue scientists and entice photographers. In 1992 some 30,000 visitors were rewarded with up-close experiences of the terrestrial flora and fauna of the islands and the marine life along the rocky shores and mangrove inlets.

This illustrated talk will confirm many of Darwin's observations on the role of the environmental extremes found on different islands as he reported these in the Voyage of the Beagle. In particular, the animal variations in color, size, and behavior of the dominant reptiles will be highlighted.

Primary plant succession on recent lava flows of about 100 years ago will be contrasted to vegetation on other islands which have Opuntia cactus trees up to five feet in circumference at breast height.

Relevant published materials such as David Lack's Darwin's Finches, Peter Grant's, Ecology and Evolution of Darwin's Finches, and Michael Jackson's, Galapagos: A Natural History Guide, provide further documentation for the keen powers of observation that Charles Darwin possessed as a naturalist. All too often the significance and value of Darwin's original observations are lost in the quagmire of theory and speculation by those who critique evolutionary theory. At the very least his many contributions about earthworms, barnacles, and the Galapagos life forms have stimulated many others to ask further questions about the Creation with its fascinating variation. Some answers about mechanisms have been answered, others are yet to be found.

ECUADOR: RED DESERT OR GREEN MANSION?

Joseph Kenneth Sheldon
Professor of Biology
Messiah College
Grantham, PA 17027

Ecuador is one of the smallest and most highly populated countries in South America. It is also one of the world's most ecologically diverse countries. Located on the equator, it is bounded by the Pacific Ocean on the west and extends well into the Amazon Basin on the east. The spine of the country is formed by the double backbone of the Andes Mountains and the Inter Andean Highlands. It is truly one of the crown jewels of Creation. It also is a country in crisis.

This illustrated talk provides a brief overview of Ecuador's amazing biodiversity. It focuses on the impact of post 1950 development and examines present trends. Special consideration is given to the altered status of the rain forests west of the Andes and to the impending crisis in Amazonia. In contrast to these recent and anticipated changes, the Inter Andean Highlands represents an altered ecosystem dating back to pre-Incan times. Here the most obvious recent impact is reforestation with exotic species, primarily eucalyptus and pine. This has helped stabilize fragile soils and provide fuel and lumber, but has been counterproductive regarding current efforts in the conservation of native ecosystems and species.

GLOBAL WARMING, BASED ON ANALYSES OF UNDERGROUND TEMPERATURES

Trevor Lewis
Pacific Geoscience Centre
Box 6000, Sidney, B.C.

The Earth's average surface temperature is the boundary condition for the conduction flow of heat through the crust up to the surface. Since the terrestrial heat flow is so small compared to the solar flux, the surface temperature is controlled by and related to the air temperature. Changes in the surface temperature propagate downward as temperature anomalies, and inversion of present underground temperatures yields past surface temperature histories.

Inversions of data from many locations in eastern Canada show that surface temperatures have increased by 2-4 K over the last century, in agreement with meteorological records for the same areas. However, these data also show that, compared to the average temperature over the last 1000 years, temperatures were abnormally low at the beginning of this period of warming. Such amounts of warming have not occurred in the Canadian Cordillera over the last century. Proxy data indicate that changes of similar magnitudes in surface temperature also occurred before the Industrial Revolution.

STATUS OF THE EARTH'S CLIMATE: 1993 AND BEYOND

Dr. Lee E. Branscome, Chief Scientist
Environmental Dynamics Research, Inc.
7338 1 55th Place North
Palm Beach Gardens, Florida 33418

For the first time in history, human activities may be inadvertently changing the global climate. The two primary concerns of atmospheric scientists are: (1) ozone depletion, and (2) global warming. Both problems are associated with anthropogenic increases in certain trace gases of the atmosphere. The problem of ozone depletion is relatively well understood through theory and observations, and mitigative actions have already been taken through international agreements. On the other hand, emissions of greenhouse gases are closely tied to a variety of essential human activities and, thus, mitigation efforts may require much more substantial changes in human behavior.

The fundamental processes related to global warming and current modeling efforts to project long-term climate change will be reviewed. The primary uncertainties in modeling climate change involve the oceans, clouds, biogeochemical processes, and the future course of human events. At the present time, projections of global climate change must be made in terms of a range of possible outcomes. Nearly all state-of-the-art climate models predict an increase of about 1.5-4 C in global mean surface temperature by the middle of the next century. However, the models are in considerable disagreement regarding details of climate change on regional scales. Nevertheless, the projected global change is significant when placed in the context of the climatic record. Temperature data of the last few decades suggest that the change may have already begun.

Atmospheric scientists are in the difficult position of presenting the urgency of the global warming problem to policy-makers and the general public, while, at the same time, admitting to the uncertainties of climate change prediction. Scientists are also faced with the problem of proposing mitigative solutions that involve a wide range of human activities. Those solutions could be closely related to the Christian viewpoint on human stewardship of God's creation or, alternatively, could be strongly influenced by secular natural philosophies.

**ECOLOGICAL ENGINEERING AND RESOURCES CONSERVATION
AN OVERVIEW OF
CHINESE ORGANIC FARMING PRACTICES**

Li-Yang Chang
Christian Wilderness Fellowship
859 Madigan Ave.
Concord, CA 94518
and
Ang-He Zhang and Mo-Mei Chen
BIRC and University of California
Berkeley, CA 94720

As resources are diminished worldwide, ecological problems are becoming more complex and less "solvable" by "advanced or modern" engineering approaches. In the past we have built our life style on the "advanced" technologies. However, they have led us into a global pollution disaster. Christians must view the environmental crisis and seek solutions for this crisis in the light of Biblical doctrines of creation, sin, wisdom, and redemption.

Chinese agricultural practice is one of many traditions from which we might learn something about God's wisdom and human stewardship. Much of traditional Chinese life style, including organic farming, is being changed by the strong wave of western popular culture. What can a Christian do to spread God's gospel to them and at the meantime, learn from Chinese traditions?

What are the Chinese organic farming practices? How do we interpret this rich tradition in a Christian perspective? An attempt will be made to review the increasingly abandoned Chinese ecological life style in relation to our Christian stewardship.

**THE FARMER'S DEARM AND THE ENVIRONMENTALIST'S LAMENT:
DRAINAGE AND WETLANDS IN SOUTHERN ONTARIO**

Harry Spaling and Barry Smit
Department of Geography
University of Guelph
Geulph, Ontario, Canada N1G 2W1

Agricultural land drainage is a human activity repeated over time and dispersed across space. These temporal and spatial attributes suggest that drainage is a potential source of cumulative environmental change. This paper describes a conceptual framework of cumulative environmental change and applies the framework to drainage in southern Ontario. The framework is based on an ecological stress-response model. The empirical application examines drainage-induced changes to the spatial distribution and extent of wetlands from 1800-1991. Census information, aerial photographs and Geographic Information System (GIS) technology are used to analyze the relationship between drainage and wetlands at two scales. Results indicate an average decline of 60% in the area of wetlands in southern Ontario since pre-European settlement. This decline is spatially associated with areas of high drainage density. Within a "typical" rural township selected for detailed analysis, drainage resulted in a 47% reduction in wetland area. The number of wetland patches changed little, but average patch size decreased 50%. Losses are greatest in patches larger than 50 Hectares, indicating increased fragmentation. These changes to the spatial distribution of wetlands are likely to threaten ecological functioning at the landscape scale, particularly streamflow and water quality, and vegetation and wildlife species dependent on wetlands.

**POLLUTION PREVENTION AND WASTE MINIMIZATION --
AN ENGINEERING PERSPECTIVE OF ENVIRONMENTAL EDUCATION**

Li-Yang Chang
Christian Wilderness Fellowship
859 Madigan Ave.
Concord, CA 94518

As pollution prevention and waste minimization requirements become mandatory, industries and hazardous waste generators are being subjected to stringent regulations and strong economic pressures to reduce waste. Pollution prevention and waste minimization enactments are specifically mandated by the U.S. Congress Resource Conservation and Recovery Act and the Clean Water Act, and by the local governments' regulations, for example, the California Hazardous Waste Source Reduction and Management Review Act. Economic pressures, such as increasing permit application fees, hazardous waste treatment and disposal fees, long-term liabilities, as well as public relations are also motivating pollution prevention.

The laws or regulations can influence people's outside behavior. However, they have little to do with our thoughts or minds. It is our desires that encourage the production of "valuable goods" and generation of "wastes". Christians ought to reduce "wastes" in our souls and from our daily life, repent for our sins, and have pure hearts.

Engineering education should provide engineers with solid scientific principles and engineering methodologies. The principles should equip engineers with "adequate" knowledge of handling chemicals, and producing more products and less "wastes". Methodologies should guide engineers so to properly use their knowledge for the production of goods and protection of environment. An attempt was made to apply Biblical doctrines in a course to educate chemical engineering students of a Christian university at Taiwan. The contents and approaches will be discussed.

GATHERING MANNA: AN URBAN FOOD-RECYCLING EXPERIMENT

Walter R. Hearn
762 Arlington Ave
Berkeley, California 94707

An empirical investigation of recovering and using edible food from supermarket dumpsters was carried out in March 1993 with several purposes in mind: 1) After helping to initiate ASA's Caring Research Awards, the author wanted to assure presentation of at least one data-gathering paper at the 1993 Annual Meeting, hoping to inspire other amateur research projects. 2) Having recycled food in this manner for twenty years, the author wanted to make a semi-quantitative evaluation to see if his efforts were worth continuing. 3) In a time of economic recession, the author wanted to pass along suggestions to other low-income individuals and families.

Over a 30-day period, 13 casual visits to the dumpsters at three food markets in three East Bay communities netted a wide variety of useful food items, including fruit, vegetables, baked goods, dairy products, delicatessen foods, and even meats. After making a "yield" correction for any inedible portions, the value of each item was compared with prices inside the store. The total value of usable food recovered was estimated conservatively at over \$100. Some of the food was shared with other low-income persons.

The paper discusses problems encountered in making valid economic comparisons and risk/benefit analyses in such an investigation, and comments on advantages and disadvantages of "gathering manna" from the supermarket waste stream.

ENVIRONMENTAL PC - IT AIN'T NECESSARILY SO

Dr. Edwin A. Olson
Emeritus Professor of Geology
Whitworth College
Spokane, WA 99251

This paper argues that today's environmental debate, like so many societal controversies of our time, is fraught with a host of "politically correct" premises which are actually wrong and thus harmful to the mitigation of real problems. Among the erroneous PC assumptions are the following:

- (1) the word crisis is an accurate term for today's environmental situation and serves to create the proper societal mindset for problem solving;
- (2) anthropocentrism, the human brand of species-ism, is the ideological demon that lies behind environmental degradation;
- (3) the Bible is a veritable handbook for attacking modern environmental problems, containing clear and specific principles which, if followed, promise sought-for solutions;
- (4) Christians, as Christians, are the salt and light which the world ought to look to for leadership in solving environmental problems;
- (5) the environmental "crisis" is a global issue and therefore must be attacked whole hog rather than piecemeal;
- (6) the environmental "crisis" is so severe as to require mounting governmental encroachment on personal liberties through the establishment of evermore pervasive and powerful federal and state regulatory bureaucracies;
- (7) the purpose of earthly human life, both individual and corporate, is sufficiently unambiguous to justify long-term grandiose schemes for organizing society in a way that solves the environmental "crisis" and rescues the earth.

A CHRISTIAN PERSPECTIVE ON DISMANTLING THE NUCLEAR STOCKPILE

Jack C. Swearingen
Manager, Technology Applications Department
and

Carolyn A. Pura
Manager, Tactical Stockpile Department
Sandia National Laboratories
Livermore, CA 94550

At first look it likely would be concluded that dismantlement of the world's nuclear weapons stockpiles would be clearly pleasing to God and opposed by Satan. Upon closer examination, however, a number of complicating issues emerge. Certainly Satan rejoiced at the arms race, but he also must delight in the dangerous instabilities of the post Cold-War era. Satan will do all in his power to divide the body of Christ and foster hostilities at both interpersonal and international levels. If instabilities, dissension, or environmental damage are increased by dismantlement and destruction of nuclear weapons, then opposition would not necessarily be in Satan's interest. Therefore, ending the Cold War, dismantling nuclear weapons, and accomplishing their environmentally conscious disposal, can either serve the Kingdom of God, or facilitate the agenda of Satan, depending upon context.

Several dilemmas emerge from a closer look at the dismantlement activity. First, research and development of technologies for environmentally conscious disposal of weapons necessarily competes for funds with the R&D required to optimally equip the military. Second, the admirable motivation to demilitarize with all haste competes with the Biblical mandate to minimize environmental damage in the process. Third, creative solutions must be found to balance the separate and conflicting demands associated with storage, destruction, and reapplication of weapons. A balance is required for a Christian approach to dismantlement just as it is in all of the Christian life.

THE SACRED GROVE IN AFRICA -
ENVIRONMENTAL CHALLENGE FOR THE CHRISTIAN
CHURCH

Jan Decher, Graduate Student
Bell Museum of Natural History
University of Minnesota
100 Ecology, 1987 Upper Buford Circle
St. Paul, Minnesota 55108

The church in Africa is coming into conflict with the increasing environmental conservation efforts in African countries, which now emphasize the importance of traditionally existing mechanisms of protection of certain forest patches, known as "sacred groves." Laws and rituals for these groves are based on indigenous beliefs like fetish and ancestor worship. This paper is based on the author's experience with traditionally protected sites in West Africa, during nine months of zoological research on small mammal populations in different vegetation zones.

The postmodern approach to conservation reinforces traditional belief and value systems, romanticizing an indigenous "harmony with nature." In many ways this reflects a renewed Western search for religion in nature. The church needs to preserve the valuable social and ecological functions of traditional religions and contain them within the new meaning that the Gospel of Christ has given to believers in Africa and elsewhere. Many Africans are seeking to hold onto spiritually important elements of their traditional culture, as invariably "things fall apart" around them with the unstoppable introduction of Western technologies and values. The paper discusses possibilities of Christian adaptation of traditional conservation in Africa without the danger of a compromising syncretism. Possible roles of Christian theological institutions in Ghana, and practical grassroots approaches are suggested.

THE U.S.E.P.A. AND THE SAFE DRINKING WATER ACT:
AN EXAMPLE OF REGULATORY ZEAL AND SCIENTIFIC FOLLY

David L. Willis
Professor Emeritus of Biology
Radiation Center
Oregon State University
Corvallis, OR 97331

The Safe Drinking water Act of 1974 authorized the U.S. Environmental Protection Agency (EPA) to promulgate regulations limiting the concentrations of contaminants in public drinking water supplies which might have adverse health effects. This paper addresses the implementation of this Act with regard to natural uranium. For the past 12 years the author has been involved in research and consulting regarding this issue. He has observed at close range how a laudable environmental health goal has been distorted by the zeal of government bureaucrats.

Ignoring virtually uniform scientific recommendations, the EPA has recently proposed an unreasonably low Maximum Contaminant Limit (MCL) for natural uranium of 20 g/L (20 ppb). By EPA's own estimate this regulation alone will impose annual costs of hundreds of millions of dollars on the public water suppliers of the nation. If some improvement in public health were secured by such expenditures, this might be acceptable. However, there is no scientific evidence of any adverse health effects in humans from consumption of drinking water containing natural uranium at any concentration. Furthermore, research using several animal species indicates a lack of hazard from consumption of natural uranium in drinking water at even much higher concentrations. This case appears to be another example of well-intended environmental zealotry that is contrary to sound scientific evidence.

IS SMALL BETTER? HUMAN SIZE, THEOLOGY AND THE ENVIRONMENT

Robert John Schier, M.D.
110 Ardith Drive
Orinda, Ca. 94563

Increasing population and advancing technology both contribute to social and environmental problems. Large populations require more space, use more resources and produce more waste than smaller ones. Technologically advanced societies generally support a higher standard of living and consequently also use more resources and produce more waste than those that are less advanced. Traditional methods of dealing with these problems include limiting population growth, convincing populations to voluntarily limit resource consumption, developing more efficient technologies, and using technology to clean up its own waste. An additional tactic deserves consideration: genetically modifying the human body to decrease size and alter physiology in a Theologically Correct manner in order to reduce resource requirements while at the same time retaining in all regards the complete humanity (as expressed in the idea of human beings being made "in the image of God") of the human beings whose bodies are altered.

**DO BIBLICAL MODELS NEED TO BE REPLACED IN ORDER
TO DEAL EFFECTIVELY WITH ENVIRONMENTAL ISSUES?**

Richard H. Bube
Professor Emeritus, Materials Science and Electrical
Engineering
Stanford University
Stanford, CA

Attempts to develop models to guide Christian response to environmental issues have frequently taken in recent years some kind of emphasis that deviates from or adds to that provided by the Bible. The general argument is that the traditional biblical view of the human/environment interaction is too human-centered, too concentrated on human authority over nature, and too missing in the crucial nature of the interactions that occur between human beings and the rest of the created world in which they live. Searching for new stimuli for dedicated and responsible action, some Christians have been led into the search for a new world view that will, in their opinion, be capable of sustaining their goals.

Typical of these efforts is the advocacy of a resacralization of nature, a recognition of the presence of the divine in everything in the created world, an appreciation of the spiritual qualities of all nature revealed to us by modern science, a removal of all theoretical distinctions between human beings and the physical universe, and the Gaia hypothesis - where Gaia is the name for the earth viewed as a living organism.

In this paper we consider the question: "Is responsible environmentalism better expressed within the biblical models of creation, stewardship and redemption, or within the proposed models of religious monism and resacralization of nature?"

**"AND GOD SAW THAT IT WAS GOOD"
-- DEATH AND PAIN IN THE CREATED ORDER**

Keith B. Miller
Post-Doctoral Fellow
Department of Geology
Kansas State University
Manhattan, KS 66506-3201

In the Genesis account and elsewhere, scripture declares God's love and care for creation, and the glory and praise it returns to Him. Yet, the creation that Scripture declares both good and an object of God's care and pleasure is a creation in which death and pain are integral, indeed vital, aspects. The long history of life on Earth makes the presence of death and pain before the Fall inescapable. The fossil record documents that the same ecologic relationships and organism interactions (carnivory, parasitism, scavenging, decomposition, disease) we observe today were fundamental aspects of biologic communities throughout Earth history. Reproduction, the care and protection of offspring, defense, escape from predators, and the pursuit of prey are defining forces that shape organisms' biology and behavior. In short, essentially all meaningful animal activity and interaction would be rendered meaningless or impossible if death was not a universal certainty. The implication of death's inseparable place in God's created order is that death and pain are not evil in the context of God's larger purpose. Physical death, pain and suffering are part of what makes us human. Scripture consistently proclaims the important role of suffering in developing Christ-like character. This is not to argue that we are to embrace death and suffering; rather it is in the struggle to understand and overcome them that our most Christ-like and meaningful thoughts and actions are expressed. As with the non-human creation, God draws beauty and purpose out of apparent tragedy. And God does not leave us to face death alone, but has passed through it Himself and won victory over it at the cross.

"Last Things First: THE IMPACT OF ESCHATOLOGY ON ECOLOGY"

Albert L. Truesdale
Nazarene Theological Seminary
1700 E. Meyer Blvd.
Kansas City, Mo. 64131

This paper explores the relationship between the Christian doctrine of eschatology and ecology. It argues that an eschatology that views the creation as extraneous to the consummation of the Kingdom of God makes a serious commitment to ecology both unnecessary and impossible. The paper shows that a positive doctrine of creation alone cannot sustain a seriously engaged ecology; it must be wedded to an eschatology that is continuous with the creation and that promotes a comprehensive stewardship of the creation as essential to the Kingdom's fulfillment.

By appealing to prominent examples, the paper shows the correlation between a discontinuous eschatology and a lack of interest in ecology. It also shows that the New Testament substantially supports an eschatology that necessarily includes the creation's fulfillment, and by clear implication necessitates ecological seriousness and engagement.

GOVERNMENT AND ENVIRONMENT: LIMITS AND NEEDS

John C. Munday Jr.
School of Public Policy
College of Law and Government
Regent University
Virginia Beach, VA 23464

The general question of civil government relative to environmental preservation is explored in the context of two major issues: extent of intrusion by civil government in private actions, and the long-term future of planet earth. The concern of significance is that looming global environmental problems are generating political pressure for abandonment of the present federal, republican form of sovereign national government in cooperative international relationships, in favor of centralized global autocracy. A four-fold framework for analysis consists of: limits of the environment; need for change in human behavior to reduce or avoid adverse environmental impact; limits on the authority of civil government; and need for civil governmental action toward environmental preservation. The general conclusion is that both our environmental heritage and our political heritage must be preserved. The political heritage is Biblical and built on protection of inalienable rights accorded to individual man by his Creator; man's duties include earth dominion and good stewardship. Principles and actions are presented which would preserve the nation's political heritage while legally and effectually protecting the environment: (1) General principle: The civil government is to protect inalienable rights against human destruction of a life-sustaining environment; (2) Corollary: The civil government is not authorized to restrain misuse of the environment absent inalienable rights infringement; (3) General principle: may by public consent protect its natural commonwealth.

WHAT RESEARCH QUESTIONS MIGHT
A SCIENTIFIC THEORY OF DESIGN SUGGEST?

Paul A. Nelson
Department of Philosophy
University of Chicago
Chicago, IL 60637

Critics of the theory of design have often argued that, among its other shortcomings, the theory leaves scientists with nothing to do -- save, perhaps, writing inspirational tracts on, for instance, how remarkable it is that our legs are just long enough to reach the ground.

In my talk I address the sober and well-intentioned variant of this objection. It holds that any theory of design puts all the really interesting questions behind the opaque screen of the Creator's sovereign will: things are the way they are because God wanted them that way. On this view, the theory of design seems to make the world a static and inscrutable place, replete with unconnected phenomena, in which all scientific research runs straightaway into the brute fact of divine agency.

Does the theory of design actually generate this sort of unhappy picture? Decidedly not, I shall argue. Taking certain biological sciences as examples, I shall illustrate how the theory of design might resolve some longstanding research questions -- in evolutionary theory, or the origin of life -- by proving that they are ill-formed, while at the same time recasting other genuine questions in soluble terms.

**THE KOKOSING RIVER PROJECT: HELPING A HIGH SCHOOL INTEGRATE
ENVIRONMENTAL RESEARCH INTO THE SCIENCE CURRICULUM**

Joseph H. Lechner, Ph.D.
Natural Sciences Division
Mount Vernon Nazarene College
800 Martinsburg Road
Mount Vernon, OH 43050

In October 1991, Mount Vernon Nazarene College received a \$34,300 grant from the Ohio Board of Regents under the federally-funded Dwight D. Eisenhower Mathematics and Science Education Act. One of the major activities supported by this award was the development of an environmental research program that could be incorporated into traditional laboratory science courses offered by Mount Vernon High School. The goals of the project were (1) to provide greater opportunity for hands-on experimentation and (2) to increase students' awareness of an concern for environmental issues.

Six faculty members from MVNC and nearby Kenyon College, and several nonacademic scientists, helped the high school faculty develop suitable protocols. All experimental work centered on the Kokosing River (a tributary of the Walhonding and ultimately of the Ohio River), which flows within easy walking distance of both the MVHS and MVNC campuses.

Geology classes at MVHS prepared topographical maps of the riverbed area using standard surveying instruments. They also sounded the depth of the river, measured flow velocities, and calculated the discharge rate.

Biology classes collected, preserved, and identified 20 fish species and over 20 invertebrate species from the Kokosing River. Four of the fish, and four of the insects, were pollution-sensitive species that one would not have expected to find unless the water had been of high quality. Other biology classes assayed river water for fecal coliforms.

Chemistry classes monitored the pH and dissolved oxygen levels of the river in situ. They also collected water samples and analyzed them for total solids, conductivity, heavy metals, nitrate, nitrite, and phosphate. Five-day biological oxygen demand (BOD) tests were also performed.

Data were exchanged with other high schools via Project Green, a computer network that is dedicated to environmental studies of waterways in the Great Lakes drainage basin. Accounts of this study were published in local newspapers, and presented to the MVHS student body in an end-of-year assembly program. This publicity sought to portray the Kokosing River as a valuable and basically-healthy ecosystem that is worthy of our ongoing efforts to preserve it. The publicity also sought to motivate students to enroll in high school laboratory science courses.

Many other public schools are seeking to incorporate environmental studies into their curricula, and to increase the level of hands-on experimentation in their science courses. Cooperation with a high school is a fruitful opportunity for ASA members, acting either as private individuals or through a college science department, to share their concern for environmental stewardship.

LOCAL POLITICS AND THE FRUSTRATIONS OF RECYCLING

Gerald D. Hess, Ph.D
Professor of Biology
Messiah College
Grantham, PA 17027

Recycling requires both personal will and discipline on the part of individuals but it also requires the cooperation of local authorities and organizations. My personal experiences as a citizen of a local municipality, an employee of a Christian liberal arts college and as a member of a local school board are illustrative of the frustrations one can encounter while attempting to practice recycling as a tangible way of caring for the creation. Living a few hundred yards from a municipal and county boundary line serves to further complicate the situation. The municipality in which I am employed has mandatory recycling while the one in which I live curtailed recycling efforts after several months when the outlet for recycled materials declared bankruptcy. Efforts by our school district to model recycling have likewise been kept to a minimum because of limitations in locating appropriate outlets for recycled materials. Sincere Christians who encounter similar experiences may decide to turn to other concerns of seemingly more eternal value. Christian environmentalists need to be sensitive to the frustrations of those fellow Christians whose efforts to "care for the creation" have been thwarted in ways such as this and seek to provide encouragement and direction to them. Aiding concerned citizens in untangling the red tape and sorting out the power struggles of local politics is a crucial component of providing Christian leadership in teaching others to live in environmentally responsible ways.

**SUBDUING THE EARTH WHILE TENDING THE GARDEN:
A PROPOSAL FOR A MORE BALANCED ENVIRONMENT**

Raymond E. Grizzle
Department of Biology
Campbell University
Buies Creek, NC 27506

and

Michael G. Cogdill
Department of Religion and Philosophy
Campbell University
Buies Creek, NC 27506

Most Christian environmental ethical approaches being developed today heavily emphasize the goodness of creation and propose a stewardship relationship. We disagree with this general approach in only one respect: creation also has some characteristics that must be overcome or "subdued" if we are to survive. In other words, we argue that there is a valid and desirable aspect of subduing creation that should explicitly be addressed with the stewardship relationship. A central concept of ecology is that the survival of nearly all species is dependent upon the deaths of other organisms; predation is a fact of life. Furthermore, the existence of human societies generally has long been dependent upon our ability to subdue creation through activities such as hunting, agriculture, and medicine. Finally, the centrality of economics and technological development -- both of which are usually associated with environmental degradation -- in most societies may preclude the usefulness of any environmental ethic that does not adequately work within their frameworks. All of the above activities may perhaps be accomplished with a caring, stewardship-like attitude, but such an attitude does not fully describe them. We argue that in some cases, some components of creation (e.g. pathogenic organisms) must be actively assaulted in a war-like fashion if we are to survive. A useful (and truthful) environmental ethic should include the characteristics of creation that must be overcome, or subdued, as well as those that must be valued and preserved.

DEVELOPMENT AND A CARING ATTITUDE

Evelina Orteza y Miranda
University of Calgary
Calgary, Alberta, Canada

This paper inquires into the logical characteristics of the term 'development.' 'Development' is frequently used as an empirical/scientific term. Presupposing certain physical/physiological structures in the human being, a child psychologist, for example, talks of stages of child development. This is 'development' in its unfolding sense. Similarly, developmental projects, say those in Third World countries, are taken to be empirical/technical in nature. Problems that arise out of them are dealt with empirically, perhaps one of technique or a miscalculation of means-end relationship. There is an empirical/scientific aspect to 'development' but it is not all there is to it.

I will show and argue that 'development' is basically a moral or an ethical term (using both terms interchangeably in this paper). Its end-state is an expression of a value. If so, what values should inform the end-state of development? If consequences are brought about by developmental activities, then moral value questions, for example, "what ends do these projects fulfill?" or "who is served by these projects?" must be central to its deliberations. Obscuring moral value aspects of development has allowed developmental projects, especially those in Third World Countries, to carry on regardless of consequences, whether or not they are harmful, respectful of rights of people to self-determination, or unjust. Or, it could be that developmental projects are informed solely by economic/business/profit values. To view 'development' solely in its empirical/scientific aspect could lead to some ethical/moral questions.

The above does not suggest that Christians, therefore, ought to cease altogether from their activities, for fear of contaminating planet earth or tampering with the animals' capacity for independent life and their awareness of it. But that in being aware of moral/ethical aspects of development, one could be observing of its wide ranging consequences not only on the quality of human lives but of all living entities of the earth. Whether a Christian tends to favor developmentalists or environmentalists, or whatever one does, the one necessary criterion that must be employed in one's activities is the one criterion that God Himself employed to judge His creation, namely, "And God saw that it was good."

My paper presents a brief explication on what God's judgment could possibly mean and argues for a case of development which, at the same time, expresses a caring attitude toward our environment. Concepts related to development, for example, sustainable development, will also be explored.

WHAT DO WE OWE FUTURE GENERATIONS IN THE CONDITION
AND KIND OF ECOSYSTEM THAT WE PASS ON TO THEM?

James C. Peterson, Ph.D.
Associate Professor of Theology and Ethics and
Director of the Program in Religion, Ethics, and Technology
Wingate College
Wingate, N.C. 28174
and
Visiting Professor of Theology Gordon-
Conwell Theological Seminary, Charlotte

Christian ethics consistently includes concern for the welfare of people, but does that include people in the future? The question last received extensive attention in the late 1970s in regard to population control. It is crucial now to develop and refine the discussion for fields such as environmental ethics. Specifically, what do we owe future generations in the condition and kind of ecosystem that we pass on to them? The response of this paper is organized around four principles widely affirmed as guiding the ethical treatment of existing people: beneficence, justice, non-maleficence, and autonomy. Each principle is tested for its applicability and implications for our current actions that will substantially affect people who have not been born yet. In regard to beneficence, the Christian traditions of neighbor love and stewardship are addressed; for justice, the Gospel tradition of reciprocity and Rawl's theory of just savings; for non-maleficence, *primum non nocere*; for autonomy, concerns about the protection of future choice and diversity. Each area is considered with full awareness of the necessity, limitations, and responsibility of making choices that dramatically affect future generations, as well as our own.

HUMAN POWER AND THE CREATED ORDER

Barbara A. Pursey, Ph.D, MDiv
Associate Professor of Christian Formation
University of Dubuque Theological Seminary
2000 University Ave., Dubuque IA 52001

Many social critics and scholars lay the blame for our current environmental problems at the door of the Christian church and its theology, as well as its offspring natural science. Whether or not we feel the criticisms are fair, there is no question that the language of "subduing" and "dominion" in Genesis and the traditional interpretation of those words leaves Christians with some explaining to do. At root this is a theological question. Today, questions about our proper relation to the cosmos are being raised from both the religious and the scientific side.

Several issues are basic to the discussion: How does God relate to the created order? How do humans relate to the rest of the created order? Is there a better way to construe these relationships than we have in the past? How we understand God's relation to the cosmos and to us influences how we view our relation to the cosmos. This paper explores these relationships and our impact on the world and its theological roots through an analysis of power.

A brief historical survey of the key developments in Western science and religion which bear on the triad of relationships between God, humanity and the cosmos will give some perspective on the issue. Different dimensions of power (following Rollo May) will be summarized. Various models of human power relationships with the rest of the created order will be focused on in turn. (1) Ruler - power over. Nature lies passive before us as it does before God. Power here is construed as control and domination. (2) Steward - power for. This is a management model which is popular in Christian circles today. We are still in control, but with an eye to responsibility before God (sometimes anyway). (3) Neighbor/friend - power with. This more holistic view emerges from the inextricable interconnectedness of all parts of the cosmos envisioned by both contemporary science and religion. When we recognize that we are part of the cosmos, not 10 feet above it, then we can begin to respect the cosmos as well as its Creator. Power is a cooperative venture with our fellow creatures and the earth itself for the good of all. While embedded in the cosmos, the human still has a special transcendent task from God - to lead the way in fulfilling the divine purpose for the cosmos as creation. The paper will conclude by exploring some implications of this new way of using our power, the need for redemption of our motivations and from our abuses of power, and how we can help others to envision a more biblically faithful and environmentally sound theology of nature.

ENVIRONMENTAL CONSEQUENCES OF A CHRISTIAN WORLD VIEW

David L. Dye, Ph.D
12825 SE 45th Place
Bellevue, WA 98006-2031

A Christian world view is characterized by assumptions (faith) that (1) there is a "Spiritual Reality" -- God, (2) this "other" Reality is revealed in the historical Person of Jesus Christ; and (3) the Bible in its original form records that revelation. Parallel assumptions (also taken by faith!) are made for the practice of science: (4) there is observable Physical Reality, to which (5) some kind of logic applies and in which (6) some kind of casualty operates. Based on these six presuppositions we conclude (a) that God created the physical universe or equivalently, God created the natural laws of space-time (as well as "spiritual" laws); further we conclude (b) that God uses these laws in His interactions with the physical universe. These laws include what we might now call laws of biochemistry, sociology, economics, as well as physics.

We humans, created by whatever processes God chose to use, but uniquely made with a spiritual nature so we can interact personally with God (who is Spirit), often attempt, at our own peril, to violate or ignore God's natural laws. Among the consequences of such attempts are what we call environmental disasters and, more commonly, environmental degradation. On the other hand, following scriptural principles can lead us to environmental quality; examples of such positive correlations will be discussed.

ANTHECOLOGY AND BIOSYSTEMATICS OF PEDICULARIS (SCROPHYLARIACEAE)

Lazarus Walter Macior
Department of Biology
The University of Akron
Akron, Ohio 44325-3908

Numerous studies of the pollination ecology of Pedicularis species have demonstrated that external (prezygotic) factors in reproductive isolation are fundamental to an understanding of its speciation. Seasonal, behavioral, and mechanical elements not only assure reproductive success but also provide for species diversification. Parallel, convergent, and divergent evolution of floral forms appear related to geographical and ecological isolation resulting in a high degree of endemism, especially in alpine regions. Anthecological studies indicate that Pedicularis and bumblebees (Bombus Latr.), its prime pollinators, have closely integrated reproductive cycles in their stressful alpine environment. Although convergence and parallelism may obscure phylogenetic relationships based upon vegetative and floral morphology in Pedicularis species, it may be possible to derive such putative relationships by combined consideration of historical dispersion, habitat preference, and pollination ecology as well as morphological traits.

Anthecological and biosystematic research of this kind confronts the creation/evolution issue with a challenge. Genetic variation in the pollinator genus produces an array of pollen/nectar foraging patterns. Genetic variation in the plant produces an array of potential floral forms that may serve as functional pollination mechanisms. This raises the question of reciprocal selection pressure under the genetic control of neither. Is the obvious coadaptation of flower and pollinator a consequence of convergent reciprocal chance? Quite possible, but there remains the open question of the overall pattern of this coevolution and the law governing it. The ultimate causality and direction of this evolution extends beyond the realm of sense perception and logic.

MONITORING AND MODELING CROPPING SYSTEM
NITRATES FOR A SUSTAINABLE
AGRICULTURE

Ronald J. Vos
Delmar Vander Zee
Christian L. Goedhart
Dordt College
Sioux Center, IA 51250

This research was done in response to social and environmental concerns over nitrate use in and loss from agricultural lands. The purpose was to investigate nitrate presence and movement in soils, soil solutions and groundwater. Furthermore, it was proposed that on-farm research could provide insight for site-specific decision making regarding nitrogen management.

The study was conducted over three-years (June 1 988-July 1991) of nitrogen use and movement in four fields at the Dordt College Agriculture Stewardship Center (ASC) and three additional farm sites. The Dordt ASC sites represented four different field conditions: two conventional tillage--upland and lowland, alfalfa, and ridge-tillage. Two test wells were drilled in each field into the water table. Suction lysimeters were placed at three depths near each well site. Soils were sampled in the top 1 m of soil using standard soil cores. Rainfall was recorded at the field sites.

This paper focuses primarily on soil nitrates under alfalfa and conventional row crops. Most soils had levels of nitrate-N above 20 ppm with some averaging as high as 60 ppm. These soil-N levels exceed what is needed for corn production. In those fields with high soil-N there is a potential for leaching of nitrate into ground water. Soil-N in alfalfa fields was consistently low, approximately 5 ppm or less. Test-well water under alfalfa was low in nitrates.

The alfalfa soil-N project conducted at Dordt ASC and three cooperating farmer's fields showed that alfalfa in both young and older stands can remove soil-N to levels that are clearly below what could be a leaching problem.

Past land use and manuring practices do contribute significantly to soil nitrogen economy. Knowledgeable and stewardly application of organic and commercial nitrogen can be accomplished with use of the Late Spring Soil Nitrate Test and the Fall Stalk Test. Furthermore, it is clear that alfalfa in rotation or strip cropping can be used not only to contribute to soil-N (via decomposition of biomass) but also to mitigate deep soil nitrogen levels.

THE GROUND OF BEING: A LITHOCENTRIC CRITIQUE OF DEEP ECOLOGY

Kenneth N. Carter, Jr.
Keith Pavlischek
Lynn Biberdorf
Northeast Missouri State University
Kirksville, MO 63501

Deep ecology has been hailed by some as a recognition of fundamental truths. However, this recognition is not fundamental enough. By their own admission, deep ecologists disavow "anthropocentrism" in favor of "biocentrism" as if these were the only two options (an example of typical Western dualistic either/or thinking?) It can be argued that biocentrism is arbitrary, parochial, and insufficiently radical to serve as a foundation for a truly anthropocentric environmental ethic and world view. The deep ecologists must go deeper, to the lithosphere, to the ground of being.

When non-biotic aspects of the environment are mentioned by environmental ethicists, they are usually considered merely as substrates, raw materials, in a work, as commodities to be exploited by the biosphere. This narrow view tacitly ignores the inherent value of the rocks in themselves apart from their utility to humans and other biota. Of that utility, of course, there can be no doubt. The higher cannot stand without the lower, and life apart from the elemental bounty of the lithosphere would not long remain alive. Lovelock Vernadsky, and others have called attention to the biogeochemical cycles which call into question the strict division of living and nonliving. If humans are but a small part of the "seamless web of life", the biosphere is a still smaller aspect of a larger web -- for which the ratio of mass of living humans to the biosphere as a whole is less than one ten-thousandth, the ratio of the mass of the biosphere to that of the lithosphere is less than one millionth!

Life attacks the literal integrity of the lithosphere. The anthropocentric and lithocentric critic each disparage tree-hugging, but for different reasons. The roots of that tree crack the rock, shattering that which might otherwise have endured intact for eons. The radical lithocentrist may be unimpressed by the claim that the tree presents the erosion of soil. What is soil but degraded rock with organic contaminants? Nor are "lower" lifeforms exempt from the charge of lithodegradation. Lichens contribute to the weathering of rock, and the oxidative degradation of rock is hastened by the high oxygen content of the atmosphere, for which plant life is directly responsible. According to Lovelock's Gaia hypothesis, the early cyanobacteria began a trend which has proceeded with increasing speed: the irreversible alteration of the lithosphere by life.

More than three quarter of the earth's surface is covered with sediment or sedimentary rock. Does the contribution of marine organisms to carbonate rock justify the existence of plankton? Regardless, the plankton do not exonerate trees, grass, and humans. To privilege life merely because of complexity, or potential, or some human standard of aesthetics would be to enter on a slippery slope culminating with anthropocentrism. If humans are not the crown of terrestrial creation, then the cyanobacteria are not the tiara.

Advances in nonlinear thermodynamics have shown that "self-organization" of complex structures involves the dissipation of entropy to the surroundings. Living organisms are without exception dissipative systems, purchasing their order at the expense of even greater disorder in their surroundings. Only in the last few years has humanity become aware that life must by its very nature degrade the geosphere.

Some extreme ecological activists have referred to humanity as a "cancer on the planet." The lithocentric perspective may require that the indictment be broadened to include life in general.

Christianity has been widely misunderstood, both from without and within, as anthropocentric. However, orthodox Biblical Christianity is actually lithocentric. There are a number of Biblical references to God as a rock and to Christ as a stone. Although lithocentric Christians cannot embrace the biocidal fever that might possess the principled secular lithocentrist, neither can they conscientiously hold the anthropocentric view that all things are merely commodities for their use. If God is One whose center is everywhere and circumference nowhere, then centrism of one thing need not imply peripheralism of all the rest. In the final chapter of C. S. Lewis' novel "Perelandra", there is a vision "of the Great Game, of the Great Dance":

Each grain is at the centre. The Dust is at the centre.
The Worlds are at the centre. The Beasts are at the centre.
The Ancient peoples are there. The race that sinned is
there...The gods are there also. Blessed be He!...
Where [He] is, there is the centre. He is in every place.

The stone which the builders rejected, the same is become the head of the corner. Whosoever shall fall upon that stone shall be broken; but on whomsoever it shall fall, it will grind him to powder. Blessed be our Rock.

CREATION, EVOLUTION, AND TAXONOMY

Steven Eugene Fawl
Chemistry Department
Napa Valley College
2277 Napa Vallejo Hwy
Napa CA 94558

One of the great deficiencies of creationism is its inability to organize biological life. In this presentation I will attempt to amend this deficiency by proposing a mathematical model for relating species within the framework of creationism. The model is based upon an analysis of the molecular sequence of macromolecules common to all living species. Once these sequences are known, the species which the molecules represent can be grouped by the similarities and differences found between these molecules. The species within each group are then related using standard numerical taxonomic techniques. The molecule of choice is cytochrome c since it is found in all living species and there is an abundance of data. When analyzed using standard evolutionary techniques cytochrome c produces phylogenies at odds with the idea of common descent, but when analyzed using these new creationistic methods the data falls into several tight groups that remain consistent with the order of creation and the fossil record. The data leads one to the conclusion that God created in several specific acts but that both macro and micro evolution has occurred since the time of creation. Furthermore, the data naturally produces gaps between groups which are consistent with the large gaps known to exist in the fossil record. Finally, a specific definition for the created "kind" flows naturally from the analysis. The true beauty of the analysis is that it is strictly mathematical and based on just a few logical creationistic assumptions.

**"THE BIBLICAL FLOOD: UNDERSTANDING A RECENT COSMOLOGICAL DISASTER:
A MODEL OF THE EVENT AND HOW IT FORMED OUR AQUIFERS**

J. Leon Dennison
Olympia, WA

A video study of the clear evidence and results of this event at and near Pleasant Valley (Coalinga), California.

The alluvium that fills this valley give direct evidence of a great cosmological disaster. The mountains and canyons that surround the valley had huge quantities of material removed from them in the very recent past. Much of this material forms the aquifer of Pleasant Valley. More of this material spilled out into the San Joaquin Valley forming a huge alluvial fan. Pleasant Valley is typical of hundreds of small and medium sized western valleys. Understanding how this aquifer was built and what happens when it is tapped for water, will help to understand the behavior of most western aquifers. The standard model of the Ice Age fails to explain the nature of this aquifer and hundreds more just like it.

Pleasant Valley is located on the eastern side of the Central California Coast Range, and is almost a part of the greater San Joaquin Valley. It is separated from the San Joaquin Valley by a low rolling ridge.

I. The valley, an alluvium-filled basin

- A. The gravel pit at Coalinga, the second deepest in California
 - 1. The significance of the depth and composition of the gravel
 - a. Maximum size, greater than three foot in diameter
 - b. Contains no clay or fine material
 - 2. The significance of the pits one and one-half mile separation from the mouth of the nearest canyon
 - 3. The significance of two sand, silt, and clay lenses that are visible in the pit
 - 4. The significance of hundreds of feet of homogenous gravel that underlie the bottom of the pit and valley
This information is available from the drilling logs of oil wells that dot the region.
 - 5. The significance of the abundance of Pliocene fossils
 - a. The fossils are enclosed in rock matrixes whose source is the surrounding mountains.
 - b. The significance of the unreported Pleistocene elephant tusks that were found in the pit.
- B. The significance of the alluvial fans of three major Coast Range canyon systems that empty into the valley in close proximity to Coalinga.
 - 1. The fans themselves
 - a. Interpreting data that has been overlooked.
 - b. The contour that the edge of the fan makes with the surrounding hills tells a story
 - 2. Why two of the fans overwhelm the third fan.
- C. The significance of the combined Coalinga-Huron alluvial fan, which spills into the San Joaquin Valley.
This fan combines helps make the southern San Joaquin Valley an enclosed basin.

II. Two of the canyon systems, Los Gatos and Warthan

- A. The mountain valley benches, which contain a heavy proportion

of gravel. These benches are being destroyed by the forces of nature.

- B. The significance of the contour interval defined by the points of small alluvial fans in the mountains
- C. The narrow breaches in once continuous small ridges across the mountain valleys
- D. The truncated ridge noses
A pattern of slow curves in tight canyons and wide curves in open, bench-floored valleys
- E. The significance of the cliffs
 - 1. The cliff bases are too clean
 - 2. The cliff faces are horizontally striated.
- F. The fossil bearing-formations
One is stacked neatly above another, yet separated from it by several dozen feet of steril consolidated sand or other type of sea bottom sediment.

III. A model of how it all happened in which all the features are integrated together.

This model is predictive and an understanding of it can help in predicting how aquifers will react when tapped for water and also where Pleistocene fossils will be found.

IV. The mathematics

- A. The force needed to grind large boulders and to push those boulders several miles out through the canyon entrances.
- B. The mathematical comparison between the benches of the California and Oregon coast ranges.
- C. The mathematical comparison between the California Coast Range and the ranges of the Great Basin province of Nevada.

ETHICAL ISSUES IN THE USE OF REPRODUCTIVE TECHNOLOGY
TO SAVE ENDANGERED SPECIES

Terry G. Pence
Associate Professor of Philosophy
Northern Kentucky University
Highland Heights, KY 41099

Reproductive technologies first developed to aid production of domestic livestock and cases of human infertility have recently been applied to endangered species. Principally the technology involves the in vitro fertilization of the egg of the endangered species and its subsequent implantation into a host womb. This may be a reimplantation into the egg donor but it may also be a surrogate of a different species.

This paper is an exploration of the ethical issues raised by such procedures. I intend to defend the use of this technology from two sorts of criticisms. Some would object to the technology because they are opposed to the deliberate infliction of pain and discomfort to animals (an animal rights/liberation objection). A second sort of criticism would agree that the preservation of species may justify the pain because they see this as an overriding obligation because of the intrinsic worth of species (biocentricism) or as part of a divine command (stewardship ethic) but object to this methodology for a variety of reasons.

In the first section I will describe more precisely what these procedures are, what has been accomplished to date and what future prospects are.

The second section defines the ethical issues raised by these procedures. In particular, the justification of, the infliction of at least some discomfort on one species for the sake of another. I argue that the closest parallel to this case is non-therapeutic research (i.e., not designed to benefit the research subject) on populations incapable of consent such as children, the mentally retarded, and demented. The justifications typically given for this sort of research, however, do not apply to the species under consideration. There is no moral community of which they are a member and to which they have presumed obligations. Nor is it plausible to believe that any species (except our own) has an interest in preserving its own species let alone another. The basic justification for inflicted pain and discomfort involved in these reproductive technologies depends on a more basic issue: are we obliged to preserve species?

In the third section, I approach this question from three evaluative perspectives: animal rights/liberation, biocentricism, and the Judeo-Christian stewardship. The animal rights/liberation position while not necessarily opposed to species preservation would have serious reservations about this discomforting technology. For them, species in themselves have no inherent worth because it is not sentient nor is it a subject of a life, only individuals do. The rarity of an animal does not affect its moral standing. This observation exposes what many see as a theoretical inadequacy of the position.

Biocentricism is one perspective which does attach inherent value to species

and consequently could easily endorse the obligation to preserve species. Nevertheless, a person may believe in the preservation of species and still object to the high tech approach of embryo transfers and frozen zoos. The reservations may stem from beliefs about the efficacy of this procedure as opposed to habitat preservation, questions about whether the end result is really a wild species, or queasiness about doing things mother nature never intended, managing species, or the inordinate concentration on flagship species while insects, plantlife, and the rest of the ecosystem are just as valuable and important. These are, I argue, legitimate concerns but not insuperable objections.

Lastly, I discuss the stewardship ethic which seems to me to provide the best rationale for species preservation. Although biocentricism also makes species preservation a moral obligation, the stewardship ethic seems to avoid what seems to me to be some of the excesses of that view.

**BRINGING ENVIRONMENTAL ISSUES
INTO THE GENERAL BIOLOGY CLASSROOM**

Stanley Rice
Huntington College
Huntington, IN 46750

Most biology majors have the opportunity to learn, read, talk, and write about environmental issues during environmental science and/or ecology courses. But most of the students at our colleges and universities take only one or two science courses, one of them being general biology. Is there any way to reach them with essential environmental information?

In most nonmajors' general biology courses, time is tight, and lectures must keep pace with laboratories. It is not easy to set aside special lectures for environmental issues. However, such issues can be integrated into an existing general biology curriculum: environmental issues can be used as examples and illustrations of major biological concepts whenever possible.

Examples include:

1. Use examples of endangered species during lectures about population genetics.
2. Use pesticide resistance in insects as an example of evolution to replace the overused peppered moth story.
3. Focus on agricultural plants for the botany section.
4. Address the question of why so many people are malnourished during the nutrition section.
5. Discuss water pollution and parasites during microbiology and invertebrates sections.
6. Rain forests provide excellent case studies for nutrient cycles, species interactions, or succession lectures.
7. Discuss acid rain during lectures on enzymes and buffers. Perhaps some of the less essential laboratory activities could be replaced with field trips to study forest succession or to visit a water pollution control plant. A laboratory about acid effects on enzymes could be specifically described as an acid rain simulation.

Finally, it would be helpful to have a textbook with this specific focus. No such general biology textbook is currently available.

CARING FOR CREATION IN CHOOSING UNDERGRADUATE RESEARCH TOPICS

Larry Martin, Ph.D.
Assistant Professor of Physics
North Park College
3225 West Foster Avenue
Chicago, IL 60625

The common search for God among all people plays itself out in our desires for security, surprise, and significance. Students in Christian colleges are particularly attuned to the need for guidance from God in their choice of major as well as their responsibility under God for the entire creation. The way a research topic in the sciences is chosen is often open to criticism for its isolation from the values of Christianity as well as the wider society.

At North Park College, the physics majors usually do some type of research in conjunction with their courses. Their works were presented recently at an undergraduate symposium. The methods, results, trials and tribulations of directing such research will be presented. Some research was done in cooperation with private industry. The weighing of competing interests and the necessary solution of ethical dilemmas presented by this research allowed students to gain an appreciation for the complexities of the real world.

The factors motivating students quickly move beyond desire for a good grade. They find that it "makes you feel like research in grad school won't be so impossible, or too foreign of an experience." They quickly learn it is "exciting to deal with new research." They also state that it is "incredibly important to start as early as possible pondering the 'imponderables'; it requires a different style of thinking than just doing homework problems - there's more excitement there - it relates more to real life somehow."

ENVIRONMENTAL EDUCATION: CATCHING THE SECOND WAVE

John R. Wood
Assistant Professor
The King's College
Edmonton, Alberta
Canada

University level environmental science/studies degree programs developed quickly on the first wave of environmental awareness beginning in the late 1960's. By the close of the 70s there were over 200 degree programs established across North America. The rediscovery of the environment as a public issue in the last five years or so has led to a second wave of program development. The publication of a new Peterson's Guide "Education for the Earth" A Guide to the Top Environmental Studies Programs" marks a new level of recognition for this academic area. Although the programs are widely distributed across higher education and generally well subscribed by students they do not yet fit comfortably in the academic mainstream. The interdisciplinary nature and nebulous definition of environmental science/studies has left this field without a clear focuss at many institutions. This paper will explore problems such as this that have arisen in twenty years of environmental education.

By way of comparison in Canada 17 or 67 institutions have bachelor degree programs in environmental science. This is similar to the ratio of program development in the U.S. One third of these were created in the past five years, in addition to several new graduate programs. Relatively few Christian Colleges had established environmental science/studies programs in the 70s. A survey of the members of the Christian College Coalition reveals that a number of these institutions have either recently begun or are actively planning new environmental science/studies programs.

**THE GAIA HYPOTHESIS: IS IT A USEFUL PARADIGM
FOR ENVIRONMENTAL UNDERSTANDING AND ACTION?**

David L. Swift, Ph.D.
Dept. of Environmental Health Sciences
Johns Hopkins University
615 N. Wolfe St.
Baltimore, MD, 21205

The GAIA hypothesis, originally proposed by James Lovelock, is a concept which treats the whole planet as a kind of living organism. It has featured as one of its key concepts the idea that life has profoundly shaped the entire planet, including its geologic features, and has, thereby, come into sharp conflict with many mainline geoscientists. Its proponents claim that it is a powerful paradigm for viewing the environmental questions, linking the living and non-living features of the earth in an interdependent network. Some environmentalists find the concept useful in that sufficient damage to certain key components of the planetary "organism" could well cause permanent disease leading to death.

Although the original Greek Goddess, Gaea, or "Mother Earth" seems to have had a "grand" purpose in bringing the earth into existence, the present day proponents of GAIA seem to find sufficient purpose in planetary "homeostasis" as a goal. If the hypothesis is simply scientific in nature, it is not necessary to be purposeful, but many of its proponents appear to treat it not only as a proper way to view earth, but a source of motivation toward environmental responsibility and action. In the absence of a creator, one might view GAIA as a modern day manifestation of the old "elan vital".

What does GAIA offer to us as an environmental paradigm that is not already found in the Scriptures? There are at least three concepts in Scripture which bear some similarity to GAIA: (1) the relational web of all which is created (Genesis 1,2), (2) the prophetic writing which contain Jehovah's covenant not only with man but with the earth (thus, in a real, albeit poetic sense, an anthropomorphic view of the earth) and (3) the eschatological view that both man and earth will be redeemed. These scriptural themes are unified by the will and purpose of the creator God and the of man, and offer an adequate prescription for environmental understanding and action.

IS MANKIND THE MEASURE?: OLD TESTAMENT PERSPECTIVES
ON MANKIND'S PLACE IN THE NATURAL WORLD

Dr. Philip Schafran
Academic Dean and
Associate Professor of Biblical Studies
Southwestern College
Phoenix, AZ 85032

In this paper I would like to survey three areas: 1) what some prominent Old Testament theologians have said favorably about mankind's exalted role over the rest of creation, 2) recent accusations against evangelical Christianity for accepting and promoting an exalted view of mankind over creation, and 3) an examination of Gen. 1-2, Psalm 8, and especially Psalm 104, to demonstrate that while O.T. Scripture does give mankind an exalted position, this must be balanced with passages which place him on a egalitarian level with the rest of the natural world (Ps. 104).

In Psalm 104 I would like to look at the interrelationship between the literary structure and themes of the poem which show that mankind is not viewed as dominant over creation or, as a Lord over creation, but rather on a level which views him equally as one part of the natural world. What is in question in Ps. 104 is not strictly mankind's relationship to the natural world but rather Yahweh's relationship to the natural world, especially to those chaotic elements in the natural world (water, heavenly bodies, darkness, and animal life). Yahweh exercises his Kingly rule over creation, not through mankind's dominance, but through his direct rule and intervention of His Spirit.

Hence, if evangelicals have seen Mankind's role as one of dominance over creation, it is because of a misunderstanding and misapplication of Scripture.

Finally, in light of Ps. 104, I would like to question whether we have read Gen. 1-2 and Ps. 8 properly, or whether there are other ways of reading these passages which promote a proper respect for a natural world.

UNIVERSITY TEACHING AND RESEARCH IN OMAN:
CASE STUDY OF A LONG-TERM OPPORTUNITY FOR COOPERATION

Stanley E. Anderson
Professor of Chemistry
Department of Chemistry
Westmont College
Santa Barbara, CA 93109

The author spent the 1990-92 academic years at Sultan Qaboos University in the Sultanate of Oman, a Kansas-size country with a modest income from oil, which lies at the entrance of the Persian Gulf. The university has been in existence for less than ten years, and has made a good start in setting up a respectable undergraduate program. I served as the head of the chemistry department during the period of my stay. In this paper I will describe the details of several major projects. The first involved providing leadership to develop a flexible chemistry curriculum preparing graduates for broad employment in the Sultanate in education, industry, and government. The second attempted to develop the research infrastructure of the department of chemistry and to formulate cooperative research programs between the department and government agencies as well as with industry which would have national relevance. These efforts provide interesting examples of cross-cultural communication and relationship that require a lot of sensitivity to local politics and protocol. I will also describe a program worked out at Westmont College to host an Omani undergraduate student for a summer research experience.

The author returned to Oman this past spring to discuss and finalize this student exchange program as well as to do some research. I will describe an environmental project to monitor various atmospheric gases which can serve as a basis for future interdepartmental cooperation. Two ASA members who are currently on the faculty at Sultan Qaboos University provide important on-going contact which gives the potential for long-term involvement.

FOUR EXAMPLES OF OVERSEAS TEACHING

Joseph L. Spradley
Professor of Physics
Wheaton College
Wheaton, IL 60187

One avenue of service for Christian teachers of science is in the many schools overseas with limited resources. Personal experience of this kind has resulted from four such opportunities over nearly 35 years of teaching. These have included a considerable variety of institutions, affiliations and situations. All have required a high degree of flexibility, but have also been highly rewarding. They were made possible by both personal and sabbatical leaves from Wheaton College, and by an adaptable and adventurous wife. A brief description of these overseas assignments will demonstrate the wide range of opportunities available in both secular and Christian schools in Africa and the Middle East.

The first position was at Haigazian College (Beirut, Lebanon, 1965-68), sponsored by the Armenian Evangelical Churches of the Middle East, with both Christian and Muslim students. The second was under USAID auspices at Ahmadu Bello University (Zaria, Nigeria, 1970-72), a state university established for Muslim students, but with a strong Christian minority. The third was for one term at Daystar University College (Nairobi, Kenya, 1988) in a program sponsored by Messiah College with mostly Christian students. The fourth was a sabbatical year at the American University in Cairo (Egypt, 1991-92), where most students were either Muslims or Coptic Christians. The problems and possibilities for Christian service in each of these diverse settings will be described.

**"JOHN WESLEY WAS BOTH A HIGHBROW AND AN EVOLUTIONIST"¹:
THE MYTH AND THE REALITY OF JOHN WESLEY'S VIEWS ON ORIGINS**

J. W. Haas, Jr., Ph.D.
Gordon College
Wenham, MA

John Wesley (1703-1791) played a major role in the rise of the English evangelical movement in the 18th Century. While widely know for his field preaching and pioneering role in what was to become the Methodist Church, few people are aware of his eclectic intellectual concerns. Over a long and productive life he would confront many of the issues stemming from the Enlightenment.

Wesley had a strong interest in the natural world as evidenced by the books that he read, comments on natural history in his Journal, medical pursuits, and extensive use of science in his written sermons and other works. His Survey of the Wisdom of God: A compendium of Natural Philosophy (1763) offered an inexpensive popular exposition of science to his constituency. Wesley closely followed the changing 18th Century perspectives on reproductive mechanisms and the theological implications which often accompanied them.

Wesley was strongly committed to the notion of a 'great chain or scale of nature,' an ancient principle which he saw as emphasizing the unity of creation. His use of this idea and rhetoric which found parallels in Darwinian discourse has led many 20th Century Methodists to argue that Wesley anticipated the modern theory of evolution in its Christian form. In this paper I will assess this claim by examining Wesley's views on creation and the 18th Century context of the rhetoric which later observers saw as having Darwinian connotations. I conclude that this episode represents a particularly bad case of historical eisegesis.

1. L. O. Hartman, *Zion's Herald*, (1926), CIII,962

"ON THE SCIENTIFIC USEFULNESS OF THE INTELLIGENT DESIGN PARADIGM"

John N. Johnson, Ph.D.
Applied Mathematician
16204 S. E. 24th St.
Bellevue, WA 98008

Materialists claim that scientists who hold to the intelligent design paradigm (IDP) are so limited that they cannot do good science. However, this paper argues that scientific progress is best accomplished with the assumption of the intelligent design paradigm even though a Creator is not always acknowledged. Moreover, there are many cases where the Darwinian evolutionary paradigm of common descent with fortunate accidents has been harmful to science. The specific examples discussed are how: (1) Kepler's and Newton's IDP assumption that a Creator made a comprehensible universe led to universal mathematical laws; (2) Pasteur's IDP assumptions led to his refutation of the theory of spontaneous generation of new life forms, and the establishment of his germ theory; (3) Darwin's assumptions that many parts of the human body are vestigial baggage led to the erroneous removal of lymph glands and tonsils from many persons' immune systems; (4) the abilities of the complex human brain with its holographic-type memory, vast storage and recognition of the past, far exceed its survival value; (5) the evolutionist presumption that increased brain size (or brain to body size ratio) implies increased intelligence has been falsified; (6) the evolutionist presumption that some human races are subhuman has led to genocide of aborigines; (7) the IDP assumption of high technology in animal instinct has been success in deciphering their navigation and migration, e.g., bat echo-location and the warbler navigating by the stars, although some enigmas remain, e.g., monarch butterfly's precise migration.

**BIBLICAL COMMANDMENTS WITH PROMISE:
IS OBEDIENCE TO SCRIPTURE BENEFICIAL TO YOUR CARDIOVASCULAR HEALTH?**

Joseph H. Lechner, Ph.D.
Natural Sciences Division
Mount Vernon Nazarene College
800 Martinsburg Road
Mount Vernon, OH 4305

At Marah, God promised His people that if they would listen to His voice, do what is right in His sight, and obey all of His laws, then they would not suffer any of the diseases that He sent upon the Egyptians (Exodus 15:26)

Dr. S. I. McMillen (None of These Diseases, 1963: Fleming H. Revell Company, Westwood, N.J.) pointed out that adherence to many Old Testament commandments would have yielded tangible health benefits. Scripture does not contain medical/scientific terminology, the most Biblical commandments do not specify the rewards for obedience; nevertheless, from our twentieth-century vantage point, we can readily appreciate the medical appropriateness of many Scriptural directives.

Obesity, dietary cholesterol, and excessive intake of saturated fat are widely recognized as risk factors for cardiovascular disease. In light of this, the Biblical admonitions against gluttony (Titus 1: 12-13), cooking meat in milk (Exodus 23:19), and the consumption of animal fat (Leviticus 3: 12-17) have obvious medical value.

Since 1950, much research effort has been directed toward elucidating a possible relationship between human behavior and cardiovascular disease. Although the Type A Personality hypothesis originally proposed by Friedman and Rosenman has not been upheld, more recent studies have identified statistically-significant correlations between heart disease and narrowly-defined personality traits such as cynicism, anger, and hostility. The confirming evidence has been so convincing that psychologists are now prescribing behavioral-modification programs designed to reduce the patient's hostility levels and thus lower his/her risk of heart attack.

Dr. Redford Williams (The Trusting Heart, 1989: Times Books, New York) has outlined a twelve-step pathway to achieving a less hostile, more trusting attitude. Williams points out that such behavioral-modification programs tend to parallel the teachings of the major world religions. I will show that every one of William's twelve steps has also been taught in the Bible.

CARING FOR CULTURES: VERBAL ART GENRES AS CULTURAL SYSTEMS

Miriam Adeney, Ph.D.
Associate Professor
Seattle Pacific University
Seattle, WA

This paper will outline five methodological approaches to the systematic analysis of verbal art genres, such as story, song, and debate. Functions of verbal art in culture will be illustrated. Specific cultural corpuses will be introduced. Using such genres for evangelism and Christian nurture will be urged, and the danger of neglecting such genres will be noted. The larger, complex issue of cultures as part of God's creation also will be discussed briefly, in the context of a theology of culture.

FOUR EXAMPLES OF OVERSEAS TEACHING

Joseph L. Spradley
Professor of Physics
Wheaton College
Wheaton, IL 60187

One avenue of service for Christian teachers of science is in the many schools overseas with limited resources. Personal experience of this kind has resulted from four such opportunities over nearly 35 years of teaching. These have included a considerable variety of institutions, affiliations and situations. All have required a high degree of flexibility, but have also been highly rewarding. They were made possible by both personal and sabbatical leaves from Wheaton College, and by an adaptable and adventurous wife. A brief description of these overseas assignments will demonstrate the wide range of opportunities available in both secular and Christian schools in Africa and the Middle East.

The first position was at Haigazian College (Beirut, Lebanon, 1965-68), sponsored by the Armenian Evangelical Churches of the Middle East, with both Christian and Muslim students. The second was under USAID auspices at Ahmadu Bello University (Zaria, Nigeria, 1970-72), a state university established for Muslim students, but with a strong Christian minority. The third was for one term at Daystar University College (Nairobi, Kenya, 1988) in a program sponsored by Messiah College with mostly Christian students. The fourth was a sabbatical year at the American University in Cairo (Egypt, 1991-92), where most students were either Muslims or Coptic Christians. The problems and possibilities for Christian service in each of these diverse settings will be described.

UNIVERSITY TEACHING AND RESEARCH IN OMAN:
CASE STUDY OF A LONG-TERM OPPORTUNITY FOR COOPERATION

Stanley E. Anderson
Professor of Chemistry
Department of Chemistry
Westmont College
Santa Barbara, CA 93109

The author spent the 1990-92 academic years at Sultan Qaboos University in the Sultanate of Oman, a Kansas-size country with a modest income from oil, which lies at the entrance of the Persian Gulf. The university has been in existence for less than ten years, and has made a good start in setting up a respectable undergraduate program. I served as the head of the chemistry department during the period of my stay. In this paper I will describe the details of several major projects. The first involved providing leadership to develop a flexible chemistry curriculum preparing graduates for broad employment in the Sultanate in education, industry, and government. The second attempted to develop the research infrastructure of the department of chemistry and to formulate cooperative research programs between the department and government agencies as well as with industry which would have national relevance. These efforts provide interesting examples of cross-cultural communication and relationship that require a lot of sensitivity to local politics and protocol. I will also describe a program worked out at Westmont College to host an Omani undergraduate student for a summer research experience.

The author returned to Oman this past spring to discuss and finalize this student exchange program as well as to do some research. I will describe an environmental project to monitor various atmospheric gases which can serve as a basis for future interdepartmental cooperation. Two ASA members who are currently on the faculty at Sultan Qaboos University provide important on-going contact which gives the potential for long-term involvement.

QUESTIONS CONCERNING THE ENVIRONMENTAL MOVEMENT

Deryl F. Johnson, Ph.D.
Professor of Biblical Studies
Warner Southern College
Lake Wales, FL

In the public media we are being bombarded with scare stories about the way in which man with his industry and technology is doing irrecoverable damage to this planet on which we live. There are stories about the dangers of the depletion of the ozone layer, global warming, the population explosion, acid rain, pesticides, herbicides more specifically, Alar used on apples, asbestos, DDT, PCBs, CFCs, halon, and many others.

Since these threats are repeated again and again from many sources as though they are truths accepted by the scientific community, the typical Christian as well as the average person believes them and are willing to accept the experts proposed solutions. Pressure is often brought upon the Congress or some agency of the government to do something about the problem. This often results in legislation or regulations to resolve the issue. The solutions are more often based on politics than on science. When one begins to examine these solutions in detail and realizes their likely consequences i increased cost of living, reducion of food and energy supplies, it raises the question, "Is all this necessary?"

When the scientific bases of these "threats to the environment" are carefully examined to see what is the scientific research on which the threat is based and the areas of expertise of the scientists who advocate the reality of the threat and those who doubt its reality, one begins to realize that there is plenty of room to question the reality of many of the alleged dangers. This raises a question about the motivations of the various environmental groups who are publicizing these cries and bringing on the government to accept and enforce their solutions. Along with this one needs to realize that newspaper reporters eager for a story that will get on the front page are more willing to listen to a scientist with a scare story than one with reassuring news.

The Christian needs to be made aware of the shaky scientific foundations of these 'scares' and also that many of the proposed solutions are contrary to Christian ethical standards.

**WONDERFUL LIFE
BURGESS SHALE AND THE HISTORY OF BIOLOGY**

Dr. Harry Cook
The King's College
Edmonton, Alberta
Canada

Stephen J. Gould, prominent evolutionary thinker and theoretician of biology, in a recent book, Wonderful Life: The Burgess Shale and the Nature of History, described the discovery and classification of these important fossils from the Canadian Rockies. Subsequent re-classification by three paleontologists led Gould to reexamine the assumption of progress that underlies most phylogenetic theories. Evolution, Gould suggests, is not a linear progression toward present species, with the most successful at the top of a cone of increasing diversity, or toward a human apex. Rather, the history of life can be characterized as a tree or a bush because not all branches reach the present: some animal types have become extinct due to exigent conditions. This presentation suggests that the history of biology resembles phylogenetic development postulated by Gould. Although not all biological theories persist to the present, the history of biology is nevertheless often presented as a linear progress toward present views and theories. Like an investigation of extinct animal types, however, an understanding of abandoned scientific theories can enlarge and enrich our contemporary view of science.

**DOES THE SPACE AND ENVIRONMENTAL RESEARCH
HELP US TO FEEL GOD'S PRESENCE IN THE WORLD?**

Dr. Sergei A. Grib
Academy of Sciences
Central Astronomical Observatory
Pulkovo, 196149, St. Petersburg, Russia

Discussed in the report is the effect of the totalitarian materialistic ideology on the development of space and atmospheric physics. Some so-called frontier problems are making a challenge to the limited strict ideology. The weakness of the Academic Commission on the UFO (called UAP) problem, which was working for more than 10 years, is demonstrated. The danger of the active space experiments with the particle injection and the ionospheric modification by high power radio waves is also discussed. The ecological, environmental and electromagnetic perturbations are usually unpredicted and uncontrolled.

Life on earth is protected by several gradient plasma boundaries: plasmopause, magnetopause, terrestrial bow shock wave front and the heliopause. There is a special kind of the equilibrium between cosmic rays, magnetic and plasma perturbations (anthropic principle of outer space). At the same time the man, when he thinks of himself as a master of nature, become a slave in his artificial polluted world.

The presence of God in the Universe might be traced internally (by personal experience) and externally (with the help of science) The cosmological anthropic principle and the anthropic principle of outer space may help in a special way for the scholar to find the way to the Ultimate Reality.

THE ECOLOGY AND SCIENTIFIC ESCHATOLOGY:
THE LIMITATIONS AND WEAKNESS OF ECOLOGICAL SCIENCES
AND CHRISTIAN SOURCES OF HUMAN OPTIMISM

Vladimir I. Kurashov
Prof. Dr.
Department of Philosophy
Kazan University of Technology
Kazan, Russia

The environmental global problem are multidisciplinary are of all sciences: natural sciences (biology, chemistry, physics, geology), mathematics, logic, methodology and philosophy of science. Philosophy in general, sociology etc. In present time we have many kinds of approaches to investigation, explanation and understanding of the ecosystems in relation with the stress of human activity. In this connection we can say about "scientific eschatology", but for prediction of the future of the world we have some insurmountable barriers, because:

1. All fields of human knowledge are essentially incomplete. So, all logic systems are based on the same postulates (logic is an axiom system), but any postulates are result of free human choice and neither provable nor falsifiable. In this connection all of logic systems consists in trying to avoid these limitations or difficulties. The same can be applied to mathematics. In the history of mathematics we have found many attempts in order to work out the foundation of mathematics, but this problem has been solved neither for general mathematics, nor for its integral parts. Further, in areas of natural sciences there are many kinds of limitation for receiving a complete knowledge of nature: finity of space-time systems available for human experiences, essentially weakness of inductive arguments (all of them are based only on a finite amount of scientific experiments). Moreover we can find in each area of science many unprovable hypotheses, ideas, postulates, beliefs, myths, etc. Further, from the point of view the principle of counter reduction discovered and presented by the author (the principle of counter reduction is based on the statement that any object of investigation there are several higher properties which can be ascertained only by investigation of the object in question as an element of a higher organized system; see: Proceedings of the 3rd Int. Congr. on Cosmic Space and Philosophy, Greece, 1991, 4th European. Conference on Science and Theology "Origin, Time and Complexity:", Italy, 1992, and 4th Int. Confer. Cosmos and Philosophy, Bulgaria, 1992) Man cannot investigate the universe, nature in general, but only its integral parts. Finally in the author's opinion from a linguistic point of view one can emphasize that any fields of human knowledge are presented in many respects by the application of words and sentences of every day language, which are impossible to define scientifically.

2. The ecosystem is ultimately a very complicated, multi elements system and all scientific artificial models of the ecosystems will be far from accordance in natural ecosystems (with theirs inorganic and organic complexity.)

In short, from scientific point of view we have not a satisfactory foundation for the prediction of future environmental changes. Christian

faith, beliefs in God's providence, and use for protection of the environment human knowledge originated from difference sources are real ways to optimistic perspective on the environment.

WHAT WOULD A SCIENTIFIC THEORY OF DESIGN LOOK LIKE?

William A. Dembski
Dept. of Philosophy
Northwestern University
Evanston, IL 60208

In Chance and Necessity Jacques Monod writes that "the cornerstone of the scientific method is the postulate that nature is objective. In other words, the systematic denial that 'true' knowledge can be got at by interpreting phenomena in terms of final causes -- that is to say, of 'purposes'." Monod might just as well have added 'design'. Indeed, it is the received view that a scientific theory of design is an oxymoron. Design we are told is dead, fatally wounded by the criticisms of David Hume, and then killed outright by the theories of Charles Darwin.

Against this monolith of secular opinion I intend to argue that design is alive and well. In particular, I shall sketch in broad strokes what we can expect a full-blown scientific theory of design to look like. The pieces for such a theory are now in place. Recent work in the foundations of probability theory indicates that we have reliable mechanisms for eliminating chance as an explanation of certain phenomena. Once chance is eliminated as an explanation, the sciences of information, complexity, computation, cybernetics, and cryptography in turn allow for reliable attributions of design. With such a theoretical apparatus in place, the data of living systems can then be fed into it. The conclusion to be drawn is that natural selection is wholly inadequate to account for the full diversity of living systems and that a designer who designs and assembles living systems serves as a better scientific explanation.

Such a scientific theory of design will have the following crucial advantages over past design arguments: (1) it will be immune to god-of-the-gaps objections; in particular, it will include an in-principle argument against the possibility of as-yet "unknown" scientific laws accounting for design. (2) it will include a theory of detection wherewith it will be possible to detect design even if we don't know the nature or purposes of the designer; in this way design can be decoupled from theological commitments; (3) it will lay bare the metaphysical assumptions of those who try to make chance in to a creative force; (4) it will engender an active research program in biology and the other special sciences, providing a framework within which to pose and answer questions about designed systems.

**THE SCIENTIFIC STATUS OF DESIGN INFERENCES:
MUST ORIGINS THEORIES REMAIN STRICTLY NATURALISTIC?**

Stephen Meyer
Whitworth College
Department of Philosophy

In recent years several articles and books have suggested, based principally upon developments in origin-of-life studies and molecular biology, that a compelling argument for design may be reformulated as a scientific theory. This paper will defend this possibility using considerations from the philosophy of science. It will argue that metaphysically neutral characterizations of scientific practice do not presently exist that define science narrowly enough to disqualify theories of design without also disqualifying evolutionary origins theories. This scientific status of intelligent design (hereafter: design) and evolutionary descent with modification (hereafter: descent) will be compared from the standpoint of several philosophical definitions of science. It will be argued that several commonly invoked definitions utterly fail to provide sufficient grounds for distinguishing the scientific status of these two competing programs of origins research.

This paper will further suggest an important reason for the inadequacy of these so-called demarcationist strategies as applied to competing theories of biological origins. It will show the demarcationist failures stem in several instances from attempts to impose normative epistemological criteria which wholly ignore the historical character of origins theories. The paper will suggest that when such distinctions are kept clearly in mind many common objections to the possibility of a scientific theory design -- (e.g., "design or creationist theories are not scientific because they; (a) invoke unobservables, (b) are not falsifiable, (c) are not testable, (d) do not make predictions, (e) do not explain by reference to natural law, (f) provide no mechanisms' etc) -- either dissolve or must be recast in such a way as to make these objections equally telling against evolutionary argument.

WHAT RESEARCH QUESTIONS MIGHT
A SCIENTIFIC THEORY OF DESIGN SUGGEST?

Paul A. Nelson
Department of Philosophy
University of Chicago
Chicago, IL 60637

Critics of the theory of design have often argued that, among its other shortcomings, the theory leaves scientists with nothing to do -- save, perhaps, writing inspirational tracts on, for instance, how remarkable it is that our legs are just long enough to reach the ground.

In my talk I address the sober and well-intentioned variant of this objection. It holds that any theory of design puts all the really interesting questions behind the opaque screen of the Creator's sovereign will: things are the way they are because God wanted them that way. On this view, the theory of design seems to make the world a static and inscrutable place, replete with unconnected phenomena, in which all scientific research runs straightaway into the brute fact of divine agency.

Does the theory of design actually generate this sort of unhappy picture? Decidedly not, I shall argue. Taking certain biological sciences as examples, I shall illustrate how the theory of design might resolve some longstanding research questions -- in evolutionary theory, or the origin of life -- by proving that they are ill-formed, while at the same time recasting other genuine questions in soluble terms.

**MOLECULAR MACHINES: EXPERIMENTAL
SUPPORT FOR THE DESIGN INFERENCE**

Michael J. Behe
Department of Chemistry
Lehigh University
Bethlehem, PA 18015

It has become clear over the past several decades that virtually all biochemical systems are complex arrangements of independent parts that only attain function when integrated into a coherent whole. Since the components of biochemical systems are irreducible (i.e. they are now composite entities; they are single molecules) biochemical systems must necessarily originate in complex form. Therefore, they must have been designed. A discussion of the blood coagulation system will illustrate these points.

Strong support for the design inference also comes from studies of proteins, which are the principal components of biochemical systems. Proteins are the molecular machines that generate energy, synthesize complex molecules, and serve as structural components of living tissue. Recent experiments have demonstrated that functional proteins are exceedingly rare. Consequently, there is at present no reason to suppose that the functional proteins contained in a typical cell were found by a nondirected search.

Quantitation and Removal of Toxic Substances in Velvet Beans
Susan Rhoads, Marc Skaddan, and Rolf Myhrman
Judson College
1151 North State Street
Elgin, IL 60123

The velvet bean (*Mucuna pruriens* and related varieties) grows prolifically in many regions of the world. It is a good source of protein, but contains significant amounts of L-DOPA, which is used in the treatment of Parkinson's disease. Ingestion of large quantities of DOPA can produce undesirable effects including psychotic episodes and uncontrolled muscle movements.

There is increasing interest in velvet beans in areas where food is scarce or expensive, or where the food supply is especially sensitive to weather conditions. In Honduras, for example, velvet bean powder is used in recipes that cover the range from tortillas to a coffee-like beverage. This suggests the need for a simple assay for DOPA, so that we can identify the least toxic strain of velvet beans, evaluate the efficacy of various detoxification methods, and measure the residual DOPA content in the various dishes that are currently being consumed.

We have developed a rapid method for the quantitative determination of DOPA in plant material by high performance liquid chromatography (HPLC). We find that the "coffee" made from roasted and powdered velvet beans typically contains 200-300 milligrams of DOPA per 8 ounce serving. This is a significant amount, and suggests that the consumption of such beverages should probably be limited.

We are currently developing a water-based detoxification procedure for velvet bean flour, with the goal of removing most of the DOPA while retaining soluble nutrients including proteins and B vitamins. We are encouraged by the observation that a large fraction of the extractable DOPA can be removed with room temperature water in only a few minutes.