Prioriteitenprogramma

Niet Lineaire Systemen

Populatiedynamica

News Letter

A newsletter for the project 'Population dynamics, including epidemiology' being part of the NWO priority program 'Nonlinear Systems'.

January 28, 2000

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This newsletter will appear once every three months during the course of the project. Its content will mainly consist of announcements of activities, such as seminars and workshops. Moreover, information about foreign visitors being in the Netherlands as part of the program will be given.

To make this newsletter as informative as possible we ask you to let us know about activities that are planned and the date visitors are coming and give lectures. Also addresses of persons (in the Netherlands or abroad) who might be interested in receiving this newsletter are welcome.

Contributions to this newsletter were made by: Hans Heesterbeek, Patsy Haccou, Alexandre Pery.

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1 Report on Theory and Mathematics in Biology and Medicine Amsterdam

June 29 - July 3, 1999 by Hans Heesterbeek (Centre for Biometry, Wageningen)

The conference Theory and Mathematics in Biology and Medicine was both scientifically and socially a great success. This meeting constituted the 4th tri-annual meeting of the ESMTB, and was simultaneously the 1999 Annual Meeting of the SMB. The 532 participants came from all over Europe and from other continents and far outnumbered the expectations. The scientific program was broad ranging and stimulating, the attendance of all sessions was continuously high (despite the seductions of Amsterdam). The conference was a living proof that large-scale meetings like this are very important for the field as a whole. Participants broadened their views by coming into contact with areas and topics that they would not encounter in specialist conferences that they would usually attend. The central message is that scientists who apply mathematical reasoning to obtain insight into biological and medical phenomena can obtain new ideas, methodology, and collaborators for their research at a broad scale meeting like this. Judging from the continuously high attendance and the fact that all meeting rooms, coffee areas and corridors were buzzing with discussion throughout the meeting we conclude that this central objective was achieved. The high attendance by young researchers (25% of participants), researchers from Eastern European countries (7%) and from Western Europe and the USA, together with the informal atmosphere of the meeting, induced considerable interaction. The program and set-up of the meeting was specifically tailored to create ample opportunity for these interactions.

The organisers had a number of practical aims. One of the aims was to stimulate the attendance of students and this was achieved. A second aim was to stimulate the attendance of researchers from Eastern Europe. This aim was also met since 7% of the participants came from Eastern Europe. Many of these researchers were subsidised from the EU-grant on a competition basis.

The program consisted of 24 sessions with 417 lectures and posters and a tremendous amount of scientific information was exchanged during the meeting. The level of the contributions was generally high as was the appreciation by the participants. The organisers invited 19 plenary speakers. The speakers were chosen with the aim to cover both established research areas, but also exciting new areas with which participants otherwise do not get into contact. Notably the latter type of plenary speaker (e.g. on DNA computing) was very much appreciated.

One explicit aim of the organisers was to increase the quality of the poster session. With this we mean not just the quality of the contributions, but specifically the amount of attention given to it during the meeting. Also, the abstract book makes no distinction between oral contributions and posters, thus stressing that both are equally valuable as scientific contribution to the meeting. Previous meetings with this broad range of topics tended to have poster sessions that were very ill attended. Also in this aim, the present meeting was very successful. The poster session, containing 162 posters, was scheduled in the middle of the afternoon on three consecutive days without any competing activities. Posters were put up for one day only, grouped according to the oral session of the corresponding day, and the researcher presenting the poster was present during the whole session. We can safely say that the attendance, discussion and interaction during these sessions was the highest of any comparable conference. It was uniformly very busy during all three sessions. At the closing of the conference three participants received a prize for their poster (and 7 others received an honorary mention) in front of all participants. For a report by the poster committee see elsewhere in this issue.

Full abstracts of all scientific contributions and other details about the meeting can be found at the following address: `http://toranaga.bio.uva.nl/tmbm99/`

2 Report on the Third NLS Winterschool on Population Dynamics, Woudschoten, The Netherlands

January 5-9, 2000 by Alexandre Pery (Laboratory of Ecotoxicology of the CEMAGREF, Lyon, France, presently at Department of Theoretical Biology, Vrije Universiteit, Amsterdam)

The Third Winterschool on Population Dynamics was organised by Fleur Kelpin (Department of Theoretical Biology, Vrije Universiteit, Amsterdam), Odo Diekmann (Department of Mathematics, Utrecht University), Hans Heesterbeek (Centre for Biometry, Wageningen) and Bob Kooi (Department of Theoretical Biology, Vrije Universiteit, Amsterdam). This Winterschool is part of the "Population Dynamics and Epidemiology" project of the NWO priority program "Nonlinear Systems".

About 66 young scientists from all over the World (Europe, China, USA, South Africa,···) and from all kind of backgrounds (population biology, mathematics, epidemiology) attended this Winterschool.

The general lines that made the success of the first two Winterschools were kept. Five lecturers gave each a series of five lectures:

- Bas Kooijman (Department of Theoretical Biology, Vrije Universiteit, Amsterdam)
- Rob de Boer (Department of Theoretical Biology, Utrecht University)
- Horst Thieme (Department of Mathematics, Arizona State University, Tempe)
- Fred Adler (Departments of Mathematics and Biology, University Of Utah, Salt Lake City)
- Roger Nisbet (Department Ecology, Evolution & Marine Biology, University of California, Santa Barbara)

Each lecture lasted around forty five minutes which was enough for the "lecturer" to tell the essential and not to long for the participants to keep concentrated. The readers provided a substantially good understanding of the way mathematics is applied to study problems in biology. They also mentioned the limits of modelling to fully represent the reality. The lectures were very lively, thanks to the questions of many participants or to the additional informations some of them could give.

Bas Kooijman *Dynamic Energy Budget theory: from molecules to ecosystem*

Bas Kooijman presented the Dynamics Budget Theory, a theory with which most of the participants were not familiar. He first began with the basic model for individual organisms. The DEB model specifies the rules for uptake and use of food for maintenance, growth and reproduction. Three life stages are distinguished; the embryo (which does not eat), the juveniles (which eats, but does not reproduce) and the adult. He pointed out the importance of taking the reserves into account in order to understand biological phenomenon. Multivariate extensions of the basic DEB model were presented on the basis of Synthesizing Units, with several substrates, several reserves and two structures. This extensions can provide a good model for plants (the two structures are roots and leafs) and symbiosis phenomenon. In his last lecture, Bas Kooijman presented the applications of the theory in several fields of social interest (Ecotoxicology, tumor growth, production optimization, $\cdots$). He insisted on the fact that Society asks for Biology, and that it is dangerous to let only non-biologists provide an answer.

Rob de Boer *models of the Immune system*

Rob de Boer provided models to explain some apparently unexpected properties of the immune system. The way of modelling was different for each model, giving thus an idea of how extensive the contribution of mathematics can be. For instance, he applied bifurcation analysis, genetic algorithms and quasi-steady state approximations. The first lectures dealt with the diversity of lymphocyte repertoire. A probabilistic-based model suggests that this diversity principally reflects the diversity of self-antigens rather than that of foreign antigens. The competition between T-cells for MHC-peptide complexes can explain why the total T-cell number hardly depends upon the diversity of the T cell repertoire or the diversity of the set of presented peptides for a sufficient diversity and/or degree of cross-reactivity. A simple model was used to explain some properties of T-cell vaccination and MHC diversity was presented as a result of host-pathogen coevolution.

Horst Thieme *Structured Population Models*

The lectures presented by Horst Thieme gave a solid mathematical foundation for the study of Population Dynamics. The first lecture presented the most rudimentary model with two stages (Larvae and Adult) and density dependence. Sufficient conditions were given to obtain a bounded solution. The possibility of stable periodic solution was discussed (Bendixon Negative Criterion, Hopf bifurcation).The cannibalism in Arizonan tiger salamanders was then used to illustrate the persistence and invasion theory. As for discrete structured metapopulation models, Horst Thieme provided the mathematical theory for the study of quasi-positives matrices. He ended his lectures with continuous structured population models, illustrated by the Pease/Inaba influenza model.

Fred Adler *Ecology And Evolution*

Fred Adler provided tools to study the evolution of spatial patterns for the use of resource with interactions between neighbours (He tries to model the STAR, that means Space Time And Resource). He first overviewed the classical theory for altruism and extended it for the use of resources in a simple resource dynamics. As storing the resource is good for everyone including the one who stores, this behaviour can be selected. For sedentary organisms, long-term local interactions with neighbours are unavoidable and provide a place where "cooperative" strategies for resource use might evolve. This evolution was studied with models for competition for space and applied to ant colonies. The importance of signals and informations shared by plants in plant-plant interactions were also discussed.

Roger Nisbet *Ecological Dynamics*

The lectures by Roger Nisbet gave a good understanding of structured and unstructured population models and of the way the results can be applied to analyse ecological data. He focused in his first lectures on the population cycles. For the delay-differential equations, the lower limit for the period of the cycles is twice the developmental delay. For an extended Nicholson-Bailey host-parasite model, this lower limit is twice the developmental delay of the host and four this of the parasite. These results are powerful diagnostic properties when determining mechanisms of population regulation from time series. Roger Nisbet dealt in his last lectures with biomass-based models to illustrate with different examples the predictive power and limitations of simple population models.

Participants were provided with two readers containing papers dealing with the presented topics.

For two afternoons (and sometimes evenings), small groups were formed to study and discuss papers related to the subjects developed in the lectures. A presentation of the work was done on Saturday afternoon. These working groups were a good opportunity to appreciate the different ways of understanding biology and mathematics by people from very different backgrounds.

The evenings, the meals and the tea and coffee breaks were not only moments to rest but although to discuss about all topics that can be of interest for young PhD students: What will I do after my PhD? How will I manage to reconcile a life devoted to research and family life? These discussion were of course followed by lighter discussions around the bar or the billiard table.

3 Report of visit of Vladimir Vatutin

reported by Patsy Haccou, Leiden.

Professor Vladimir Vatutin (Dept. of Discrete Mathematics, Steklov Mathematical Institute, Moskou, Rusland) heeft in de periode van 16 t/m 23 december 1999 een bezoek gebracht aan de sectie Theoretische Evolutiebiologie van het instituut EEW te Leiden. Het bezoek vond plaats in het kader van een boek over vertakkingsprocessen als modellen in de biologie, dat wordt ge-edit door P. Jagers (Gothenburg) en P. Haccou (Leiden). Professor Vatutin is een expert op het gebied van o.a. sub-kritische vertakkingsprocessen. Tijdens zijn bezoek is er een eerste opzet van het door hem te schrijven onderdeel gemaakt. Voorts heeft hij op 21 december een lezing gehouden, getiteld *Branching processes and genetic divergence*. Hierin vertelde hij hoe de orde van grootte van de geschatte tijd tot een gezamenlijke voorouder samenhangt met het vertakkingsproces-model waar vanuit wordt gegaan. Vervolgens relateerde hij de resultaten aan de waargenomen orde van grootte van genetische divergentie tussen chimpansees en mensen.

4 Calendar

August 23-27, 2000

Second international conference on deterministic and stochastic modeling of biointeraction
Information:

Fabio Augusto Milner	Email : `destobio@math.purdue.edu`
West Lafayette, Indiana, USA	`http://www.math.purdue.edu/~milner/DESTOBIO_2000.html`

June 3-8, 2001

6th Int. Conference on Mathematical Population Dynamics, Marrakech, Morocco, June 3-8, 2001
Organized by: The Department of Mathematics, Chalmers University of Technology and the University of Göteborg, Göteborg, Sweden
and Le Centre Internationale de Formation et de Recherche: Systemes Dynamiques Marrakech, Morocco

The sixth International Conference on Mathematical Population Dynamics is an interdisciplinary meeting of biologists and mathematicians concerned with populations of biomolecules, genes, cells and living organisms as well as other topics of mathematical population biology and epidemiology. The meeting will be focused on (both deterministic- and stochastic) mathematical theory, model analysis, and modelling of quantitative data pertaining to cell- and molecular biology, epidemiology, cancer research, population genetics, population biology and other related areas.

Proposals for topics and subjects may be submitted to the conference secretaries.

Please send the application by mail, fax, e-mail or the online form that can be found at the conference home page, preferably before September 1, 1999 to one of the scientific secretaries and mark the envelop "MPD6".

Information:
Conference secretaries: Marina Alexandersson, Ulrica Olofsson, Ziad Taib,
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