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 10, 2001

Visit the Home Page on:
`http://www.bio.vu.nl/nls/`

This is the last issue of the Newsletter.

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Contents

1 Editorial

This is the last Newsletter of the NWO priory program "Population dynamics, including epidemiology", part of the NWO priority program 'Nonlinear Systems'. The NLS-Newsletter appeared three times per year during the course of the project. Its content consisted of announcements of activities, such as seminars, workshops and summer- and winterschools and reports of visits of foreign visitors being in the Netherlands as part of the program. From October 1992 till July 1994 Lia Hemerik (Wageningen) was the editor of this newsletter. I hope you enjoyed reading this newsletter and that you found the information useful. Announcements of forthcoming conferences, summer- and winterschools can be found via the NVTB (Nederlandse Vereniging voor Theoretische Biologie) electronical newsletter `nvtb@bio.uu.nl` and the NVTB web-site `http://www.bio.vu.nl/nvtb/` maintained by Ingeborg van Leeuwen `ingeborg@bio.vu.nl`. You can subscribe, unsubscribe or send information (plain text-files) to the NVTB mailing-list by sending an email to `nvtb@bio.uu.nl`. If you have further questions about the NVTB mailing-list contact Rob de Boer `R.J.DeBoer@bio.uu.nl`.

I agree with the orgenizers of the NWO Special Year on Mathematical Biology, 2001 (see below) that:

> In recent years the NWO-program on Non-Linear Systems has had a major impact on collaboration of mathematicians, physicists and life scientists. Within this program important results have been achieved, mainly in the field of population dynamics, a research area within ecology.

I would like to thank Karin Uyldert for the administrative-work, such as updating the mail-list, and binding and sending of the newsletter.

2 Report of the Symposium Evolutionary Ecology of Sex

by Sander van Doorn.

This summer (29 August - 2 September 2000) Franjo Weissing organised a symposium and a PhD summer school on the *Evolutionary Ecology of Sex*. Both events took place at the Biological Centre in Haren (University of Groningen). The symposium was originally planned as a small-scale event, but the subject aroused a lot of scientific interest, reflected by the fact that it attracted an impressive number of 180 people. Among these were many of the leading figures of the field, as well as 70 PhD students who also attended the summer school. The scientific program aimed at bringing together empirical and theoretical biologists, and at reviewing the field from both points of view. It was this mix, together with the mix of young and veteran scientists, that catalysed fruitful interactions and made the symposium both scientifically and socially a great success. The three days of the symposium were filled with lecture sessions on particular topics in the field (evolution of sex, sex determination, sex allocation, sexual selection, sexual conflict and battle of the sexes), a poster session and several discussion sessions. Here I will discuss each of the lecture sessions briefly, focusing mainly on the theoretical contributions.

2.1 Evolution of sex

The evolution of sex is a longstanding problem, and even after 50 years of intensive research "the twofold cost of sex" still makes it difficult to understand the origin and evolutionary stability of sexual reproduction. In his talk, **Ilan Eshel** pointed out that the wideheld belief that sex speeds up evolution is only justified in a fluctuating environment. He showed that in a constant environment sex will even slow down evolution (since recombination destroys favourable gene combinations faster than it can create them). In the second part of his talk, Ilan Eshel argued that the evolution of sex is a problem that is inseparably linked to the evolutionary theory of ageing. In fact, the decision whether to reproduce sexually or asexually is very much like the decision whether to invest in self-maintenance or to create new offspring. Steven Siller pointed out that the maintenance of sex is much easier to understand if one takes into account that sexual reproduction almost automatically leads to distinct sex roles and to sexual selection. In particular, sexual selection by mate choice can reduce the genetic load of a sexual lineage relative to the genetic load of an otherwise equivalent clonal lineage. If one sex (typically the male sex) does not provide parental care and hence does not contribute to the population growth rate, sexual selection on this sex can be highly efficient in purging the population of deleterious mutations without negative consequences at the population level. The details have still to be worked out, but the proposed synthesis between the 'evolution of sex' theory and sexual selection theory is highly promising.

2.2 Sex determination

After some empirical talks on the surprising variety of sex determining mechanisms in vertebrates and invertebrates, **Brian Charlesworth** reviewed several theories on the evolutionary degeneration of Y-chromosomes. Based on rather complex population genetical models, he derived a number of testable predictions. However, the available empirical data do apparently not yet allow an accurate discrimination between the various hypotheses.

2.3 Sex allocation

After more than a century of intensive research, sex allocation patterns are now remarkably well understood, and this success of sex allocation theory is often hailed as a triumph of evolutionary theory. As demonstrated by **Stuart West**, demographic and genetic parameters are now routinely derived from sex ratio patterns, by means of an 'inverse optimality' approach. However, the success of sex allocation theory seems to be largely restricted to invertebrates, partly because standard assumptions of the theory are systematically violated in vertebrates (Ben Sheldon). To bridge the gap between data and theory and in order to make sex allocation theory more widely applicable, **Ido Pen** systematically extended the theory to include 'sex allocation in a life history context'. During the symposium, Ido defended his PhD thesis on this topic (see `http://www.biol.rug.nl/theobio`). In his talk and in his thesis, Ido demonstrated convincingly that, in spite of the inherent complexity of the problem, promising progress can be made with the help of a generalized reproductive value approach.

2.4 Sexual selection

Yoh Iwasa reviewed the current state of sexual selection theory, and **Andrew Pomiankowski** and **Rauno Alatalo** demonstrated how the theoretical principles can be applied to specific empirical systems. In an excellent overview talk, Yoh Iwasa showed how the classical results regarding Fisher's runaway process of sexual selection can be put into a broader perspective. On the basis of an optimality principle, he demonstrated that, quite generally, a Fisherian 'runaway' does not occur when there is a cost of female choice. On the other hand, he made the important point that this and related results are based on equilibrium considerations. By means of a specific example, he showed that the runaway process easily leads to stable evolutionary cycles of exaggerated male traits and corresponding female preferences. In such a nonequilibrium context, the co-evolution of exaggerated traits and preferences can occur despite costs of female choice. In the second part of his talk, Iwasa discussed several variants of the 'good-genes' model of sexual selection. He derived the general result that costly male ornaments and corresponding female preferences can evolve when the cost for making the ornament decreases with male quality. Finally Iwasa pointed out some shortcomings of the current models of sexual selection, such as the lack of interest for e.g. sensory bias and direct benefits. This last point was addressed by **Hanna Kokko**, who analysed a model for a species with biparental care and mutual mate choice. She showed that there is a conflict between signals for genetic quality and parental quality, which may result in a 'runaway' in which the importance of parental care continually diminishes.

2.5 Sexual conflict

Bill Rice addressed various genetic conflicts between the sexes, and he illustrated his ideas by interesting data on intersexual developmental conflicts in Drosophila. When the two sexes are selected toward different optima of a phenotypic trait, and when the genes underlying the trait are expressed in both sexes, then alleles will typically be favourable to one sex, while harmful to the other. Rice showed experimental data demonstrating that such sexually antagonistic alleles do indeed occur in Drosophila, and are in fact quite abundant. This finding may have important implications for theoretical models, such as the good-genes model of sexual selection.

2.6 Battle of the sexes

Olof Leimar and **Peter Hammerstein** reviewed various game theoretical models on the interaction between the sexes. In the closing talk, **Barry Sinervo** then showed how game theoretical principles can be applied to the side-blotched lizard, which shows evolutionary cycles on a short time-scale. First of all, frequency dependent selection on male morphs drives oscillations analogous to a rock-scissors-paper game. Second, different female strategies (producing either many low-quality offspring or a small number of high-quality offspring) promote stable population cycles. The details of the system, in particular the interplay between evolutionary and ecological processes, are still not well understood. For years to come, this interesting system, together with many others presented during the symposium, will provide food for thought for theoreticians and empirical workers alike.

3 NWO Special Year on Mathematical Biology, 2001

Organisers: L. Stougie en S.M. Verduyn Lunel

The section Mathematics of NWO-Exact organises in 2001 a series of seminars and a winter school on mathematics and biology. The motivation for this initiative comes from the need to investigate the possibilities for mathematics to participate in new research programs in the field of biological sciences (like the NWO Bio-Molecular Informatics Program). The central organisation of the special year consists of Leen Stougie and Sjoer Verduyn Lunel. In coordination with local organisers 9 days will be organised on location. Subjects have been selected that are of interest both to mathematics and to biological sciences. The aim is to provide mathematicians an overview of the problems encountered by biologists, biochemists, and researchers in medical sciences on the one hand, and to stimulate contacts between the two research groups on the other hand. The special year will be concluded with a "winterschool" for advanced master students and PhD-students.

More information can be found on the web-site, including information on related activities: `http://www.cwi.nl/projects/NWO-jaarthema`.

PROGRAM:

15-17 January 2001: Computational Molecular Biology , EURANDOM, Eindhoven, Organizers: Mathisca de Gunst and Willem van Zwet, see `http://www.eurandom.tue.nl/workshops/CMB.htm`

21 February 2001: Biofarmacy, TNO-Pharma, Zeist, Organizers: Jan van der Greef and Sjoerd Verduyn Lunel

23 March 2001: Bio Informatics Pattern Analysis, Centrum voor Wiskunde en Informatica, Amsterdam, Organizers: Monique Laurent, Lex schrijver, and Leen Stougie

April 2001: Computational Neuroscience, Nederlands Instituut voor Hersenonderzoek, Amsterdam, Organizers: Jaap van Pelt and Arjen Van Ooyen

May 2001: Cellular Networks, Vrije Universiteit, Amsterdam, Organizer: Hans Westerhoff

June 2001: Biocomputing, Bioinformatica Instituut, Nijmegen, Organizer: Gert Vriend

September 2001: Experimental Organic Chemistry, Nederlands Polymeren Instituut, Eindhoven, Organizers: Rint Sijbesma and Leen Stougie

Oktober 2001: Vision: An Inspiration for Science, Image Sciences Institute, Utrecht, Organizer: Bart ter Haar Romeny

November 2001: Macro-molecular Crowding in Cell Biology, Centrum voor Wiskunde en Informatica, Amsterdam, Organizer: Mark Peletier

The motivation for organising such a special years is given by the fact that biological sciences have seen an overwhelming development since the unraveling of the genetic code. Both on molecular and on cellular level enormous knowledge has been acquired with important applications in biomedical and agricultural sciences. Knowledge about individual behaviour of enzymes, cells and organisms is just a first step in understanding the laws that govern the complex collective behaviour of populations of such individuals. On the macroscopic level processes in living systems are still poorly understood. To reach for deep insights a multi-disciplinary effort will be required from mathematics, computer science, physics, chemistry and biology. The time seems to ask for initialising such an effort from out mathematics.

On almost all universities in the Netherlands interdisciplinary research with life sciences is started. This holds as well for the research institutes CWI (Centre for Mathematics and Computer Science) in Amsterdam and EURANDOM in Eindhoven. In recent years the NWO-program on Non-Linear Systems has had a major impact on collaboration of mathematicians, physicists and life scientists. Within this program important results have been achieved, mainly in the field of population dynamics, a research area within ecology.

It is crucial that these successful multi disciplinary initiatives will be continued, covering a much wider spectrum of life sciences, and that mathematical research attempts to relate to the Bio-informatics initiative of NWO. It is clearly very important that the mathematical research groups pay major attention to all these new possibilities for applied research, and it is evident that close contacts with biologists and biochemists will be indispensable. In that sense there are enough opportunities. The Dutch research groups in the field of biology and biochemistry have an excellent international reputation.

For the organisation of the Special Year we have chosen for orientation on the wide spectrum of mathematics (and computer science) on the one hand and on a comparably wide spectrum of life sciences on the other hand. Without doubt, a successful start will generate returns in the form of interesting and relevant mathematical problems, interesting publications, a name on the map of a new research area, financial support through research projects and last but not least hopefully an attraction of the field for future students.

For more information you can contact:

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P.O. Box 9512 2300 RA Leiden `verduyn@math.leidenuniv.nl`

4 Fourth Winterschool on Population Dynamics

In the first week of January 2002, Odo Diekmann, Hans Heesterbeek and Andr de Roos will organise the fourth winterschool on Population Dynamics. The first three schools in this two-yearly series were very successful. They were sponsored by the NLS-programme. The fourth school will be based on the same philosophy (see various NLS-newsletters on the NLS-web site). It will be financially supported within a large project of collaboration between the University of Amsterdam (Population Biology) and Wageningen University and Research Centre (Center for Biometry) paid for by the Ministery of Economic Affairs through the ICES/KIS programme.

At the moment three lecturers have agreed to come: Hal Caswell (Woods Hole Oceanographic Institute; stage structured population models), Eva Kisdi (University of Turku) and Hans Metz (University of Leiden and IIASA; both adaptive dynamics). Three other prominent lecturers have been approached but have not yet confirmed their participation. Their respective topics are in: epidemiology & genetics, behavioural ecology and evolution.

Readers who are interested in attending the winterschool, or who wish to receive more information when information becomes available, can send an e-mail to Hans Heesterbeek and will then automatically be notified of further developments.

E-mail address: `j.a.p.heesterbeek@plant.wag-ur.nl`

5 Calendar

June 3-8, 2001

6th Int. Conference on Mathematical Population Dynamics, Marrakech, Morocco, June 3-8, 2001

Call for papers: Research papers on different aspects of population dynamics are solicited from researchers in a very wide range of areas in biology and applied mathematics.

Scope: The purpose of the conference is to serve as an interdisciplinary meeting where biologists and mathematicians discuss issues of mutual interest. Among the invited and keynote speakers, we expect to have the names of some of the most prominent researchers in the area.

Topics: Examples of theme are Cell- and Molecular Biology, Mathematical Ecology, Molecular Population Genetics, Epidemiology and Theory of Epidemics, Mathematical Methods of Population Dynamics, Control Theory, Public Health Issues, Urban Dynamics, Mathematical Demography, Stochastic Models, Biostatistics and Bioinformatics, Spatial Dynamics and any other themes were deterministic or stochastic population modelling is involved.

Location: The conference will take place in a pleasant resort in the beautiful city of Marrakech, Morocco.

Deadlines: The deadline for pre-registration is January 15 2001. Abstracts must be submitted before January 30 20001.

Information:
Conference secretaries: Marina Alexandersson, Ulrica Olofsson, Ziad Taib,
Email: `mpd6@math.chalmers.se`
Webpage: `http://www.math.chalmers.se/~ziad/popdyn/Mpd6/index.html`

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June 11-22, 2001

ESMTB School Biology and Mathematics of Cells: Physiology, Kinetics and Evolution Sigüenza, Spain, June 11-22, 2001

The Second School of the European Society for Mathematical and Theoretical Biology will be held in Sigüenza, Spain, June 11-22, 2001. The First (Summer) School on Spatial Structures in Biology and Ecology: Models and Methods took place in Martina-Franca, Italy, September 4-15, 2000. The Sigüenza school is also a follow-up of the School "Mathematics in Cell Physiology and Proliferation" which was held in Termoli, Italy, 6-19 June 1999. The school will feature classical as well as novel aspects of cells, the building-up of material inside a single cell, the migration and aggregation of cells, the cell-cycle mechanism, cell proliferation of normal and abnormal cells, new techniques of exploration of the genome, and evolutionary aspects of cells. The school will take place in the Seminary of Sigüenza which will also accommodate the participants and the instructors. The entire Seminary will be at the disposition of the school. The Seminary is a recent construction, with a number of class rooms of various sizes, surrounded by a large garden. It is a few kilometers away from the medieval town of Sigüenza, whose Parador, an old castle superbly renovated, and the Cathedral, will give the participants a pretext for pleasant evening excursions. Sigüenza is about 100 kilometers from Madrid, which can be reached by the regional train. The facilities of the school will make it possible to organize the activities in such a way as to allow participants to select among some of the courses offered.

The courses will be divided into two groups: the morning courses (9:00-12:30) are the primary courses, devoted to the keynote subjects. They are intended for all participants. The afternoon courses (16:00-19:00) are the complementary courses. Some of these courses will be given in parallel sessions; some of the complementary courses will be repeated in several sessions, allowing for smaller groups and a better interaction of participants and teachers. Communications by participants will be organized.

Each course is divided into units of 40mn. Two formats for the communications: 10mn (appropriate for a work in progress, such as first year of a PhD, good to break the ice) and 20mn (for already well advanced or even completed work). The choice is entirely yours. There will be ten days of classes, Monday through Friday, during two weeks.

The web page `http://www.siguenza.eurobiomath.org` provides, besides information on the school, a forum for discussions during the preparation of the school as well as a reserved area for the organizers and the instructors. Access to the draft of lecture notes via the web page will hopefully be available.

Timeschedule:

November 2000: First announcement, topics covered

January 2001 : Second announcement, program and logistics

April 1, 2001: Deadline for pre-registration and application for financial support

April 15, 2001: Selection by a committee of successful applicants for financial support (subject to availability of funding)

May 15, 2001: Deadline for registration (evidence of participation should be provided); Deadline for reception of instructors lecture notes There is no deadline for submission of communication notes or abstracts, although early submission is strongly encouraged.

June 10, 2001: Welcome and registration

June 11, 2001: School starts

The school is linked with the following institutions/societies/groups: ETSIIM (Spain), IRD (France), ESMTB (Italy), SFBT (France), MTBio (Deutsch), EMBMA, RTN (Research Training Network)

Application form is available at `http://www.bondy.ird.fr/lia/fichiers/Ovide/fichiers/ecole-6-2001.html`

Information:

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First week of January, 2002

Fourth Winterschool on Population Dynamics.
Information: Hans Heesterbeek `j.a.p.heesterbeek@plant.wag-ur.nl`