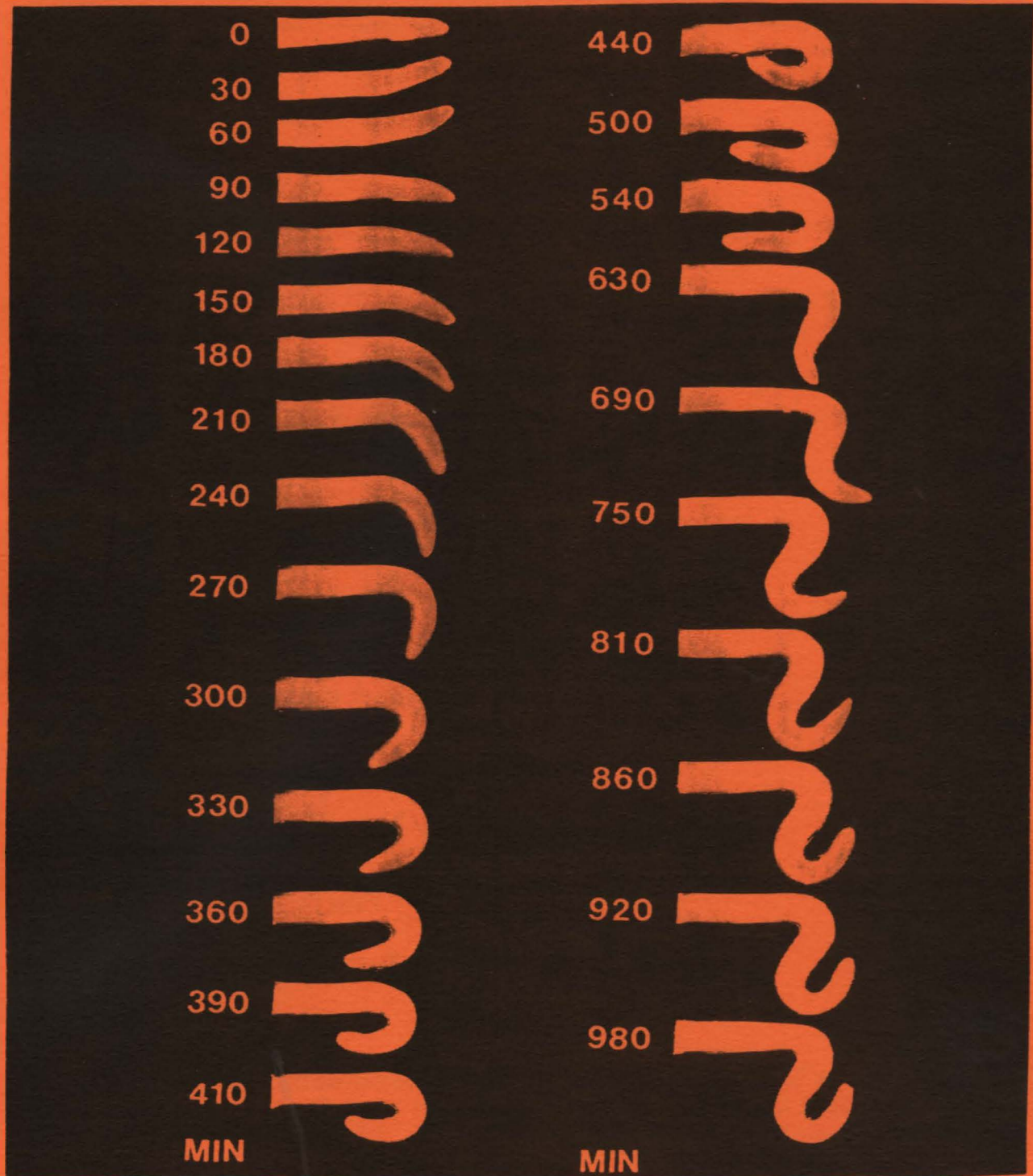


Bioscene



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Table of Contents

Articles:

- The Sierpinski Carpet as a Mathematical Model
for the Location and Sizes of
North American Grasslands** 3
Norman Woldow
- Powdertracking Small Mammals:
An Illuminating Exercise for Undergraduates** 7
Donald B. Hoagland
- Teaching Biology as Part of a Women's
Studies Program** 11
Jacqueline Scholar
- News & Views:**
- In Memoriam: Frances A. Rogers** 6
- 1993 AMCBT Conference: Tentative Agenda**
October 28-30, 1993, Millikin University 14
- A Brief Look at Millikin University** 17
- Second Call for Papers** 18
- AMCBT Membership Application Form** 19

Cover Illustration: Time-Lapse Series of the Response of Maize Roots to Gravity. The gravitropic response of maize roots pretreated with an ethylene inhibitor is shown. Initially roots exhibit a "wrong way" curvature prior to positive graviculture. Inhibiting ethylene in roots results in exaggerated, prolonged oscillatory movement during the gravirresponse. This illustrates the interaction of auxin and ethylene during a classic hormone response used in most teaching laboratories.

Photo provided by T. J. Mulkey and S. Y. Kim, Indiana State University

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The Sierpinski Carpet as a Mathematical Model for the Location and Sizes of North American Grasslands

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Introduction

Fractal geometry provides a useful perspective on the levels of organization concept in biology: molecules, cells, organisms, populations, ecosystems, and biospheres each have their own characteristic structures and functions (Fiebleman, 1954). Fractal geometry aims at understanding genuinely complicated shapes without the artificial simplifying assumptions of earlier mathematics systems. For an introduction to fractal geometry, see Mandelbrot (1983) and for an introduction to the use of fractal geometry in biology, see Obermark and Kelley (1988).

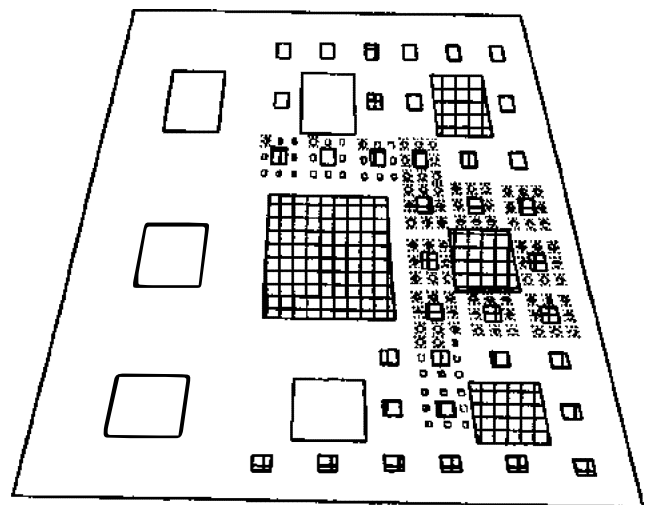
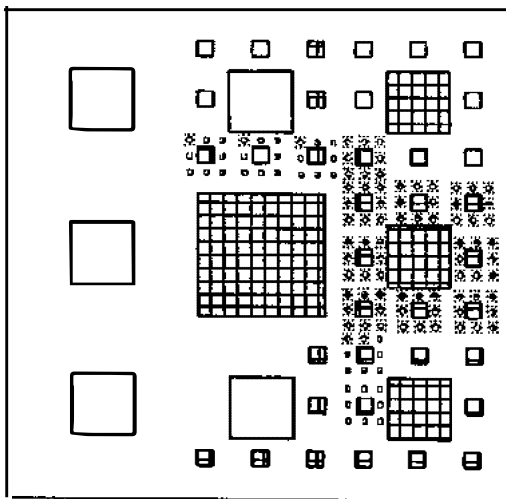
Self-similarity and self-affinity

A fractal set has the same shape or pattern at all scales: its big parts are made up of

little parts that are all similar to each other and to the bigger parts. In some structures like coastlines, the feature of self-similarity extends over a large range of size. On the other hand, an automobile is not self-similar with its parts (e.g., tires and carburetor). In the biota, we find much self-similarity, but it is confined to narrow size ranges (Peitgen and Richter, 1986).

Iterative Process of Formation

Fractal sets are formed from simple sets called initiators by a series of repeated operations. The iterative process can be simple or arduous to the point of requiring a computer. Many different structures are formed by naturally occurring iterations (e.g., fern fronds; Obermark and Kelley, 1988).



Figures 1 and 2. A sample diagram illustrating a Sierpinski Carpet and a distorted Sierpinski Carpet.

Fractal Dimension

Each fractal set has a fractal dimension between the topological dimensions for points (0), lines (1), plane surfaces (2), and volumes (3). Different living structures have different fractal dimensions expressing real differences between them (Mandelbrot 1983).

Sierpinski Carpet

I propose one example from fractal geometry, the Sierpinski Carpet (Fig. 1), as a mathematical model for the location and sizes of North American grasslands. This work was not done as a definitive analysis of North American grasslands, but rather as an aid to understanding the geography of grasslands as a useful example of fractal modeling for a specific geographic system.

Methods

I drew Sierpinski diagrams onto map projections and published vegetation maps of North America so that they were of the same scale and centered on the same coordinates. Using simple rotation and angular distortion, I then modified the Sierpinski model to make it more descriptive (Fig. 2). To give a better approximation of shape and establish connections between some of the model grasslands I drew a more elaborate fractal model using a percolation lattice [see Gefen, Aharony and Alexander (1983) for more information on percolation models] with the Sierpinski carpet (Fig. 3).

Results and Discussion

The Sierpinski carpet models the location and size of many grasslands in North America without complex variables (e.g., climate, anthropomorphic activity, fires) that

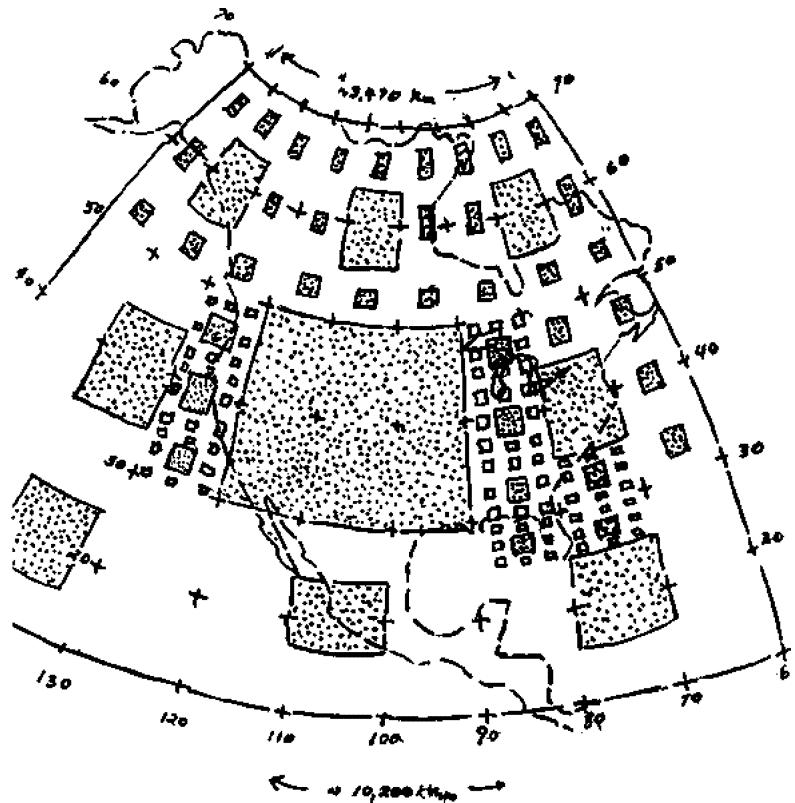


Figure 3. A Sierpinski Carpet superimposed on a map of North America.

govern their distribution. The model corresponds well with seven aspects of the actual distribution of grasslands in North America:

- (1) The immense central grassland at the first iteration of the model.
- (2) The Everglades, a large aquatic grassland, at the second iteration of the Sierpinski carpet model.
- (3) The large Illinois grassland at the third iteration.
- (4) Smaller prairies in the southeastern United States including those in Alabama, Georgia and Florida such as the Okefenokee Swamp [Hastings Biosystems article] and the Kissimee Prairie (mostly aquatic grasslands) are present.
- (5) Many tiny grasslands of from one to a few hundred square kilometers throughout North America are well represented by the higher iterations of the Sierpinski carpet model.
- (6) A large grassland near the Central Valley of California is present.
- (7) Large grasslands in the tundra regions of

Alaska and Northern Canada, where grasses are major components of the vegetation along with mosses, lichens and small forbs are indicated.

Sierpinski Model

The model deviates from the actual distribution in three respects. Each suggests where the model needs to be refined and extended.

- (1) The central grassland of the model extends too far west, and it is oriented incorrectly. If desired, this could be corrected with another rotation and distortion of the Sierpinski carpet.
- (2) The Sierpinski carpet permits no connections between any of the grasslands. This shortcoming of a simple model suggests that a percolation lattice should be established in and around the squares. The connections in the lattice would allow the model grassland to percolate out of the Sierpinski squares and would allow the surrounding model vegetation to percolate into the squares. By varying the scale and connectedness of the percolation cells, the combined model should be more realistic. The large river systems in the center of North America are modeled appropriately as highly connected percolation backbones. In addition to establishing the pattern of connections between some of the grasslands, the percolation model breaks up the regular square shapes of the Sierpinski carpet model, making it more realistic.
- (3) The Sierpinski carpet model places a large grassland in the Northeastern United States and Southeastern Canada where forest has predominated until recently. This area could be modelled as a separate Sierpinski carpet of grassland in which a forest center developed. After many iterations of the Sierpinski carpet model, this region would be modelled almost entirely by forest, with only a narrow network of grasslands. This interpretation is similar to the conditions reported by early European settlers in the region.

In recent history the northeastern United States and Southeastern Canada have developed large grasslands including grain grasses, improved pasture and hayfields, urban suburban and industrial lawns. Coastal grasslands, marshes, dune grasslands and alpine meadows continue to occur throughout this region.

Interpretation

The Sierpinski carpet model is more than a simple coincidence model because its iterations roughly parallel the processes by which vegetation develops over space and time.

Grasslands can develop in areas now supporting other vegetation, and other vegetation, like forests, can develop in areas that were recently grasslands. There also are many areas where grasses and other vegetation are interspersed. This is consistent with critical systems or systems oscillating between attractor conditions. This aspect of the real distribution is well represented by the Sierpinski carpet, where parts of the diagram experience both conditions at different iterations.

Separate historical events are important influences on vegetation. The different vegetation of two closely similar tracts can often be explained only as the outcome of a unique series of events. This is particularly true of recent North America where species and associations have advanced and retreated across the continent as the conditions of life have changed.

The fractal geometry model corresponds well with the series of temporal events that have formed the distribution of grasslands. Thus, the Sierpinski carpet model provides an abstraction for the general way in which the distribution of North American grasslands was formed as well as the present distribution itself.

Conclusion

The Sierpinski carpet provides a realistic model for the location and sizes of grasslands in North America because the iterative math-

emational process by which the fractal structure is formed parallels the historical processes underlying the development of grasslands. The model provides an additional mathematical tool for studying the geography of grasslands and a working fractal model of a real geographic system. If you wish to see

further applications of fractal geometry to spatial analysis of grasslands see Milne (1992) and other ecosystems see Burrough (1981), DeCola (1989), Lam (1990), Milne (1988), Palmer (1988 and 1992), and Wiens and Milne (1989).

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In Memoriam:

Dr. Frances A. Rogers
Professor of Biology
Drake University

died of cancer on November 12, 1992. She was 69. Frances received her bachelor's degree from Drake University in 1944 and went on to earn a master's degree from the University of Chicago and a doctorate from the University of Iowa. After earning her doctorate she taught for short times at Earlham College and Cornell College. She returned to Drake in 1956 as a part-time instructor and was appointed to a full-time position in 1969. Originally trained in parasitology, she became a specialist in comparative vertebrate anatomy and taught her final classes during the Spring, 1992, semester and had planned to retire at the end of the 1992-93 academic year.

Dr. Rogers was noted for her excellent teach-

ing and personal interest in students. She devoted extra time to advising students about their careers and followed their progress beyond graduation. Colleagues and students described Frances as a dedicated professor who truly cared for her students. AMCBT members will remember her presentations on the use of videotapes to demonstrate basic concepts and abnormalities for comparative anatomy.

Frances had many ties to Drake. Her father, Chaires Ritchey, taught history when she was an undergraduate student and her husband, Rodney Rogers is a professor of biology and was chairman of the department for many years. Their sons, Bill and Bob, graduated from Drake University. Bob is a research analyst for the Iowa Department of Revenue and Finance. Bill teaches non-majors biology at Ball State University, Muncie, Indiana. The Frances A. Rogers Memorial Student Research Lecture has been established with the Drake Biology Department.

Powdertracking Small Mammals: An Illuminating Exercise For Undergraduates

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INTRODUCTION

Despite their secretive nature, small mammals have provided and continue to provide field and theoretical biologists numerous opportunities for research. Hundreds of papers have been published describing the natural history, behavior, and population ecology of small mammals (Nowak and Paradiso, 1983). Additionally, many theoreticians have used small mammal populations in theoretical studies of population cycling and cost-benefit analyses of mating strategies (e.g., Greenwood, 1980; Tamarin and Sheridan, 1987).

Small mammals also make good subjects for undergraduate laboratory exercises. There are greater than 180 small mammal species representing nine families and two orders inhabiting North America north of Mexico (Hall, 1981). Rodents are the most abundant species, are found in virtually all North American habitats, and are relatively easy to capture. Additionally, an abundant literature is available and nearly every state has a handbook of mammals. Handbooks (e.g., *Mammals in Kansas*) generally provide distribution maps and detailed descriptions of each species and often include photographs. A non-mammalogist can, with little effort, learn to identify the few species likely to be captured in a potential trapping area. Additionally, I have found that students enjoy getting into the field and trapping small rodents. Most have not seen representative members of the local small mammal community and few, if any, have handled live wild animals. Rodents are relatively easy and safe to handle and are generally active at night, as are many college students.

This paper describes an easy-to-use, inexpensive field trip/laboratory exercise designed to delineate home ranges of small mammals. The objective of this exercise is to have students participate in the design of the exercise, collection of data, analysis of data, interpretation of data, and presentation of results.

HOME RANGE

Burt (1943:351) described the home range of an animal as "that area traversed by the individual in its normal activities of food gathering, mating, and caring for young." The simplicity and clarity of that definition belies the difficulty encountered in its application. For many years mammalogists delineated home ranges through analysis of trapping records obtained from geometric grids; the capture coordinates being subjected to various estimating methods (Jennrich and Turner, 1969). In addition to having several inherent sources of error, trapping yields few data concerning the manner in which animals actually use the area defined as home range (Sanderson, 1966). Attempts to provide more accurate data on both size and utilization of home range by using alternative techniques such as radioisotope tagging (see Ambrose, 1960; Godfrey, 1953), paper tracking (Sheppe, 1965; Justice, 1961), and sand tracking (e.g., Siniff and Tester, 1965) have met with varying degrees of success. Cochran and Lord (1963) introduced the technique of radiotelemetry as a more precise method of estimating home range and activity periods. Unfortunately, radiotelemetry is an expensive technique and requires a level of expertise beyond what can be reasonably expected after a few hours of practice (per-

sonal experience). Fisher and Cross (1979) used a battery-light tracking technique for studying movements of nocturnal small mammals and reported precise home range maps and activity periods. Although relatively inexpensive, this technique is limited by the extent of ground cover. Mammals can be observed in open areas but disappear in forested, shrub, or grassland habitats.

Recently, an inexpensive easy-to-use technique of home range determination has been reported. Powdertracking consists of dusting live-trapped small mammals with fluorescent powder by gently placing them in a plastic bag containing the powder (Lemen and Freeman, 1985). Animals covered with the pigment leave a trail that can be followed at night with a portable long-wave ultraviolet light. Powdertracking has been used in reports of social interactions among deer mice (Kaufman, 1989), horizontal and vertical movements of white-ankled mice (Mulligan and Baccus, 1990), and home ranges of prairie voles (Jike, Batzli and Getz, 1988). The technique also allows identification of manipulated objects, burrows entered, and foods consumed. Powdertracking has a minimal impact upon the activity of mice (Mikesic and Drickamer, 1992) and fluorescent trails persist for long periods of time (Halfpenny, 1992).

MATERIALS AND METHODS

The expense of this laboratory exercise depends upon the equipment available. I prefer folding traps constructed of galvanized steel because they are easy to store and transport, and are more durable than lighter weight aluminum. A 3 X 3.5 X 9" folding trap constructed of 30 ga. galvanized steel weighs 0.8 lb and costs approximately \$10.00 (H. B. Sherman Traps, Inc., P.O. Box 20267, Tallahassee, FL 32316, 904-562-5566). This size trap is suitable for small mammals ranging from 15 g to 350 g. Currently, nine colors of fluorescent pigments are available: chartreuse, deep green, orange-yellow, sunset orange, orange-red, red, cerise, pink, and magenta (Radiant Color, 2800 Radiant Ave., P.O. Box 4019, Richmond, CA 94804-0019, 800-777-2968). I have successfully used green, magenta,

pink, and orange pigments; other investigators have used different colors and combinations of colors (Kaufman, 1989; Lemen and Freeman, 1985). Each color is packaged in a one-pound container and costs \$12.00

(one pound is enough powder to dust one elephant or 100,000 mice).

An Eveready Indoor/Outdoor Commander Fluorescent Lantern (model no. 5209, Union Carbide Corporation, Danbury, CT 06817) equipped with a 6-W ultraviolet tube (General Electric, F6T5-BLB) or a Blakray fluorescent lantern (model ML-49, Ultra-Violet Products Inc., San Gabriel, CA 91778) is used to follow trails. The price of these portable lanterns varies, but I have purchased the Eveready Lantern and a 6" bulb that fits a UV bug zapper for under \$40.00. Most rodents, shrews, and moles can be captured with bait consisting of mixed grains. Peanut butter works well, but it is messy and attracts ants. Trap sites are marked with wooden garden stakes for permanent grids or surveyor's tape for temporary grids.

This exercise can be performed as part of a laboratory course if suitable areas are reasonably close, or during an overnight field trip. I have used both methods with success. The first method involves establishment of a trapping grid (I generally use a 49-trap grid with 7-m intertrap distances in a geometric design that fits the topography) and repeated trapping sessions. Traps are baited before dusk and checked 2-3 hours later. Animals are removed from traps by shaking them into cotton muslin bags that just fit over the door of the trap (one yard of muslin is sufficient to make 4 20 X 38 cm trap bags). A string tied around the top of the bag allows the animal to be weighed in the bag (alternatively, bags can be manufactured with pull strings). Inspection of the animal is achieved by rolling the excess bag, forcing the animal to one side, grasping the bag with the animals loose neck skin between your thumb and first finger, and peeling the bag from around the animal to determine sex, age, and identity. If further studies are to be conducted the animal can be marked by toe-clipping. Headlamps are preferable, but hand-held flashlights suffice to conduct these activities

in the dark. The animal is then placed into a plastic bag containing powder and allowed to move around until it is covered with the powder. Trails are followed and marked with surveyor's tape the following night. Approximately two hours are required for two individuals to follow and mark each trail. Detailed maps can be constructed when convenient.

The second method can be accomplished during an overnight field trip. Traps are set in a grid formation or along lines before dusk and checked 2-3 hours later. Animals are dusted, released, and tracked 1-2 hours after release. Detailed maps are constructed the following morning.

Both methods provide sufficient data for interpretation, however, the grid method allows for repeated tracking of the same individuals and comparison of home ranges

Home-range size of each animal, as determined by grid trapping or by powdertracking, can be estimated by the smallest possible convex polygon that encompasses all points of the home range (the convex-polygon method of Jennrich and Turner, 1969).

determined by mark-recapture methods and powdertracking.

Grid coordinates derived from repeated captures can be easily analyzed by one of the mathematical methods reported by Jennrich and Turner (1969). Home-range size determined by powdertracking is easily analyzed by the methods described by Jike, Batzli and Getz (1988). Their methods involve tracing home ranges onto translucent paper, cutting out the designs, weighing the paper designs, and comparing paper weights to the weight of paper representing a known area.

RESULTS AND DISCUSSION

This exercise begins with discussions of the concept of home range and how it can be measured. Once a definition of home range is accepted, students invariably suggest

observation as appropriate experimental method. After realization that most small mammals are nocturnal and secretive, trapping becomes the logical method of choice. At this point I provide a few papers from the literature cited section of this paper. During the next class meeting we discuss specific designs for grids or trap-lines, trapping and powdertracking schedules (trapping schedules may bias results because some animals become trap-shy and others become trap-happy), and methods of analyses. This procedure insures that students have first-hand involvement with the design of a scientific study and ownership of the investigation.

Conducting the experiment appears to generate the most enthusiasm. Many students willingly participate in trapping during unscheduled laboratory times, either at regular intervals or on overnight field trips. Additionally, most students are partly nocturnal and powdertracking small mammals on field trips provides them with structured activity after dark.

Data analysis, report preparation, and presentation of results can be an individual or a group effort. I prefer small groups of 3-4 students who divide up the tasks of data analysis, literature research, and final preparation. This is the manner in which most research scientists function and students should be encouraged to do the same. The obvious problems with this approach are that some students may contribute very little and some students may not understand certain aspects of the process.

CONCLUSIONS

Powdertracking small mammals is an illuminating experience for undergraduate students. They learn the difficulties of conducting field investigations that support such simple ideas as home range. They design and conduct field research in an effort to define the actual home range of a small mammal. Both students and faculty get an opportunity to get into the field. And finally, powdertracking represents a worthwhile after dark activity for overnight field trips.

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Teaching Biology as Part of A Women's Studies Program

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About four years ago I was asked by a group of faculty in other areas to help put together a minor in Women's Studies. I agreed to develop a Biology of Women course - BI (WS) 340, which would complement other courses in the minor. The Women's Studies Minor consists of 18 credit hours and the following:

Required Courses:

- *Introduction to Women's Studies
- *Women's Studies Seminar
- *at least 6 credit hours from the following Women's Studies courses:
 - Philosophy of Women
 - Women in American Society
 - Biology of Women
 - Psychology of Women
 - Issues in Women's Studies
- *At least 6 credit hours from the following courses in the Arts & Sciences:
 - Human Genetics
 - Nutrition Through the Lifespan
 - Communication & the Sex Roles
 - Human Development (Psychology Dept.)
 - Human Sexuality (Psychology Dept.)
 - Marriage & Family
 - Aging in American Society
 - Social Problems
 - Ethnic Relations
 - Adult Development

The Biology of Women's course was designed to concentrate on the biology, anatomy, and the normal and abnormal physiology of women throughout her lifespan. Psychological and sociological topics are avoided as much as possible.

The course objectives are:

- to give the student an in-depth understanding of female anatomical structures and physiology.
- to focus attention on women's health care.
- to focus on the role of women in science, allied health fields and medicine.
- to expose the students to scientific language.
- to study the causes and treatments of disorders common to women.
- to discuss the special nutrient needs of women and how they can be met.
- to understand basic cell structure, basic genetics, and cell reproduction.
- to study the biological aspects of human reproduction, including fertility and infertility.

In the first class the students are presented with the fact that most women do not know much about their body, especially how it works and so they are at the mercy of health care givers and readily do what they're told when, in fact, they should take a more active role in any decisions concerning their body. They should ask questions about procedures, etc. . . and alternatives. Perhaps women don't ask questions because they don't know what questions to ask. Thus, one of the goals of this course is to educate women (and men) so that they can be INFORMED patients. Also, in the first class, we talk about the position of women in science, medicine and the health care fields. Are they at the top? Are they Deans? Are they department heads? Are they on state boards of health? Are they on hospital boards? We also talk about the large national health studies concerning cardiovascular

health and the fact that women were and are not included. We also talk about some of the organizations that promote or support women's health care such as the National Women's Health Organization based in Washington.

Several lectures are spent going over anatomical structures that are specific to women such as the pelvic girdle—flare of the ilium, curvature, and tilt, the pelvic inlet, overall bone structure. Also the students study the anatomy of the ovary, uterus, uterine tubes, vulva, vagina, and the mammary glands. Skeletons and models of the organs are used and students are expected to study the models. The students are required to label drawings on tests. Comparisons are also made to comparable male anatomy.

The menstrual cycle and female endocrinology are studied in depth. The action of hormones including feedback systems and receptors are included in this part of the course. Eating disorders (Anorexia Nervosa and Bulimia), Toxic Shock Syndrome, endometriosis, and PMS are also covered.

Another series of lectures are spent covering the basis of biological difference. Students learn in detail the changes that occur in boys and girls during embryonic and fetal development, during puberty and what can go wrong. At this time they also study cell structure, chromosomes, karyotypes, DNA, mutations, mitosis and meiosis.

Students also study the Male vs. Female brain in terms of reported hormonal effects, neurotransmitter and anatomical differences.

The physiology of intercourse is another topic dealt with in the class. At this point we also study sexually transmitted diseases, sexual problems in women, sexual responses in the older woman and in the physically handicapped woman. Sex during pregnancy is also discussed.

The mammary glands are studied extensively through drawings, models and lecture. Changes in breasts are studied relative to pregnancy, milk production, tumors, cancer,

etc. Breast surgery of all types including reduction, augmentation and implants are discussed. Students are taught how to do a breast self-exam and they see a NOVA video on breast cancer in which Dr. Susan Love, a breast cancer surgeon, discusses the pros and cons of radical mastectomies vs. lumpectomies. Then the students learn what a gynecological exam should include and how to do a vaginal self-exam. At this time gynecological difficulties such as vaginitis, yeast infections, bacterial infections, AIDS in women, chlamydia and cervical dysplasia, the PAP test and cervical and uterine cancer are studied.

The next series of lectures are on pregnancy, including fetal development, changes in the woman's body, complications, abortion, weight gain, nutrition, drugs and alcohol, labor and delivery, anesthesia, prepared childbirth, intervention, abuse of Caesareans and breastfeeding.

Fertility and infertility problems, including artificial insemination are explained. Contraception is covered in detail—concentrating on the pill (how it works, side effects, contraindications for its use). Norplant, the IUD, and new contraceptives on the horizon are also covered. Pelvic Inflammatory Disease is discussed at this time. Natural family planning, tubal ligation, RU-486, and abortion are included in this part of the course.

The next lectures deal with menopause—myths, facts, and symptoms. Students read a paper on "Estrogen Therapy" and write a one-page reaction to it. At this point in the course the subjects of osteoporosis, cardiovascular disease and genitourinary problems are dealt with. The students see a short video on women and cardiovascular disease from the local American Heart Society.

Another topic discussed in the course is cosmetics. To understand why cosmetics may or may not be harmful to the body, skin structure is studied in detail. Myths about various skin creams are dispelled. Other topics include: the regulation of what is in cosmetics, the treatment of skin disorders, and hair

structure. Collagen injections are also discussed and a brief video from ABC's 20/20 news show is shown.

The special nutritional needs of women are also studied. Students learn about vitamin supplements, weight gain and the value of exercise in a woman's life. Recent findings relevant to controlling PMS and other disorders through good nutrition are discussed.

The majority of students who take this three-credit course are over 25 and are upper classpersons. Approximately 40% are male. Most of the students are non-science majors such as business, accounting, and information management majors. The next largest group of majors are from psychology and sociology. Most of the students choose to take it because it has upper level credit and "sounds interesting." The male students ask a lot of questions and make interesting comments. The female students enjoy adding personal experiences to amplify subjects being discussed.

In teaching the class I use many models, pass out many drawings, and show relevant videotapes. The students read 3-4 assigned articles on controversial subjects such as estrogen therapy, male vs. female brains, and *in vitro* fertilization and write a one-page reaction to each article. They also write a five-page library research paper on a topic of their choosing or from a list of provided possible topics.

The greatest difficulty in teaching this course is keeping up with changing statistics. The number of women suffering from the various types of cancer or sexually transmitted diseases, changes yearly. For this reason the statistics in the textbook (*Biology of Women* by Ethel Sloane, 1985, John Wiley Press.) are not useful and sometimes confusing for the student. The textbook is excellent except for outdated statistics here and there. I try to keep up on current events relevant to this subject by reading the *Science Newsletter*, *Time*, *Nutrition Action Newsletter*, *Science*, many medical journals passed on to me by a local physician, pamphlets from various societies such as the Osteoporosis Society, American Heart Association, and American

This course has been extremely enjoyable and satisfying to teach. The students learn a tremendous amount of material about the female body—much of it very practical information. Because of its upper credit status it draws non-science students back into the science area beyond what is required as part of the general core. (This course can also be used to satisfy the science core requirement.) The course also provides for good discussions and hopefully dispels many old-wives' tales.

Cancer Society. I also keep up with television specials and news programs on topics discussed in the class.

Another challenge in the course is getting the students to learn the scientific language. They dislike learning medical and anatomical terms but in the end they feel that they are the better for it.

This course is an exciting, thought-provoking, meaningful and very worthwhile contribution to the education of liberal arts students and is recommended highly as an elective in a Biology curriculum.

For additional information:

1. Dreifus, C., ed. 1977. *Seizing Our Bodies: the Politics of Women's Health*. Vintage Books, New York, New York. 321 pp.

2. Fausto-Sterling, A. 1985. *Myths of Gender: Biological Theories About Women and Men*. Basic Books, Inc., New York, New York. 258 pp.

3. Hubbard, R. 1990. *The Politics of Women's Biology*. Rutgers Univ. Press. New Brunswick, New Jersey. 229 pp.

4. Hubbard, R., Henifin, M. S. and Fried, B., eds. 1982. *Biological Woman—the Convent Myth*. Schenkman Publishing Co., Inc., Rochester, Vermont. 376 pp.

5. White, E. C. 1990. *The Black Women's Health Book*. Seal Press, Seattle, Washington. 299 pp.

News and Views

COMMUNICATIONS AND TECHNOLOGY IN BIOLOGY

AMCBT 1993 FALL MEETING TENTATIVE SCHEDULE
MILLIKIN UNIVERSITY
OCTOBER 28-30, 1993

	LOCATION
Thursday, October 28	
6:00-8:00 p.m. REGISTRATION RECEPTION	STALEY LIBRARY INDEPENDENT STUDY
8:00 p.m. OPENING SESSION	ALBERT TAYLOR HALL
Welcome for AMCBT	in SCHILLING HALL
<i>S. Jeanene Yackey, Program Chair</i>	
<i>Harold Wilkinson, Local Arrangements</i>	
WELCOME to Millikin University	
PRESIDENT:	
OPENING ADDRESS	
Title: Insects and World Food Crisis	
<i>Speaker: Tom Turpin</i>	
9:30p.m. EXECUTIVE COMMITTEE MEETING	STALEY LIBRARY 22
Friday, October 29	
7:00 a.m. REGISTRATION	
7:00-8:10 a.m. BUFFET BREAKFAST	RICHARD TREATS
(price included in registration)	UNIVERSITY CENTER
Interest Groups by Discipline	
8:10-8:55 a.m. CONCURRENT SESSION I	STALEY LIBRARY
1. TEACHING INFECTIOUS DISEASE BY THE CASE METHOD	
Cathy Hunt and Mary Ann Mc Murray,, Henderson Community College, Henderson KY	
2. DEVELOPING AND IMPLEMENTING AN INSERVICE PROGRAM IN BIOTECHNOLOGY FOR SECONDARY SCIENCE TEACHERS	
Karen Klyczek, Biology Department, University of Wisconsin, River Falls WI	
3. ORGANIZING A TROPICAL ECOLOGY COURSE	
David J. Hicks, Biology Department, Manchester College, N. Manchester IN	
4. HOW TO WIN AT SCIENCE FAIRS	
Rudolph Prins, Department of Biology W. Kentucky University Bowling Green KY	

9:05-9:50 a.m. **CONCURRENT SESSION II**

1. **AN EFFECTIVE METHOD OF TEACHING ENVIRONMENTAL PRINCIPLES TO NONMAJORS**
Ted Michaud, Department of Biology, Carroll College, Waukesha WI
2. **REGIONAL SCIENCE FAIRS**
Ray Reed, Department of Biology, Jefferson Community College, Louisville KY
3. **MOUNTAIN ECOLOGY: A NEW FIELD COURSE AT LORAS**
Tom Davis, Department of Biology, Loras College, Dubuque IA
4. **INTERACTIONS OF ACTIVATED MACROPHAGES WITH MALIGNANT TUMOR CELLS**
David Thomasson, Biological and Physical Sciences, Fontbonne College, St. Louis MO

9:50-10:40 a.m. **COFFEE EXHIBITORS** **INDEPENDENT STUDY**
INFOSHARE: POSTERS, SOFTWARE, VIDEO

10:45-11:45 a.m. **KEYNOTE ADDRESS** **ALBERT TAYLOR HALL**
Title: Biological Visualization **in SCHILLING HALL**
Speaker: Robert V. Blystone, Trinity University, San Antonio TX

12:00-1:30 p.m. **OPEN LUNCH, EXHIBITS, INFOSHARE**

1:30-5:00 p.m. **FIELD TRIPS**
1. Illinois Power Field Station
2. ADM Hydroponics and MariMann Herbs
3. Sports Medicine Clinic of Macon County
4. Rock Springs Environmental Center

1:30-4:00 p.m. **WORKSHOP SESSIONS**

1. **FAST PLANTS FOR SLOW BIOLOGISTS**
Tim Mulkey, Indiana State University, Terre Haute IN **SCOVILL**
2. **USING HUMAN TO TEACH HUMAN PHYSIOLOGY**
Pat Bowne, Alverno College, Milwaukee WI
3. **(Multimedia — computer programs)**
Claire A. Rinehart, Western Kentucky University, Bowling Green KY
4. **DIGITAL VIDEO MICROSCOPY**
Robert V. Blystone, Trinity University, San Antonio TX

6:00-7:00 p.m. **SOCIAL HOUR** **RICHARD TREATS UNIVERSITY CENTER**

A Brief Look at Millikin University--

Millikin University, founded in 1901, is a multipurpose, coeducational, independent institution affiliated with the Presbyterian Church (U.S.A.). Enrollment is approximately 1,750 students. Millikin enjoys an outstanding academic reputation and continues to reflect the balance of career orientation and liberal arts education envisioned by its founder, philanthropist James Millikin.

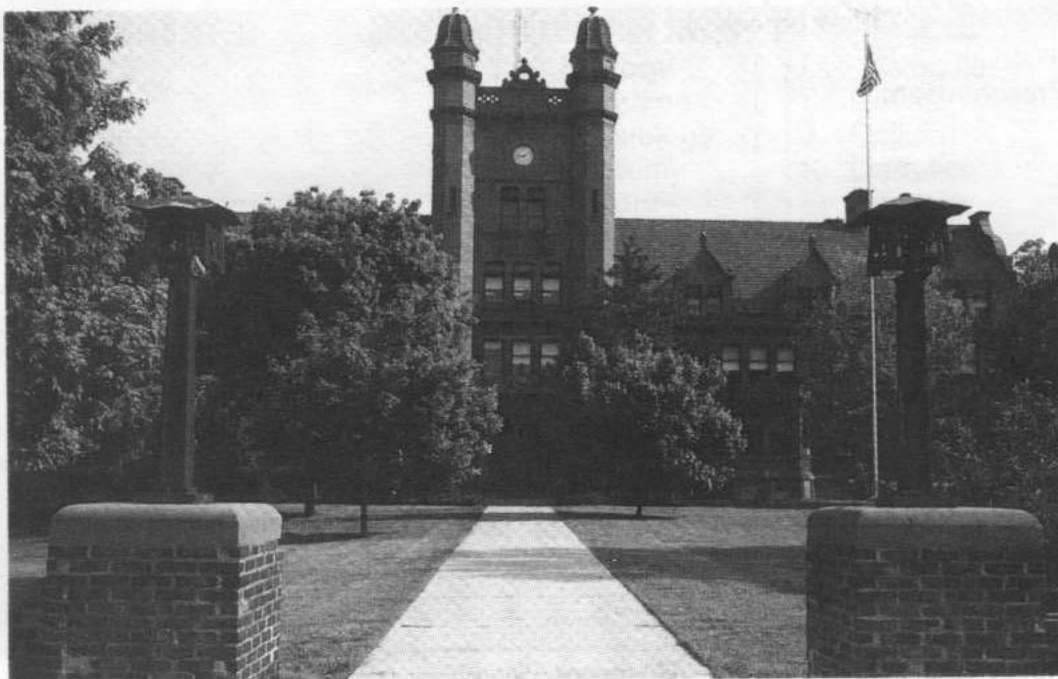
Millikin awards five undergraduate degrees. Students select a course of study from among more than 50 majors and pre-professional programs in the College of Arts and Sciences, the College of Fine Arts, the School of Nursing, and the Tabor School of Business.

The University operates on a two-semester academic calendar and provides opportunities for internships, indepen-

dent study, and off-campus projects. Courses also are offered in the evening during the regular academic year and during a seven-week summer session.

Millikin is accredited by the North Central Association of Colleges and Schools, the National Association of Schools of Music, National League of Nursing Programs, and American Chemical Society. Programs in teacher education are approved by the State of Illinois.

Millikin is located in Decatur, Illinois, a small city of approximately 100,000 residents near the center of the state. Decatur offers a wide variety of conveniences and serves as an important industrial and agribusiness center. The city is home to headquarters for several international corporations.



SECOND CALL FOR PRESENTATIONS
Association of Midwestern College Biology Teachers (AMCBT)
CONFERENCE
October 28-30, 1993
Millikin University
Decatur, Illinois

Do you have:

Labs that work?

Interesting Teaching Methods?

Tips on Teaching Nonmajors?

Useful Software?

Exciting Demonstrations?

The AMCBT 1993 Meeting will focus on
"Communications and Technology in Biology"
Papers, Posters, Software, Media and Workshops are invited.

Final deadline -April 15, 1993

Name: _____ Institution: _____

Address: _____

Work Phone: _____ FAX Number: _____

Check one Oral presentation (45 min. including discussion)
 Poster session
 Workshop (2-3 hours)
 Other (specify)

Title of Presentation:

Abstract:

Special equipment or facilities required: _____

Return to Sister Jeanene Yackey, Fontbonne Science Academy, Fontbonne College,
6800 Wydown Blvd., St. Louis, MO 63105-3098 Fax: (314) 889-1451

Application For Membership
**ASSOCIATION OF MIDWESTERN
COLLEGE BIOLOGY TEACHERS**

NAME: _____ DATE: _____

TITLE: _____

DEPARTMENT: _____

INSTITUTION: _____

STREET ADDRESS: _____

CITY: _____ STATE: _____

ZIP CODE: _____

ADDRESS PREFERRED FOR MAILING: _____

CITY: _____ STATE: _____

ZIP CODE: _____

WORK PHONE: _____ FAX NUMBER: _____

HOME PHONE: _____ E-MAIL ADDRESS: _____

MAJOR INTERESTS:

- 1. Biology
- 2. Botany
- 3. Zoology
- 4. Microbiology
- 5. Pre-professional
- 6. Teacher Education
- 7. Other _____

SUB DISCIPLINES:

- A. Ecology
- B. Evolution
- C. Physiology
- D. Anatomy
- E. History
- F. Philosophy
- G. Systematics
- H. Molecular
- I. Development
- J. Cellular
- K. Genetics
- L. Ethology
- M. Neuroscience
- N. Other _____

RESOURCE AREAS:

RESEARCH AREAS:

Have you been a member before? _____ If so, when? _____

PLEASE MAIL
MEMBERSHIP APPLICATION

FORMS TO:

**Edward S. Kos
Executive Secretary, AMCBT
AMCBT Central Office
Department of Biology
Rockhurst College
Kansas City, MO 64110**

CURRENT DUES ARE \$25.00
