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IMA UPDATE

Winter 1997

This is one of a series of quarterly notices concerning the activities
of the Institute for Mathematics and its Applications.

CONTENTS

I. NEWS AND NOTES:

- a. **1997 Summer Program for PI Graduate Students: Selected Topics in Algebraic Topology**
- b. **1998 Summer Program for PI Graduate Students: Topology of Manifolds**
- c. **PI Conference: Geometric Analysis, April 4–6, 1997**
- d. **PI Conference: Fast Algorithms for Control, Signals and Image Processing, June 6–8, 1997**
- e. **Weekly list server at the IMA**

II. IMA CALENDAR

III. Summer 1997 Program: STATISTICS IN THE HEALTH SCIENCES

Details and visitor lists for six weeks of Summer 1997 program.

IV. 1997–98 Program: EMERGING APPLICATIONS OF DYNAMICAL SYSTEMS

V. RECENT IMA VOLUMES

I. NEWS AND NOTES

a. **1997 SUMMER PROGRAM FOR PI GRADUATE STUDENTS: SELECTED TOPICS IN ALGEBRAIC TOPOLOGY**

PARTICIPATING INSTITUTIONS: Centre National de la Recherche Scientifique, Consiglio Nazionale delle Ricerche, Georgia Institute of Technology, Indiana University, Iowa State University, Kent State University, Michigan State University, Northern Illinois University, Ohio State University, Pennsylvania State University, Purdue University, Seoul National University (RIM - GARC), Texas A&M University, University of Chicago, University of Cincinnati, University of Houston, University of Illinois (Chicago), University of Illinois (Urbana), University of Iowa, University of Kentucky, University of Manitoba, University of Maryland, University of Michigan, University of Minnesota, University of Notre Dame, University of Pittsburgh, University of Southern California, University of Wisconsin, Wayne State University.

PARTICIPATING CORPORATIONS: Bellcore, Eastman Kodak, EPRI, Ford, Fujitsu, General Motors, Honeywell, IBM, Motorola, LORAL, Siemens, 3M.

Each year this program brings together, for four intense weeks in the summer, a select group of 30–40 mathematics graduate students from the IMA Participating Institutions, in general at most two from each PI. Students are nominated by their department heads and must commit to participation for the full four weeks. Each PI may also submit a ranked list of additional students for the program, who may be chosen if places are still available. Further qualified students may participate at their own expense. The students live in a dormitory on one of the PI campuses; the location of the campus changes from year to year. During the four weeks, there are a series of (related) lectures given by four senior mathematicians. Lectures will be held in the morning, with working groups meeting most afternoons, under the guidance of the lecturers and advanced graduate students. Funding for the lecturers and most of the student living expenses are assumed by the IMA. The goals of this program are:

- To expose graduate students to a selected set of exciting topics.
- To create interaction among students from different institutions.

The program is addressed to good students who have completed a full year of genuine graduate courses, and who have indicated a preference for the general area of the summer program, but who probably have not yet narrowed down to a specific research topic.

The Summer 1997 topic will be **Selected Topics in Algebraic Topology**, and will be held July 21–August 15, 1997 at **the University of Chicago**. Prof. Peter May will be in charge. The schedule of lecturers and topics is:

Week	Lecturer & Topic	Affiliation
July 21–25	Mike Hopkins Elliptic curves and stable homotopy	MIT
July 28–August 1	Bill Dwyer The algebraic topology of compact Lie groups	University of Notre Dame
August 4–8	James McClure Maps between classifying spaces (Possibly Dyer-Lashof operations)	Purdue University
August 11-15	Peter May Topics in stable and equivariant homotopy theory (possibly also operads and their applications)	University of Chicago

Names of students suggested as participants should be submitted to the IMA (staff@ima.umn.edu) by **March 1**.

b. 1998 SUMMER PROGRAM FOR PI GRADUATE STUDENTS: TOPOLOGY OF MANIFOLDS

The Summer 1998 topic will be **Topology of Manifolds**, and will be held at the University of Iowa. Exact dates and minicourse topics are to be announced.

c. Participating Institution Conference: GEOMETRIC ANALYSIS, APRIL 4–6, 1997

The **Workshop in Geometric Analysis** will be held April 4–6, 1997 at Texas A&M University. The Workshop will continue all day Friday (April 4) and Saturday through mid-day Sunday (April 6). The Workshop will focus on recent developments in Geometric Analysis. The following persons have agreed to speak: Alice Chang (University of California, Los Angeles), Toby Colding (New York University), Yakov Eliashberg (Stanford University), Mikhael Gromov (IHES/Univ. of Maryland, College Park) (tentative), Richard Hamilton (University of California, San Diego), Tom Ilmanen (Northwestern University), Richard Schoen (Stanford University), Leon Simon (Stanford University), Michael Struwe (ETH, Zürich), Vladimir Šverák (University of Minnesota), Clifford Taubes (Harvard University) and Jean Taylor (Rutgers University).

The Workshop is supported by the National Science Foundation, the Institute for Mathematics and Its Applications, and Texas A&M University. Persons who wish to participate in the Workshop should contact the Workshop directly at the address below. Graduate students and junior faculty are especially encouraged to participate.

The organizers expect to be able to offer limited support to some participants. Persons wishing to apply for financial support should consult the Workshop URL (see below) or write directly to the Workshop for application instructions. To be considered, applications for financial support must be received by the Workshop not later than February 28, 1997; early application is encouraged.

All correspondence should be sent to the following address:

Workshop in Geometric Analysis
Mathematics Department
Texas A&M University
College Station, Texas 77843-3368
Email address: wga@math.tamu.edu

Current information about the Workshop is always available on the World-Wide Web at the URL address: <http://www.math.tamu.edu/wga>.

The IMA is also supporting the Workshop as follows. Mathematicians from the Participating Institutions of the IMA are eligible to receive IMA/PI funding, where available, to come to the Workshop. Application to use IMA/PI funds for the workshop should be made directly to Participating Institution department chairs.

d. Participating Institution Conference: FAST ALGORITHMS FOR CONTROL, SIGNALS AND IMAGE PROCESSING, JUNE 6–8, 1997

The objective of the three-day Symposium is to bring together people from the areas of Control Theory, Signal and Image Processing and Computational Linear Algebra to discuss recent advances, trends and future directions for research on fast algorithms. This will offer a unique opportunity for interaction among these groups and will provide a forum of interdisciplinary communication that should encourage researchers to develop a new sense of participation and a new perception of these areas as closely related scientific disciplines.

The Symposium will feature a special emphasis on modern methods in scientific computing and linear algebra relevant to digital control, signal and image processing. For such applications it is important to consider ingredients such as (1) sophisticated mathematical models of the problems, including *a priori* knowledge, (2) rigorous mathematical theories to understand the difficulties of solving problems which are often ill-posed, and (3) fast algorithms for either real-time or data-massive computations. Aspects of each of these three ingredients will be discussed by speakers in the Symposium by way of short courses, invited and contributed lectures, and invited and contributed mini-symposia on relevant topics.

Sponsors of the Symposium are the IMA, the Fields Institute, the Centre de Recherches Mathématiques and the Manitoba HVDC Research Center.

On June 6 a set of tutorial short courses will be given. Speakers will be Stephen Boyd (Stanford), Raymond Chan (Chinese University of Hong Kong), Tom Kailath (Stanford) and Byron Welsh (Air Force Institute of Technology).

Invited speakers will include Eleanor Chu (Guelph), Martin Hanke (Germany), Simon Haykin (McMaster), Linda Kaufman (Bell Labs), Christopher Paige (McGill), Haesun Park (Minnesota), Ali Sayed (UCSB) and G. W. Stewart (Maryland).

The Summer Meeting of the Canadian Mathematics Society (CMS) is being held in Winnipeg June 7–9, 1997 and hence overlaps with the ILAS Workshop on June 7 and 8. A CMS Session on Linear Algebra organized by ILAS/IIMS will be held on June 9, 1997 which is open to Symposium attendees.

Contributed papers which deal with the themes of the meetings are solicited. Please send author, title and abstract before March 31, 1997.

All enquiries regarding the meeting, including those on contributed papers, should be addressed to: P. N. Shivakumar, Director. Registration forms should be sent to: Mrs. S. Henderson, Conference Coordinator. Address for both is as follows:

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420 Machray Hall
University of Manitoba
Winnipeg, Manitoba R3T 2N2
Canada

Tel: (204) 474 6724 Fax: (204) 275 0019
E-Mail: insmath@cc.umanitoba.ca
URL: <http://www.iims.umanitoba.ca>

The IMA is also supporting the Workshop as follows. Mathematicians from the Participating Institutions of the IMA are eligible to receive IMA/PI funding, where available, to come to the Workshop. Application to use IMA/PI funds for the workshop should be made directly to Participating Institution department chairs.

e. WEEKLY IMA SEMINAR LIST AVAILABLE BY LIST SERVER

The IMA is happy to offer its e-mail mailing list service. The mailing list “weekly” is a distribution each Thursday of the next week’s schedule of IMA seminars and events. If you wish to subscribe, simply send an e-mail message to imalists@ima.umn.edu whose first line is of the form

subscribe weekly

If your preferred e-mail address is different from the one from which you are sending the request, the first line should be

subscribe weekly you@e.mail.address

The subject line and the rest of the message are ignored. Questions or problems should be sent to owner-weekly@ima.umn.edu.

The current week’s updated seminar list may also be obtained via **finger seminar@ima.umn.edu**.

II. IMA CALENDAR

1. MATHEMATICS IN

HIGH-PERFORMANCE COMPUTING, September 1996–June 1997

Fall 1996: The Mathematics of Computing

September 9–11: Short Course on The Message Passing Interface Standard

September 11–13: Short Course on High-Performance Fortran

September 16–20: Workshop on Algorithms for Parallel Processing

October 21–25: Workshop on **Evolutionary Algorithms**

November 11–15: Workshop on **The Mathematics of Information Coding, Extraction & Distribution**

November 18–20: Workshop on **Data Mining and Industrial Applications**

December 2–6: Workshop on **3D Scanning: from Physical Objects to Computer Models**

Winter 1997: **Molecular Modeling & HPC**

January 20–23: Workshop on **Molecular Structure: Dynamics, Geometry and Topology**

March 12–13: Special Workshop on **Structured Adaptive Mesh Refinement Grid Methods**

March 17–21: Workshop on **Computational Radiology and Imaging: Therapy and Diagnostics**

Spring 1997: **Parallel Computational Mechanics:**

April 3–4: Tutorial on **Mathematical and Computational Issues in Drug Design**

April 7–11: Workshop on **Mathematical and Computational Issues in Drug Design**

April 21–25: Tutorial on **PDE Software**

April 28–May 2: Workshop on **Grid Generation and Adaptive Algorithms**

May 12–16: Special workshop on **Parallel Processing of Discrete Problems**

June 9–13: Workshop on **Parallel Solution of PDE**

2. STATISTICS IN THE HEALTH SCIENCES, July 7–August 29, 1997

See detailed descriptions below.

3. EMERGING APPLICATIONS OF DYNAMICAL SYSTEMS,

September 1997–June 1998

See overview of topics below.

4. CODING AND CRYPTOGRAPHY, two weeks in Summer 1998

5. MATHEMATICS IN BIOLOGY, September 1998–June 1999

6. REACTIVE FLOWS & TRANSPORT PHENOMENA, September 1999–June 2000

Academic Year Program:

III. STATISTICS IN THE HEALTH SCIENCES

July 7–August 22, 1997

Organizers: Scott Zeger (Chair), John Hopkins University; Donald A. Berry, Duke University; Joel Greenhouse, Carnegie Mellon University; Elizabeth Halloran, Emory University; Barry Margolin, University of North Carolina; Marvin Zelen, Harvard University; Patricia Grambsch, University of Minnesota; Seymour Geisser, University of Minnesota; Sandy Weisberg, University of Minnesota.

Many important contributions to health care have been made by statistical scientists. Examples include development of randomized-control-trial and case-control methods of investigations. Nearly every aspect of health research has statistical components. These components are sometimes well developed and sometimes not. Frequently, researchers from different disciplines develop their own approach to a statistical problem, but with little interaction among the various disciplines. The overall aim of the workshop is to bring together statisticians with other substantive scientific workers, who are working in health areas with theoretical and methodological statisticians, to discuss and explore current statistical methods in the health sciences and to develop new methods where needed. In view of the rapidly changing health-care environment, the time is ripe for such an interchange. There are five topics, one for each week of the program, with the exception of the Clinical Trial topic, which will take place over two weeks.

Week 1: Genetics. July 7–11 (Elizabeth Halloran, Seymour Geisser)

Statistical methods for population genetics are finding increasing areas of application, including DNA profiles, evolutionary phylogenies, hereditary disease patterns based on mitochondrial DNA, and even the origins and spread of language.

DNA profiles of several genetic loci are an important tool for identification to measure alleles in hypervariable loci, whether based on RFLP or PCR techniques. The use of these techniques, however, to ascertain similarity of two profiles and to estimate the relative frequency of a profile in a specified population and their underlying statistics have been the subject of much heated debate.

The building of evolutionary trees to establish phylogenies, or the relations between organisms, families, or species, is another important area of population genetics. In the medical sciences this is particularly important in the area of microbiology and parasitology. Examples include malaria, HIV, and tuberculosis. It is also used in studies of descent based on mitochondrial DNA. Mitochondrial DNA is inherited from the mother, so requires different statistical approaches than the usual linkage analysis based on nuclear DNA. Several difficult statistical issues arise in phylogeny building. One is the alignment of sequences. Second is the estimation of the distances based on some assumed evolutionary model. Third is the building of a tree structure based on a clustering algorithm. Fourth, is the problem of inference about the complex tree structure that was obtained. Methods of inference include likelihood methods and bootstrapping, but neither is well-understood in this application.

The statistical methods of population genetics and for the analysis of disease patterns based on mitochondrial DNA have lagged behind those for linkage analysis based on nuclear DNA. This workshop will be a unique opportunity for top-level statisticians to meet with quantitative geneticists to advance the statistical underpinnings of these emerging problems.

CONFIRMED SUMMER PROGRAM VISITORS: July 7–11, 1997 (as of 1/14)

Genetics

CHERNOFF, HERMAN	Harvard University	JUL 6 - 11
EFRON, BRAD	Stanford University	JUL 6 - 11
EWENS, WARREN	University of Pennsylvania	JUL 6 - 11
FEINGOLD, ELEANOR	Emory University	JUL 6 - 11
GEISSER, SEYMOUR	University of Minnesota	JUL 7 - 11
GEYER, CHARLES	University of Minnesota	JUL 7 - 11
HALLORAN, ELIZABETH	Emory University	JUL 6 - 11
HOLMES, SUSAN	Cornell University	JUL 6 - 11
LI, WEN-HSIUNG	University of Texas	JUL 6 - 11
MUELLER, LAURENCE	University of California-Irvine	JUL 6 - 11
NEWTON, MICHAEL	University of Wisconsin-Madison	JUL 6 - 11
SCHORK, NICOLAS	MetroHealth Medical Center	JUL 6 - 11
SEILLIER-MOISEWITCH, FRANCO	Univ. of North Carolina	JUL 6 - 11
SIEGMUND, DAVID	Stanford University	JUL 6 - 11
SPEED, TERENCE	Univ. of California-Berkeley	JUL 6 - 11
SUN, FENGZHU	Emory University	JUL 6 - 11
TAVARE, SIMON	University of Southern California	JUL 6 - 11
WEIR, BRUCE	North Carolina State University	JUL 6 - 11
WIJSMAN, ELLEN	University of Washington	JUL 6 - 11
YLVESAKER, D.	Univ. of California-Los Angeles	JUL 6 - 11

Week 2: Imaging. July 14–18 (Scott Zeger, Joel Greenhouse)

Medical sciences, in particular radiology, have experienced an explosion of new technologies for imaging the structure and function of cells, tissues and organs. Magnetic resonance imaging (MRI), fractional MRI and PET scanning are examples of techniques that can provide practically real-time three-dimensional images. But the explosion of data has created important questions of how best to design studies to

analyze the information they contain. Methods for constructing and enhancing images, for identifying and classifying particular anatomical features such as lesions and tumors and for mapping the functional response to a stimulus require further development. Interactions among radiologists, biomedical engineers and statisticians will advance this emerging field.

CONFIRMED SUMMER PROGRAM VISITORS: July 14–18, 1997 (as of 1/14)

Imaging

BRYAN, NICK	Johns Hopkins Hospital	JUL 13 - 18
CHEN, CHIN-TU	University of Chicago	JUL 13 - 18
COX, ROBERT W.	Medical College of Wisconsin	JUL 13 - 18
DETRE, JOHN A.	University of Pennsylvania	JUL 13 - 18
EDDY, WILLIAM	Carnegie-Mellon University	JUL 13 - 18
GENOVESE, CHRISTOPHER	Carnegie-Mellon University	JUL 13 - 18
GREENHOUSE, JOEL	Carnegie Mellon University	JUL 13 - 18
JOHNSTONE, IAIN	Stanford University	JUL 13 - 18
LANGE, NICK	McLean Hospital	JUL 13 - 18
NOLL, DOUG	University of Pittsburgh	JUL 13 - 18
RAZ, JONATHAN	University of Michigan	JUL 13 - 18
SMALL, STEVEN	University of Maryland	JUL 13 - 18
STOFFER, DAVID	University of Pittsburgh	JUL 13 - 18
STROTHER, STEPHEN	University of Minnesota	JUL 13 - 18
THULBORN, KEITH	University of Pittsburgh	JUL 13 - 18
WEISSKOFF, ROBERT M	MGH-NMR Center	JUL 13 - 18
WOODS, ROGER	UCLA	JUL 13 - 18
WORSLEY, KEITH	McGill University	JUL 13 - 18
ZEGER, SCOTT	Johns Hopkins University	JUL 13 - 25

Week 3: Diagnosis and Prediction. July 21–25 (Patricia Grambsch, Seymour Geisser)

The overall goal is to understand how patient information should be used to diagnose disease, both for the individual patient and at the level of population studies. Classical statistical techniques, including discriminant analysis, regression, and classification have recently been joined by newer technologies, including probabilistic expert systems, neural networks and fuzzy logic. At the population level, public screening programs aim at early detection of disease in the hope that early diagnosis will lead to more cures or longer survival. Implementation costs for those programs amount of billions of dollars. Issues such as the initial age to begin participating in a screening program, the number of and timing of diagnostic exams, optimal methods for incorporating accruing patient information over a sequential series of exams and differential screening strategies for populations at varying levels of risk are open questions. There are expanding efforts to plan programs to detect some chronic diseases early in the expectation that earlier diagnosis combined with therapy will result in greater cure rates and/or increase survival. This is especially true in cancer, diabetes and heart disease. The range of problems ranges from the planning and analysis of early-detection clinical trials to the planning of public health programs. There are serious controversies in many of the applications to specific diseases. For example in breast cancer, randomized trials have shown that mammography is effective in reducing mortality only for women over 50 years of age. The American Cancer Society recommends that women over 50 should receive an annual mammogram, yet in the Scandinavian countries the recommendation is every two years and in the United Kingdom every three years. Nearly all of these controversies may be clarified by development of new statistical theories. Probabilistic models, incorporating trial results, can lead to the solutions of many of the problems for specific chronic diseases. The design of mass screening trials and programs can benefit from decision-theoretic analysis methods aiming at minimizing costs and optimizing health outcomes. The statistical issues raised here impact most areas of statistics and health.

The statistical issues include classification/discriminate analysis, regression, classification and newer technologies, including expert systems, notably probabilistic systems and neural networks. At the population

level, screening studies are important. The statistical issues include length-based sampling, number and scheduling of screening studies, and differential screening strategies in populations at varying levels at risk. The statistical issues raised here impact most areas of statistics and health.

CONFIRMED SUMMER PROGRAM VISITORS: July 21–25, 1997 (as of 1/14)

Diagnosis and Prediction

BARTKO, JOHN	National Institute of Mental Health	JUL 20 - 25
CHRISTENSEN, RONALD	Univ. of New Mexico	JUL 20 - 25
EPSTEIN, LEONARDO	Battelle Memorial Institute	JUL 20 - 25
GASTWIRTH, JOSEPH L.	George Washington Univ.	JUL 20 - 25
GEISSER, SEYMOUR	University of Minnesota	JUL 7 - 11
GRAMBSCH, PATRICIA	University of Minnesota	JUL 20 - 25
HENSCHKE, CLAUDIA	Cornell Univ. Medical College	JUL 20 - 25
IBRAHIM, JOSEPH	Harvard University	JUL 20 - 25
JOHNSON, WESLEY	Univ. of California-Davis	JUL 20 - 25
KAFADAR, KAREN	Univ. of Colorado-Denver	JUL 20 - 25
LE, CHAP	University of Minnesota	JUL 20 - 25
LEE, SANDRA	Harvard University	JUL 20 - 25
NORMAND, SHARON-LISE	Harvard University	JUL 20 - 25
PAPANDONATOS, GEORGE	SUNY-Buffalo	JUL 20 - 25
PARMIGIANI, GIOVANNI	Duke University	JUL 20 - 25
PETTIGREW, KAREN	National Institutes of Health	JUL 20 - 25
SHIH, JOANNA	National Heart, Lung and Blood Inst.	JUL 20 - 25
SHIH, JOE	Merck & Company, Inc.	JUL 20 - 25
SKATES, STEVEN	Harvard University	JUL 20 - 25
UTTS, JESSICA	Univ. of California, Davis	JUL 20 - 25
WEISS, ROB	Univ. of California-Los Angeles	JUL 20 - 25
WITTES, JANET	Statistics Collaborative, Inc.	JUL 20 - 25
ZEGER, SCOTT	Johns Hopkins University	JUL 13 - 25
ZELTERMAN, DANIEL	Yale University	JUL 20 - 25

Weeks 4 & 5: Design & Analysis of Clinical Trials. July 28–Aug. 8 (Donald Berry, Marvin Zelen)

Clinical investigations remain the single most important medical tool to evaluate and compare various therapies. This includes design and analysis for drug and vaccine development, and for evaluation of the efficacy and safety of therapeutic agents and vaccines. The issues involved include early stopping (interim analysis), censored missing data, problems of compliance, competing trials, intermediate endpoints, surrogate markers and univariate and multivariate survival analysis. Among the issues of interest are: the design of clinical investigations beginning with an understanding of drug mechanisms through pharmacokinetics/dynamics studies, and the assessment of drug safety and efficiency (*i.e.*, the design of Phase I, III, IV studies). We are also interested in the design of prevention and vaccine trials. A particularly challenging problem is the design of trials with multivariate endpoints.

CONFIRMED SUMMER PROGRAM VISITORS: July 28–August 8, 1997 (as of 1/14)

Design & Analysis of Clinical Trials

BERRY, DON	Duke University	JUL 28 - AUG 8
CHALONER, KATHRYN	University of Minnesota	JUL 28 - AUG 8
DAVIDOV, ORI	Harvard University	JUL 28 - AUG 8
DIXON, DENNIS	National Institutes of Health	JUL 28 - AUG 8
GEORGE, STEVE	Duke University	JUL 28 - AUG 8
GREENHOUSE, SAMUEL	George Washington University	JUL 27 - AUG 8

HALLORAN, ELIZABETH	Emory University	AUG 3 - 8
HELLMAN, SAM	University of Chicago	AUG 3 - 8
HU, PING	Dana-Farber Cancer Institute	JUL 28 - AUG 8
LAGAKOS, STEPHEN	Harvard University	JUL 28 - AUG 8
LEWIS, ROGER J.	UCLA	JUL 27 - AUG 8
LOUIS, THOMAS	University of Minnesota	JUL 28 - AUG 8
MARGOLIN, BARRY	Univ. of North Carolina	JUL 28 - AUG 8
PRENTICE, ROSS	University of Washington	JUL 28 - AUG 8
RACINE-POONE, AMY	Mathematical Applications	JUL 28 - AUG 8
SHEINER, LEW	Univ. of California-San Francisco	JUL 28 - AUG 8
SIMES, JOHN	University of Sydney	JUL 28 - AUG 8
SIMON, RICHARD	National Institutes of Health	JUL 28 - AUG 8
STANGL, DALENE	Duke University	JUL 28 - AUG 8
WAKEFIELD, JON C.	Imperial College School of Medicine	JUL 28 - AUG 8
WEL, L.J.	Harvard University	JUL 28 - AUG 8
YOUNG, STANLEY	Glaxo, Inc.	JUL 28 - AUG 8
ZELEN, MARVIN	Harvard School of Public Health	JUL 28 - AUG 8

Week 6: Statistics and Epidemiology: Environment and Health. August 18–22 (Joel Greenhouse, Elizabeth Halloran, Marvin Zelen, Barry Margolin)

The objective of Week 6 is to examine the special analytic problems associated with observational studies in drawing associations between exposures and disease outcomes. Not only are epidemiologic studies observational, but often the quality of the data is poor. Some of these problems include measurement error, informative missingness, aggregate data used for defining individual risks, the use of monitoring and surveillance data and the use of geographic information systems (GIS) for spatial mapping. The leading question is whether it is possible to draw inferences about causal effects of exposures on disease outcomes in epidemiologic studies.

It is only within the past few decades that we have learned about the importance of the environment on the health of individuals living in a modern industrial society. Many of these environmental problems are man-made and are detrimental to health. The realization of the connection between health and the environment is only a recent phenomenon. It reflects advances in the science of measurement and the development of statistical techniques capable of dealing with complex data. It is the purpose of this week-long workshop to discuss several case studies of environmental problems relating to health. The studies which will be discussed are:

1. the importance of indirect smoking on the respiratory health of non-smokers;
2. the role of small changes in the magnitude of air pollution on mortality;
3. consequences of the contamination of the water supply on the health of infants and children;
4. the association between electromagnetic forces and children's leukemia;
5. the relation between radon and cancer;
6. the possible relationships between soldiers exposed to agent orange in Viet Nam and birth defects of their children; and
7. the role of "acid rain" on depleting the quality of the environment over large regions of the U.S.

CONFIRMED SUMMER PROGRAM VISITORS: August 18–22, 1997 (as of 1/14)

Statistics and Epidemiology: Environment and Health

BRESLOW, NORMAN	University of Washington	AUG 17 - 22
BROOKMEYER, RON	Johns Hopkins University	AUG 17 - 22
CARLIN, BRADLEY P.	University of Minnesota	AUG 17 - 22
CARROLL, RAYMOND J.	Texas A&M University	AUG 17 - 22
DEVINE, OWEN J.	Ctr. for Disease Control & Prevention	AUG 17 - 22

MARGOLIN, BARRY	Univ. of North Carolina	JUL 28 - AUG 8
MORRIS, CARL	Harvard University	AUG 17 - 22
PEARL, JUDEA	Univ. of California-Los Angeles	AUG 17 - 22
ROBINS, JAMES M.	Harvard University	AUG 17 - 22
ROSENBAUM, PAUL	University of Pennsylvania	AUG 17 - 22
SCHWARTZ, JOE	Harvard School of Public Health	AUG 17 - 22
SPIRITES, PETER	Carnegie Mellon University	AUG 17 - 22
THOMAS, NEAL	University of North Carolina	AUG 17 - 22
VAN DER LAAN, MARK	University of California-Berkeley	AUG 17 - 22
WALLER, LANCE	University of Minnesota	AUG 17 - 22
WASSERMAN, LARRY A.	Carnegie Mellon University	AUG 17 - 22
YOST, MICHAEL	Univ. of Washington- Seattle	AUG 17 - 22

Academic Year Program:

**IV. EMERGING APPLICATIONS OF
DYNAMICAL SYSTEMS**

September 1, 1997 - June 30, 1998

Organizers: John Guckenheimer (Chairman) (Cornell University)
Eusebius Doedel (Concordia University)
Martin Golubitsky (University of Houston)
Yannis Kevrekidis (Princeton University)
Rafael de la Llave (University of Texas, Austin) and
John Rinzel (National Institutes of Health)

Dynamical systems theory describes general patterns found in the solutions of systems of nonlinear differential equations. The theory focuses upon those equations representing the change of processes in time. Geometric and analytic study of simple examples has led to tremendous insight into universal aspects of nonlinear dynamics. Experimental studies in diverse areas ranging from fluid flows to chemical reactions to laser dynamics to cardiac rhythms to neural output have confirmed the ubiquity of these dynamical patterns. Harnessing theoretical advances in the mathematics for the solution of larger, more complex practical problems requires further effort in understanding algorithmic and computational issues related to dynamical systems, extensions of the theory to important classes of systems that arise in applications, and attention to the modeling of complex systems that are accessible to only limited measurements of their components.

Work at applying the methods developed by dynamical systems theory to “real world” problems has been a thoroughly interdisciplinary effort. For over fifteen years, there has been a lively dialogue between mathematicians, scientists and engineers concerning the observation and interpretation of dynamical patterns in laboratory and natural systems. To some extent, missing from this discussion has been a set of quantitative models that accurately represent the behavior of the observed systems. The patterns identified by the theory are qualitative, and frequently the theory has been used to classify patterns rather than to build models that can be used for purposes of design or prediction. Computational capabilities have been a limiting factor in constructing such models since they seldom lend themselves to solution solely with analytic methods.

This program offers a set of activities that address the issue of applying dynamical systems methods to a wider circle of problems. There are three components to our approach: a focus on the algorithms that underlie the computation of system behavior, a focus on particular application areas that appear timely for rapid scientific advances through the use of dynamical systems methods, and emphasis upon areas in which existing mathematical theory provides an inadequate substrate for work with applications. The application areas we have selected involve physiological and chemical processes.

Fall Quarter (September 1 – December 30, 1997): Numerical Analysis of Dynamical Systems
Winter Quarter (January 2 – March 31, 1998): Dynamics in Physiology and Chemistry

Spring Quarter (April 1 – June 30, 1998): **Symmetry and Pattern Formation**

CONFIRMED LONG-TERM FALL 1997 PARTICIPANTS (as of 1/21)

Four Weeks or More

Numerical Analysis of Dynamical Systems

BARKLEY, DWIGHT	University of Warwick	SEP 5 - JUN 30
BATES, PETER W.	Brigham Young University	SEP 28 - OCT 31
BEYN, WOLF-JUERGEN	University of Bielefeld	SEP 1 - DEC 30
CURRY, JAMES H.	University of Colorado	SEP 1 - 30
DE LA LLAVE, RAFAEL	University of Texas	SEP 1 - DEC 30
DELLNITZ, MICHAEL	Universitaet Bayreuth	SEP 1 - 30
DOEDEL, EUSEBIUS	Concordia University	SEP 1 - DEC 25
FIEDLER, BERNOLD	Free University of Berlin	SEP 1 - DEC 31
GUCKENHEIMER, JOHN	Cornell University	SEP 1 - JUN 30
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