

# ***ECMTB*** **Communications**

**ECMTB Editorial Board**

Wolfgang ALT  
Helen Byrne  
Andreas Deutsch  
Edith GEIGANT  
Hans HEESTERBEEK  
Vlastimil Krivan  
Frithjof Lutscher  
Philippe Traqcqui



**A European Forum for Interdisciplinary Exchange and Presentation  
Official Communication Bulletin of the ESMTB:  
European Society for Mathematical and Theoretical Biology**

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## Editorial

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*Dear friends of Mathematical and Theoretical Biology!*

This 5<sup>th</sup> edition of the *European Communications in Mathematical and Theoretical Biology* realizes some changes and, in response, tries to offer most convenient transparency and efficiency.

First of all, Europe is on its way to become an increasingly organized political and economic union. In this situation, the increasing role of scientific exchange and collaboration between European working groups in our interdisciplinary field (embedded into the rapid development of modern biology, medicine, biotechnology, information and computer sciences) puts an obviously strong challenge to the *European Society of Mathematical and Theoretical Biology (ESMTB)*. Therefore, the new Society Board, half of it newly elected in a ballot end of 2002, as one of its first actions has reformulated the '*goals*' of the Society (see following page). We would like to ask you as a reader of these Communications, independent from being a member of the Society or not (yet), to critically check content and sense of these goals and of the indicated strategies for realization. Furthermore, if you have any questions, critique or suggestions for changes and modifications, please, let us know as soon as convenient for you (best **before end of August**): just send an e-mail to [Helen.Byrne@maths.nottingham.ac.uk](mailto:Helen.Byrne@maths.nottingham.ac.uk). For, the idea is to finalize these goals on the next board meeting (September 19, 2003 in Bonn) and edit them together with some more information as a kind of *public leaflet*, to be used for presenting the European Society and attracting more interest for it.

Second, an *Editorial Board* has been formed (see front cover) which will take over responsibilities to promote publicity and communication actions by the ESMTB and, in particular, to coordinate the collection and distribution of information and reports between Society members by using the following **3 publication 'organs'**:

- 1) **ESMTB Web-Site** [www.esmtb.org](http://www.esmtb.org) (run by *Andreas Deutsch*) mainly for short-term announcements (as free positions or meetings, new books or journals), for general information about the Society and their organs, and for membership registration (currently there are about *240 Society members*). Some of these informations will be available by using a link to the **MTBio Web-Site** [www.mtbio.de](http://www.mtbio.de), an independent, international and interactive network of modelers and theoreticians in biology;
- 2) The monthly appearing **JMB-pages** (2 in each of the 12 yearly issues of the *Journal of Mathematical Biology*) named "**Perspectives in Mathematical and Theoretical Biology**" (edited by *Hans Heesterbeek*) containing further ESMTB announcements, short reports or announcements of conferences, but mainly intending to publish diverse articles of appealing interest to the broader community of biomathematicians and mathematical modelers;
- 3) These **Communications**, continuing to appear twice the year and serving as a **European forum for interdisciplinary presentation, scientific exchange and discours** among mathematical and theoretical biologists. Besides the *Society News* it will regularly fill sections with *Reports* (on funding or past activities), about *History*, *Recent Theses*, *Research Announcements* and *Group Presentations* (not in this issue), as well as commented announcements of *New Journals and Books* or *Forthcoming Events*.

It is the aim of the editorial board, to find more and more *contributors* sending such information; in particular, brief reports, research announcements and presentations *from the various European countries* are very welcome!!!! Channeling these contributions appropriately into one of the above-described media will be guaranteed. Thus, please, do not hesitate to ask around in your scientific neighborhood or, even better, write an own contribution and send it to one of us at any time (see list of e-mail codes below).

Finally, printing and shipping of the Communications has now been shifted from *Rome* in Italy to *Ceske Budejovice* in the Czech Republic. We thank Vlastimil Krivan for organizing this new start. Furthermore, from the next issue on, *Frithjof Lutscher* will take over much of the editorial work, which up to now has been performed by *Edith Geigant* in an excellent manner for more than five years. We would like to express our special thanks to her!

In the name of the editorial board

*Wolfgang Alt*

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The **closing date** for the next issue COMMUNICATIONS # 6 will be **October 31, 2003**. Please send your information, reports or other material to one of the editors, preferentially by e-mail to *Wolfgang Alt* ([wolf.alt@uni-bonn.de](mailto:wolf.alt@uni-bonn.de)), *Andreas Deutsch* ([deutsch@zhr.tu-dresden.de](mailto:deutsch@zhr.tu-dresden.de)) or *Hans Heesterbeek* ([j.a.p.heesterbeek@vet.uu.nl](mailto:j.a.p.heesterbeek@vet.uu.nl))

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## Society News

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### ESMTB's new logo



### New ESMTB Website

ESMTB has a new website with same access as before:

[www.esmtb.org](http://www.esmtb.org)

Besides this website, the "*European Communications*" and the regular pages in *J. Math. Biol.* filled by the society, serve as the central places for exchanging information and messages within and about the ESMTB (for more details see the editorial and various sections below).

Andreas Deutsch (ESMTB treasurer)

[deutsch@zhr.tu-dresden.de](mailto:deutsch@zhr.tu-dresden.de)

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**PLEASE, PAY FOR YOUR MEMBERSHIP FEES 2003 !** – For registration/payment see: [www.esmtb.org](http://www.esmtb.org)

and the information by the ESMTB treasurer on page 4 below!

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### ESMTB Board Elections 2002

Total number of ballot papers sent out: 336

Total number of ballot papers returned: 97

The results were:

Deutsch	55
Byrne	53
Preziosi	52
Alt	52
Bravo	49
Westerhoff	41
Jacob	37
Heinrich	31

Therefore the following 5 candidates are elected:

- *Alt, Bravo, Byrne, Deutsch, Preziosi*

### Next Triennial Conference ECMTB 2005 in Dresden

The next ECMTB (European Conference on Mathematical and Theoretical Biology) will take place **July 18-22, 2005 in Dresden**. Andreas Deutsch is chairman of the organizing committee. Details about the conference will be available from the beginning of 2004.

Andreas Deutsch (ESMTB treasurer)

[deutsch@zhr.tu-dresden.de](mailto:deutsch@zhr.tu-dresden.de)

### Goals of ESMTB

#### Introduction

As we enter the 'post-genomic' era of molecular and cell biology (including its biomedical and biotechnological applications) there is an increasing need for appropriate mathematical methods that help to evaluate and interpret the vast streams of experimental data -- with ever refined temporal, spatial and typological resolutions. The rapidly expanding areas of bioinformatics and scientific computing will play an integral role in the development and application of suitable algorithms for quantitative data acquisition and exploration (data mining, image processing, simulation etc.).

However, the requested goal to detect, understand and explain basic structures and functions underlying the observed biological processes in its multi-scalar dimensions, can obviously be achieved only by intensified interdisciplinary activity and collaboration of experimental and theoretical biologists on one side, and applied mathematicians on the other. For the emerging "hot topics" biologically appropriate theories and corresponding mathematical models must be developed in order to assist in the generation of new biological hypotheses and the performance of statistical evaluations.

In such a climate and for these reasons the "European Society for Mathematical and Theoretical Biology" is engaged in coordinating and supporting the corresponding community of scientists, their projects and institutions by all means available to them. The most important of these aims are formulated below:

#### Goals

- To develop new mathematical models and methods for investigating biological problems
- To apply mathematical techniques to address current and emerging biomedical and biotechnological applications
- To enhance interdisciplinary communications between biological and mathematical research groups throughout Europe

- To strengthen links with related communities and institutions (e.g. biophysics, bioinformatics, biotechnology, biochemistry, biomedicine and bioengineering)
- To establish training and exchange programmes in mathematical biology.

### Strategies

- The Journal of Mathematical Biology (JMB)
- The triennial conference and themed workshops, held in conjunction/cooperations with related research communities
- Short courses designed for young researchers (PhD students and postdoctoral researchers)
- Relations with other societies
- Fund-raising and advertising activities
- Education of researchers
- Research networking

Helen Byrne for the Board of ESMTB

[Helen.Byrne@maths.nottingham.ac.uk](mailto:Helen.Byrne@maths.nottingham.ac.uk)

## Statements of the newly elected ESMTB Board members

### Rafael Bravo de la Parra

As an ESMTB board member my two main aims are helping in the coordination of conferences, workshops and schools, and working in bringing to light the MTB community in Portugal and Spain (Iberia in W. Alt's notation) overflowing towards Al Magreb (Morocco, Algeria).

*Conferences, workshops and schools.*

- A permanent objective is the reception and distribution of information. At least once a year a selection will be announced and commented in ESMTB pages of the Journal of Mathematical Biology.

First call for help: please send me/us (ESMTB board) any information concerning conferences, workshops and schools.

- An objective for next year is that ESMTB gets funding from EU through the VI framework programme (Marie Curie Conferences and Training Courses) for the organization of a series of summer schools and workshops. Demand deadline is 20 April 2004 and the events could be spread along four years beginning six months after deadline (see also page 9 below).

Second call for help: please send me/us suggestions of themes, possible organizers, etc.

*Southwest MTB community.*

The objective is to use the ESMTB as a meeting point for south-west researchers in the field of MTB or connected fields.

Third call for help: please if you feel concerned by this objective contact me.

*Rafael Bravo de la Parra (Departamento de Matemáticas, Universidad de Alcalá, 28871 Alcalá de Henares Madrid, Spain)*

[rafael.bravo@uah.es](mailto:rafael.bravo@uah.es)

### Luigi Preziosi

One of my task as a member of the Board is to look at the VI framework programme of the European Community to examine funding possibilities for the society (for more details see page 9 below).

The first possibility is to write a project in the action "Series of events", including the next 4 summer schools and other events like the "Mathematics in Medicine Study Group" usually organised at Nottingham.

Unfortunately, it is impossible to include Large Conferences. However, writing such a proposal would have a coordinative and synergistic advantage.

A second possibility which will be investigated consists in promoting the formation of a "Research Training Network" on a specific bio-mathematical topic.

In addition, Helen Byrne and I are going to list the existing teaching activities in biomathematics in Europe at a bachelor, master and doctorate level.

In order to gather all possible information and to avoid missing valuable activities we actually need the collaboration of all ESMTB members.

Information on existing courses and degrees can be sent to [preziosi@polito.it](mailto:preziosi@polito.it) or [Helen.Byrne@maths.nottingham.ac.uk](mailto:Helen.Byrne@maths.nottingham.ac.uk)

### Phillipe Tracqui

My contributions as an ESMTB board member will be, on the scientific side, to contribute to the organization of conferences and schools, to report on and strengthen links with the scientific MTB community in France and francophone countries through the Francophone Society for Theoretical Biology (SFBT) as well as with the community of scientists in cytomechanics and bioinformatics already involved in national and European research programs, especially regarding Networks of Excellency and associated IP in the fields of simulation of cellular processes and health.

On the administrative side, my contribution will be to insure the required connections with the French administration for different aspects of the ESMTB statutes, as well as contributing to fund-raising.

Specific action will also concern the new restructuration of the French universities training programs (LMD profiles) which will enhance European students exchanges.

*Phillipe Tracqui (Inst. A. Bonniot, 38706 La Tronche CEDEX, France)*

[Phillippe.tracqui@imag.fr](mailto:Phillippe.tracqui@imag.fr)

## Wolfgang Alt

As a 'renewed' member of the Board and in the function of a vice-president, I feel responsible for supporting the various ideas and activities trying to intensify and amplify communication within the society (in particular by currently leading the *Editorial Board* of these *Communications*) and with neighboring societies, associations or even smaller groups in our field, which would like to build up their scientific contacts.

Besides the international *SMB (Society for Mathematical Biology)*, there exist national organizations as the *Dutch* and the *Francophone Societies*, the *Israeli Society* or the *Japanese Association*. Interaction with them concerns joint meetings, exchange of information and programs as well as regulations for joint memberships.

Most important, however, as I believe, are the duties that our Society has in structuring the *scientific landscape of 'whole Europe'* (not wanting to distinguish between 'old' and 'new') and of its surrounding cultures in *Near-east* and *Northern Africa*. In my opinion the current procedure of 'expanding' the EU and 'exporting' scientific expertise and organization from Western Europe into these regions, is oversimplifying, one-sided and, in the long run, dangerous. For, it often neglects the great values of science in Central and East Europe that had been performed there in universities and academy institutions during the last five and more decades (and which has suffered from the political and economic break-down of the communistic state systems and their capitalistic replacements) – but also the values of old scientific traditions having grown for centuries in the realm of Islamic culture, which so much has served as a source for the blooming of 'our' science, basically embedded into a Christian culture.

Therefore, one of my aims will be to stimulate new (or activate old) memberships of the Society in these regions and promote opportunities for them to present their work and thinking, and to enter into a fruitful scientific exchange.

Wolfgang Alt (*Abteilung Theoretische Biologie, Universität Bonn, D-35115 Bonn, Germany*)

[wolf.alt@uni-bonn.de](mailto:wolf.alt@uni-bonn.de)

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### **IMPORTANT NOTE of the new ESMTB treasurer: The ESMTB Year 2003 Membership Fees**

Payment of the membership fees for 2003 is now due and should soon be performed!

The **Individual Annual Membership Fee** is:

- 50 Euro (full member)
- 40 Euro (SMB full member)
- 25 Euro (student, Eastern European member)
- 20 Euro (student SMB member)

(using: SMB: Society for Mathematical Biology)

The **Institutional Annual Membership Fee** is

- 200 Euro

### **Methods of payment**

The methods of payment are

- Bank draft transfer (strongly preferred!)
- Send cash
- Cheque (please avoid this method since high fees are charged)

### **1. BANK DRAFT TRANSFER**

Payment may be made directly to the ESMTB account, details of which are:

Bank: Dresdner Bank

Account Name: ESMT

Account Number: 04 076 801 01

Bank Code No.: 850 800 00

**SWIFT-BIC: DRES DD FF**

**IBAN: DE 18 85080000 0407680101**

Bank Address: Dresdner Bank, Dr. Kuelz-Ring 10, D-01067 Dresden

### **2. CASH**

If you are sending cash, please use the following procedure:

(a) send the treasurer an email ([deutsch@zhr.tu-dresden.de](mailto:deutsch@zhr.tu-dresden.de)) informing him that you are sending cash so that he knows to expect it.

(b) put the cash in a sealed envelope and send this in another envelope to the following address:

Andreas Deutsch, ZHR, Dresden University of Technology, D-1062 Dresden, Germany

(c) send the letter by registered post.

### **3. CHEQUE**

If paying by cheque, please make the cheque payable to "ESMTB". Please avoid this method of payment since high fees are charged!

### **ESMTB membership benefits**

As ESMTB member you can subscribe to the following journals at reduced rates:

- Journal of Mathematical Biology (Springer): 120 Euro per year. The Journal of Mathematical Biology is the official ESMTB journal!
- Acta Biotheoretica (Kluwer): 75 Euro per year
- Journal of Biological Systems (World Scientific): 75 Euro per year

These rates are payable together with the membership fee!

*Treasurer of ESMTB:* Andreas Deutsch, Center for High Performance Computing, Dresden University of Technology, Germany.

[deutsch@zhr.tu-dresden.de](mailto:deutsch@zhr.tu-dresden.de)

## Minutes of the ESMTB Board Meeting

Turku, February 21, 2003

Meeting starts 10.00 am

Present: *Mats Gyllenberg* (MG, chair), *Helen Byrne* (HB), *Vlastimil Krivan* (VK), *Philippe Tracqui* (PT), *Rafael Bravo de la Parra* (RB), *Andreas Deutsch* (AD), *Luigi Preziosi* (LP), *Wolfgang Alt* (WA), *Hans Heesterbeek* (HH).

Absent with apology: *Marcelle Kaufman* (MK)

### 1. Adoption of the agenda

Discussion about possible appointment of external advisors is added to item 9 of agenda. Discussion about creating an overview of the curricula in theoretical biology (broad sense) is added as item 19 of the agenda.

### 2. Minutes of the General Assembly (Milan July 5<sup>th</sup>, 2002)

One confusing error in the minutes is corrected: "The membership fee for normal members who pay for 3 years in advance should *not exceed* 3×60 Euro." Otherwise the minutes are approved (neglecting minor typing errors).

A point of action in connection to these minutes is that the new statutes having been approved in Milan (effective January 1<sup>st</sup>, 2003) have to be formally deposited in Grenoble, together with the new board. HH and PT will make sure that this is taken care before March 2003.

### 3. Minutes of the Board Meeting (Milan July 2<sup>nd</sup>, 2002)

The minutes are approved (neglecting minor typing errors).

### 4. Report from the Vice-president

- Unfortunately no reports from the former president or the treasurer were received in time for the meeting. There is therefore no financial report covering the whole of 2002 and no up-to-date list of members. The vice-president will contact them again after the meeting.
- Mail received from January 1<sup>st</sup>, 2003: The European Mathematical Society (EMS), of which the ESMTB is a member, has a new president: prof. John Kingman. The newsletter of EMS is looking for a new editor-in-chief. The first Abel-prize of the Norwegian Academy, will be presented by the King of Norway on behalf of the (EMS member).
- The third conference on Deterministic and Stochastic methods in Biology (DESTOBIO) will be a joint meeting with the series on Mathematical Population Dynamics. The meeting will be organized

by prof Mimmo Iannelli and will take place June 21<sup>st</sup>-25<sup>th</sup>, 2004, in Trento, Italy.

- Several e-mails were received from members who had difficulty in paying their membership fee.

### 5. Election of the President

### 6. Election of the Vice-president

It is proposed that *Mats Gyllenberg* will become president and that *Wolfgang Alt* will become vice-president. This is unanimously approved. MG and WA accept this appointment. MG points out that he would gladly continue as vice-president if WA would be president, but WA indicates that he is happy in the role of vice-president. MG points out that he will work to make the meetings more efficient in that the agenda will be accompanied by clear proposals for decisions as a basis for discussion. In addition it should be clear to the members who in the board is responsible for carrying out decisions that have been taken and a timetable attached to that. All board members agree.

### 7. Election of Secretary and Treasurer

Given the increased workload of secretary and treasurer, which have been combined in one person up to now, it is decided that the functions will be split. *Hans Heesterbeek* is proposed as secretary and he accepts. It is proposed that the treasurer will be sought from among the new board members, in order to assure continuity for the members for six years. *Andreas Deutsch* volunteers to take over the position of secretary. All board members are very grateful to him.

### 8. Election of two cash auditors

Independent cash auditors need to be appointed from outside the board. It is proposed that *Daniela Morale* and *Kalle Parvinen* will be asked for this task. Both have accepted the task.

### 9. Distribution of tasks and duties among the board members

WA opens the discussion by arguing that it could be good for the society to have a council of external advisors. They could form a good connection to applied fields and to communities that are at present under-represented in the board (e.g. bioinformatics, biometry, biophysics). It is proposed that these advisors should then be given clearly defined tasks and to postpone the discussion to the next Board meeting. A workable proposal for a possible council could be that they receive the agenda with proposals for decisions in advance of each board meeting to allow them to express their opinions to the benefit of the board.

The tasks and duties of board members fall into several categories, all of which are a separate item on the agenda. The distribution of tasks will therefore be discussed under the various items below.

### 10. Goals and strategy of the society

In a long discussion about this topic several concrete proposals are made to make clearer for the members what the profile of our society is that makes it different

from other societies and to make clearer what the society can do for its members (what are the benefits that members have and what would members want the activities of the society to be). The following board members, under the initiative of AD, will form a sub-committee for this purpose: AD, WA, HB, PT and VK. The task of this committee is in addition to the above to present a clear and balanced proposal for the goals and strategy of the society (mission and how to achieve this) and to prepare a clear program for what the present board aims to achieve in the following three years, which should be phrased in such a way that progress can be measured by the society and success can be evaluated. The complete plan must be available by the end of August 2003, to be discussed and implemented at the next board meeting in September 2003. The sub-committee will receive input from the other board members and the committee will have its first meeting in Turku on Saturday February 22<sup>nd</sup>.

### **11. Financial situation of the society, handling of membership fees**

A long discussion ensues concerning the management of finances of the society. It is decided that: i) credit card payments (VISA, MasterCard) must be made possible; ii) bank account should be in the name of the society and no longer in name of a person, in order to prevent any conflicts of interest; iii) reminders for payment of fees should be sent out at the end of each calendar year to all members; iv) professional help in accounting and/or secretarial help for the treasurer in collecting payments etc should be possible and the society should be able to pay a small sum for these services if needed. The new treasurer AD will immediately set up the bank account in Germany, with credit card payments. The current members will then receive a renewal notice for 2003.

The fees for 2003 are set as follows: 50 Euro for a full member, 25 Euro for student members (proof of student status required), 200 Euro for Institutional members.

With respect to Institutional members the following is decided: if an organization becomes a member it can provide a list of up to five employees who become full members of the society and therefore have full access to all benefits. The organization can also profile its activities in theoretical and mathematical biology or its interests on the web-page and in the Communications and post job advertisements.

It should become very transparent for society members how their money is being used for their benefit. AD will draft a first list and report on this before March 21<sup>st</sup>, 2003. This could also contain what does NOT happen with the money (e.g. all travel and other costs for the board meetings are borne by the institutes and departments of the individual board members).

We will use the benefits document to pro-actively approach potential new members and Institutional members. Up to now there has been little activity to actively seek new members, save for the time periods preceding ESMTB conferences and summer schools.

It is decided that in future the amount that is the difference between the full fee for attending an ESMTB meeting (summer school, conference, ...) and the reduced fee for members, should go to the society.

There is an urgent need to generate more income for the society, since honouring the contract with Springer is important. At the moment this contact bears a very heavy burden on the finances of our society.

There have been preliminary talks about reciprocal membership with the Society for Mathematical Biology (SMB). It is decided to make haste with this construction and to facilitate discussions we decide to offer reciprocal membership of ESMTB to full SMB members for 40 Euro. MG will contact the current SMB president Mark Lewis with the aim to achieve symmetry in the reciprocity in that the same service should then be open for our members. Membership of both organizations will then be possible at a reduced total rate, with access to the Journal of Mathematical Biology and the Bulletin of Mathematical Biology. Before the next board meeting this should be settled, but preferably sooner.

### **12. The society and the Journal of Mathematical Biology (JMB)**

The discussion focuses on the content and logistics for producing the two ESMTB pages for every issue of JMB. It is decided that the whole board bears the responsibility for producing content and that HH will coordinate and act as the contact to Springer. HH will approach Springer immediately concerning deadlines, submission details and format etc. HH will also contact Angela Stevens who, in the previous board, took the responsibility of designing an ESMTB logo. We need this logo urgently to put on the cover of the journal. HH will also discuss proposed content with the managing editors of JMB.

For content it is decided that an important aim is to attract mathematicians reading JMB to the society and to the field of mathematical and theoretical biology. It is not specifically intended as a source of information about the society to ESMTB members, since the website and the Communications continue to serve that purpose.

We propose to call the two pages: *Perspectives in Mathematical and Theoretical Biology*. Since the contributions have to be produced like clockwork in order not to hold up the printing of the monthly issues, we have to plan far in advance. It is decided that the president MG is responsible for the first issue; HB will review the EU network on cancer which is nearing its end for the second issue; RB will provide an announcement of coming ESMTB activities such as summer schools and conferences for the third issue; HH will make a selection of new books and journals for the fourth issue (probable twice a year); HH will approach an expert from the applied side of our field or from a methodological side of an associated field to write a short perspective on interesting mathematical problems from that area (twice a year, several names have been suggested) for the fifth and seventh issue; LP will write

on funding possibilities in Europe for the sixth issue. Detailed planning for the remaining issues of 2003 will be done before the next board meeting in September. Depending on the deadlines from Springer we hope to start with the April or May issue of 2003.

Each board member is responsible for sending suggestions for future content (as precise as possible) to HH. Suggestions from ESMTB members are also much appreciated.

### 13. The 6<sup>th</sup> framework program

LP will explore for the next board meeting how the ESMTB could step in the 6<sup>th</sup> framework program, in particular in connection with the Pierre et Marie Curie grants. An opportunity could be that such grants could be proposed and managed by the society through a European network.

### 14. Relations to other societies

MG argues that it is good for the ESMTB to be a member of EMS and ICIAM, and that he represents the society in EMS and ICIAM meetings. WA will explore possible connections with European societies in Bioinformatics and Biometrics. Relations with SMB: see item 11 above.

### 15. ESMTB Communications

WA reported that the last issue of the Communications were ready and sent by email mid-November, but unfortunately the printed version was not finished until mid-February due to problems with the printer in Rome. The printer in Rome will not be used again. His proposition is to carry on the Communications in a cheaper and more readily form. Two problems were underlined: i) cost and reliability of printing (at present shipping around 500 euros, printing 1500 euros); ii) finding a place for printing and shipping of the issues, since it is no longer possible at Rome and very difficult in Bonn. On the other hand, the periodicity of publication (twice a year) and content (past activities, dissertations, presentation of research groups, ...) remain quite appropriate. Issues should nevertheless cover a more representative fraction of the research and training activities of different regions in Europe. Scientific papers will no longer appear in the Communications.

Other points:

VK will analyse the possibility of taking care of the printing and shipping, on a basis of 300 to 500 copies of 50 pages, published twice a year. He will report on this within two weeks.

AD suggested that the access (web and paper) to the issue should be restricted to registered members only. PT suggests advertising new issues in the two JMB society pages. WA suggest that we should actively seek to increase advertisements in the *ESMTB Communications*, coming from not only book companies, but also from other companies (e.g. computers, scientific software). A typical announcement page for such potential sponsors must be written. PT and WA take over responsibilities for this.

After discussion, an editorial board for the communications has been established, including WA, HH, VK, HB, AD, PT (board members) and E. Geigant together with F. Lutscher (who has volunteered to become involved).

Next issue is planned for June/July.

### 16. ESMTB Web

AD agrees taking care of the web-site, including the transfer from the Leipzig site and maintenance. He indicates that the MTBio-network ([www.mtbio.de](http://www.mtbio.de)), which he has set up and maintains, will work in synergy but has different purpose.

### 17. Next ESMTB Conference

Previously contacted by V. Capasso, RB has accepted to investigate the possibility of organising the 6<sup>th</sup> ESMTB Conference in Alcala, Spain, in 2005. He will give a final answer before March 21, 2003, since accommodation for the estimated 500 participants is not yet assured. However, Madrid is located quite close. HB also investigates if organisation of the conference in UK is an alternative possibility.

ATTENTION: Soon after the meeting, both possibilities turned out not to be realizable. Then, after a brief search, already within March, the Board thankfully received the following offer:

- **The 6<sup>th</sup> ESMTB Conference will be held in Dresden, Germany**
- **Dates: July 18 – 22, 2005**
- **Main organizer: Andreas Deutsch**

### 18. Summer schools, workshops and other activities

RB is co-organiser of a summer school in Alcala this September. A proposition of a summer school "Cell Biology and Mathematical Modelling", in June 7-19, 2003, Island of Hvar, Croatia, is made by O. Arino. The board approves the request of O. Arino to announce this school as an ESMTB School. MG will approach O. Arino to discuss how the ESMTB could financially get some feedback from the schools (see item 11 above). He underlines that very often students have E.C. grants and thus cost reduction for students appears not crucial in this case.

### 19. Curricula in Europe

Main issues are: how to structure interdisciplinary curricula, and how to attract or bring biology to Applied Mathematics students.

Markus Kirkilionis, in Warwick, has offered to make a proposal and LP and HB will contact him.

The board meeting ends at 7h45 pm.

Recorded and written up by

*Philippe Tracqui and Hans Heesterbeek.*



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## Letters to the Board

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***Vincenzo Capasso, Milano ( December 17, 2002)***

Dear New Board Members.

Since I will not be in the new Board next year, I wish to congratulate all of you for having accepted this mission.

The fact that new and young members have been elected shows that the Society is alive, and reading your election statements I can see the enthusiasm and new ideas that you will bring in this challenging mission.

All of you know the aim of the EU Commission to establish a European Research Area; it is important that our scientific community shows the importance of theory and mathematics to face the enormous challenges which arise from the emerging fields of Biology and Medicine to improve quality of Life.

I wish to let you know that I will always be available to support any action you will call me in, even though I am out of the Board.

As part of the Applied Math Committee of the EMS I will always keep the attention vivid on the above topics of our interest.

Many thanks again and welcome on BOARD!!

Vincenzo

***Hans Heesterbeek, Utrecht ( December 18, 2002)***

Dear Vincenzo and others,

thank you for your encouraging words. Since it takes too long to get everyone to collaborate on a fitting response I take the opportunity to say a few words to the departing board members.

Dear Vincenzo: I think I speak for everyone when I state that the society has benefited enormously from your ideas, initiatives and work you have done in the past six years. We would not be where we are today without your enthusiasm and endless willingness to do work for the society and promote it. No other president before you (while not in the least diminishing their efforts and results!) has put so much energy successfully into the society. We must all be very grateful and indeed hope that we can call on you for advice in the years to come.

Dear Zvia, Angela and Ovide: Also to you we must be very grateful for all your efforts on behalf of the society. The last three years were certainly the years in which the board showed the most activity and results and generated

a much increased visibility and usefulness for its members. Your contributions have been very diverse (journals, web-site, summer schools, ...) also very instrumental in keeping the society alive and active. If there is one additional thing that this board separated from others before it, it is that the board members really met for group discussions twice a year. I have enjoyed these discussions a lot and I feel they really help in furthering the aims of our society. We must thank you also for your contributions to these meetings.

Last but most certainly not least, we should be very grateful to Mark. He acted as secretary and treasurer for the society for many years. Out of administrative chaos that he inherited, he created a clear picture of the societies members and assets. He set up an administrative and financial system that will serve us very well in the future and this is a most valuable and necessary asset for a self-respecting society. For this, and for his any other activities for the society, we owe him lots of thanks.

Hans

***Zvia Agur, Bene-Ataroth, Israel (December 18, 2002)***

Dear Hans and all new and old members of the Board.

First of all, thank you, Hans, for your kind words. In the last two years I have done very little for the society, but am quite proud of being part of the group of people who shaped its initial form. I wish the new members a lot of success in bringing the society to new successes and hope to meet all of you in the near future.

Yours,  
Zvia

***Hans Westerhoff, Amsterdam ( December 17, 2002)***

Dear Friends.

As non elected candidate, I congratulate the ESMTB and the elected candidates with this great new board. I shall be more than willing to help the new board whenever they feel this might be useful. I thank the election committee for the fair organization of the elections.

Sincerely Yours,

Hans V. Westerhoff

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## Report on Funding Programs

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### VI Framework Programme launched by the European Commission (EC)

The aim of this report is to give a brief overview of the basic features of the VI Framework Programme for Research and Technological Development (FP6) of the EC which may be of interest for researchers in the field of mathematical and theoretical biology. In particular, the attention will be mainly devoted to the so-called Marie Curie Actions. The hope is to give a guide for navigating through the various activities, funding schemes, thematic areas, type of projects, deadlines, web-sites, and so on.

The first step of the VI Framework Programme was the identification of seven priority thematic areas. Among them, the thematic areas of major interest for researchers in mathematical and theoretical biology are:

- **Life sciences, genomics and biotechnology for health**, which is sub-divided in “Advanced genomics and its applications for health” and “Combating major diseases” ([www.cordis.lu/fp6/lifescihealth/](http://www.cordis.lu/fp6/lifescihealth/))
- **Food quality and safety** ([www.cordis.lu/fp6/food/](http://www.cordis.lu/fp6/food/))
- **Sustainable development, global change and ecosystem** ([www.cordis.lu/fp6/sustdev/](http://www.cordis.lu/fp6/sustdev/))

A call for submission of Expressions of Interests was done last year in June and was aimed at the formation of Networks of Excellence and Integrated Projects. At present the European Commission is at the end of the evaluation procedure. The Expressions of Interests can be searched at the internet site.

Another interesting opportunity for researcher of such a growing and interdisciplinary field as mathematical and theoretical biology is given by the activity on **NEST - New and Emerging Science and Technology**, that aims to support unconventional and visionary research with the potential to open new fields for science and technology ([www.cordis.lu/fp6/nest/](http://www.cordis.lu/fp6/nest/)). This activity is divided in

“Adventure” projects aimed at applying innovative and multidisciplinary approaches to address long-standing challenges.

“Insight” projects focussing on potential risks to society of newly discovered phenomena or new scientific developments.

“Pathfinder” initiatives which will support a group of complementary projects focussed on specific, highly challenging objectives, to advance work in emerging scientific and technological fields.

In the framework of the Marie Curie Actions

([www.cordis.lu/calls/mariecurie-actions/](http://www.cordis.lu/calls/mariecurie-actions/),  
[www.cordis.lu/fp6/mobility/](http://www.cordis.lu/fp6/mobility/), or  
[www.europa.eu.int/mariecurie-actions/](http://www.europa.eu.int/mariecurie-actions/))

it is useful to distinguish between host-driven actions and individual-driven actions. In the former case the host institution applies for a number of researchers and, after approval, advertises the research positions and selects the researchers. In the latter case, the researcher applies jointly with the host and, if withdrawing, cannot be replaced by other researchers.

Before going through the list of possibilities, it is important to recall that early-stage researchers are those within the first 4 years of research activity, not holding a PhD degree yet, experienced researchers are those having at least 4 years of experience, or holding a PhD degree. Some actions are only open to experienced researchers with no more than 10 years research experience.

The Marie-Curie Actions typically require transnational mobility, i.e. a researcher must be national of a State other than that of the host organisation. However, with respect to the V Framework Programme that allowed only the employment of researchers of the Member States or the Associated States, participation and funding of researchers from third countries is foreseen in most of the actions.

The European Community has established the following reference rates for Marie Curie actions:

If recruited under an employment contract (as it is usually the case) an early stage researcher will receive 29000 Euros per year and an experienced researcher will receive 44500 Euros per years. In addition, they will receive mobility allowances (10800 Euros per year if they are moving with the family and 7200 Euros per year if not) reimbursement of travel costs depending on the distance from their country of origin (up to 2500 Euros per year) career development allowance (2000 Euros per year)

### *Host-driven actions*

**RTN - Marie Curie Research Training Networks:**  
[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=23](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=23).

**Next deadline: 19 November 2003**

This action is addressed to networks of universities, research centres, international organisations or enterprises mainly established in the EU or in an associated state. The aim of RTNs is to promote the training, mobility and professional development of researchers (mainly early stage), through research and transfer of knowledge, within the frame of international collaborative research projects. Projects normally last four years and fellowships can range from three months up to three years. At least 65% of the financial support must be allocated for expenses associated with the appointment of the young researchers.

**EST - Marie Curie Host Fellowships for Early Stage Research Training:**

[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=25](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=25)

*Next deadline: 11 February 2004*

This action is directed at European organisations that want to reinforce their training capacity for early stage researchers. Typically within the context of a PhD, training will focus on the acquisition of specific scientific and technological research competencies as well as complementary and interdisciplinary skills.

The scheme will support early-stage researchers of all countries and nationalities.

**ToK - Marie Curie Host Fellowships for the Transfer of Knowledge:**

[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=26](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=26)

*Next deadline: 19 May 2004*

This action is directed at European organisations that want to develop new areas of competence or to establish industry-academia exchange. Besides the recruitment of experienced researchers it is possible to send staff members to predetermined institutions. Fellows can be of any country or nationality. There are two schemes contemplated:

Marie Curie Development Scheme in which researchers transfer knowledge to develop the research potential of institutions. Priority will be given to organisations in Less-Favoured Regions of the EU and in the Associated States;

Marie Curie Industry-Academia Strategic Partnership Scheme supporting long-lasting collaborations between enterprises and universities via exchange of researchers.

**SCF, LCF - Marie Curie Conferences and Training Courses:** [fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=27](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=27)

*Next deadline: 20 April 2004*

This action is directed at the organisation of large conferences and series of events, e.g. conferences, summer schools, laboratory courses. Support will mainly be given for the participation of researchers with up to 10 years of research experience.

**Individual-driven actions**

**EIF - Marie Curie Intra-European Fellowships:**

[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=28](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=28)

*Next deadline: 18 February 2004*

This action will support internal mobility within EU Member States and Associated States for at most two years.

**OIF - Marie Curie Outgoing International Fellowships:**

[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=29](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=29)

*Next deadline: 12 February 2004*

This action will support the mobility from EU Member States and Associated States to a third country. The scheme includes a one to two years period abroad

followed by a mandatory return phase in Europe (one year).

**IIF - Marie Curie Incoming International Fellowships:**

[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=30](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=30)

*Next deadline: 12 February 2004*

This action will support mobility from third countries to EU Member State and Associated States for a period of one to two years. For developing countries, emerging and transition economies, support for fellows to return to their country of origin may be included.

**ERG - Marie Curie European Reintegration Grants:**

[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=35](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=35)

*Next deadline: Open call till 31 October 2004*

This action is addressed to researchers who have just completed a Marie Curie fellowship of at least two years and want to continue their research activities in a different organisation. Priority will be given to reintegration in the researcher's country of origin. The support will consist of a grant to be used within one year.

**IRG - Marie Curie International Reintegration**

**Grants:** [fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=36](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=36)

*Next deadline: Open call till 31 October 2004*

This action is addressed to European researchers who have carried out research outside Europe for at least five years. Financial support will be given for the professional reintegration project in a host organisation located in a Member State or Associated State during two years.

**Promoting and recognising excellence**

**EXT - Marie Curie Excellence Grants:**

[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=32](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=32)

*Next deadline: 18 May 2004*

This action aims at the creation and development of research teams for leading edge or interdisciplinary research. The grant will cover a period of up to four years and will be based on a well-defined research programme around a researcher who has, early in her/his career, shown the potential to reach a high level of autonomy and excellence.

**EXA - Marie Curie Excellence Awards:**

[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=33](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=33)

*Next deadline: 18 May 2004*

These are scientific prizes to give public recognition to excellence achieved by former beneficiaries of EC mobility and training grants. Candidates may apply themselves or will be proposed by others.

### EXC - Marie Curie Chairs:

[fp6.cordis.lu/fp6/call\\_details.cfm?call\\_id=34](http://fp6.cordis.lu/fp6/call_details.cfm?call_id=34)

Next deadline: 21 January 2004

This action supports world-class researchers of any nationality for a period of research and lecturing at a host organisation, in particular European researchers of world reputation who are active outside the Member States and Associated States, to encourage them to resume their careers in Europe. Appointments will have duration of one to three years.

All calls above can be also reached through the sites [fp6.cordis.lu/fp6/call\\_details.cfm?ID\\_ACTIVITY=594](http://fp6.cordis.lu/fp6/call_details.cfm?ID_ACTIVITY=594) or [fp6.cordis.lu/fp6/subprop.cfm](http://fp6.cordis.lu/fp6/subprop.cfm)

### Summarising:

Early stage researchers can apply for Host Fellowship for Early Stages Research Training, and for the participation in Research Training Networks and funded Conference and Training Courses.

Experienced researchers can apply to all measures but Host Fellowship for Early Stages. Of course Grants, Chairs and Awards are usually for very experienced researchers.

The sites where to look for fellowship vacancies can be reached through [www.cordis.lu/improving/opportunities](http://www.cordis.lu/improving/opportunities), [www.cordis.lu/improving/fellowship/](http://www.cordis.lu/improving/fellowship/), [improving.cordis.lu/mc](http://improving.cordis.lu/mc).

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## History of Mathematical and Theoretical Biology

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### Back to Bertalanffy: the system theoretical approach to biology

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#### 1. Introduction

Physics has shaped the scientific landscape of the 20<sup>th</sup> century to such an extent that the latter has been named „century of physics“. Today we witness impressive successes of the life sciences and, prognostically, one already has characterized the just started 21<sup>th</sup> century as „century of biology“. However, progress in applications is not always accompanied with that in theoretical foundations. In this respect, biology cannot compete with physics. Rather, since a long time, there stands a demand for a unifying conceptual framework of the biosciences.

The Austrian scholar *Ludwig von Bertalanffy* (1901 – 1972) had, since the thirties of the last century, proposed a holistic and system theoretical approach, named by himself *Organismic Biology*. His concept seems to be important also for us today, therefore we want to remind it here. In this context we will also touch the natural-philosophical concept of ‚strata‘ and discuss pros and cons of a ‚general system theory‘.

#### 2. Strata of Reality

Non-living nature, living nature and what belongs to the humans is usually distinguished with ease. However,



it is quite difficult to conceptually grab ‚life‘ or even ‚human life‘, i.e. to find firm definitions. The three ‚realms of nature‘ had been distinguished already in antique thinking. The philosopher Friedrich Engels (1820 – 1895) extended the scheme to five *forms of motion: mechanical, physical, chemical, biological, and social* [10]. Nicolai Hartmann (1882 – 1950), the main representative of the *ontological* direction of philosophy,

divided reality in four so-called *strata: anorganic, organic, mental, and spiritual* [13].

Each of these schemes also carries a ranking: from the lower to the higher level, from the simple to the complex. A lower stratum or quality (an equivalent notion in this context) is a condition for existence of higher ones.

The ontological distinction corresponds to a classification of sciences. The *empirical sciences* are divided according to their topics into *physics, chemistry, biology, and human sciences*. An alternative distinction separates *nomothetical (Gesetzes-)* from *ideographical knowledge (Ereignis-Wissen)*. Geography and history, to mention two examples, are ideographically dominated; *mathematics and philosophy* are *non-empirical sciences*, because their statements are per se not to be checked by experience.

The *strata concept* outlined here, raises fundamental philosophical questions:

- How are strata or qualities to be defined more precisely?
- What is life? What is man; or, what is intelligent life?
- Is a given stratum reducible to lower strata?

The answer of *reductionism* to the last question is yes, that of *holism* no. This pair of doctrines also characterizes views to the *part – whole* relation. Reductionism claims, that „the whole is reducible to its parts“, whereas holism says: „The whole is more than the sum of its parts.“ Strata theory puts high and low quality into relation like the whole and its parts.

Variants related to biology of reductionism and holism are *mechanism* (or *mechanicism*) and *vitalism*, respectively. The first claims that biology is reducible to physics and chemistry. The *machine theory*, a variety of mechanism, claims living beings to function like machines. Vitalism, an alternative philosophy of biology, postulates an immaterial principle named *vital force, entelechia* or something else that organizes life.

### 3. The quest for foundations of biology

After world war I the long-lasting discussion about fundamental questions of life sciences intensified. People sensed a discrepancy between accumulated knowledge of facts, on the one hand, and the current status of theory, on the other hand. Some authors compared biology with physics, which was just in a state of scientific revolution and on the way to great progress. The discussions mounted in demanding for a „*Theoretical Biology*“ comparable to Theoretical Physics. „Theoretical physics, founded on mathematics, is the purest model of general science“ ([18], p. 1).

Representative for the situation at that time is a book series (see [18, 11, 17]) edited by Julius Schaxel, in which he promoted the following program: „The *Abhandlungen zur theoretischen Biologie* constitute an arena that collects works of those biologists and philosophers, who try to bring the unsatisfactory plurality of biological theories nearer to a founded knowledge by critically investigating the relevant areas of research and teaching.“ ([11], p. III)

The actual discussion was still influenced by the continuing mechanism-vitalism debate. This more ideological controversy had, to say something positive, sharpened the view to relevant problems. Also in debate was Ostwald's *energetics*, which had a curious intermediate position between mechanism and vitalism [16]. For Wilhelm Ostwald (1853 – 1932) *energy* is more than a physical quantity, it is also a life-organizing principle. Philosophically, the energetic principle can be interpreted as being either material or immaterial.

Finally, a remark on *Darwinistic evolution theory* should be made. Seen from today, the wide-spread low opinion on it in those days might wonder: it was regarded hypothetical up to speculative. „With Darwinism clear concepts disappear...“ ([18], p. 11). To us, Charles Darwin (1809 – 1882) appears as the *Copernicus of biology*; he proposed the first general theory of life, which is able to explain evolution, functionality, and other observed facts. The big difference between then and today is, that the discovery of material (molecular) vectors of heredity still lay ahead. Because of bad experiences, people were suspicious of hypothetical constructions.

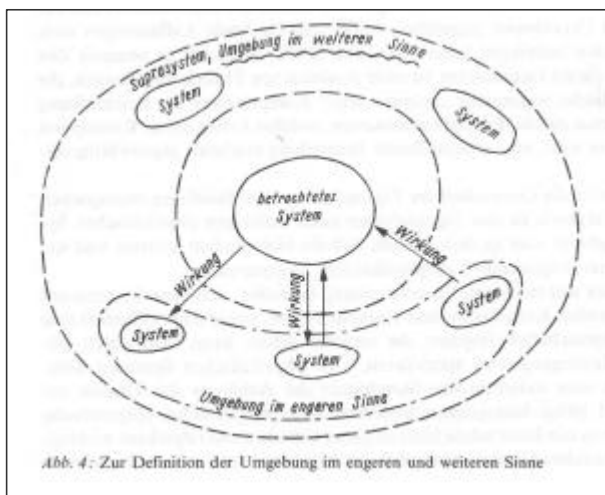
### 4. Bertalanffy's „Organismic Biology“

*Ludwig von Bertalanffy* (1901 – 1972), by education a philosopher, worked on fundamental problems of biology since mid of the 20-th. He published numerous articles and about half a dozen of books [2 – 9]. Already in his first book „*Theoretische Biologie*“ in 1932 [2] he developed the essential ideas. The preface starts with the sentence: „In this volume the attempt is undertaken to comprise the nowadays available theoretical results of biology, to order them and to present them from a unified point of view“ (p.III). Starting point is a discontent with the current status: „Most researchers



seem to agree that the formation of concepts and theories in biology is by far unsatisfactory“ (p.III). „It is a quite generally accepted fact that contemporary biology is in a critical state“ (p.1). And physics is named for comparison; a *theoretical biology* should be built after the model of theoretical physics.

In [2] Bertalanffy amply examines and evaluates the relevant literature. His profound critique of mechanism and vitalism, reviewed below, is valid timelessly. Mechanism, on one hand, can never fulfill its promise of completely reducing life to physical and chemical grounds. The analogy between organism and machine fails in one important question: Who is the constructor? On the other hand, vitalism postulates a transcendental principle just for explaining one observed fact: the well-organized functioning of organisms. This is not more parsimonious or plausible than the fact itself, thus it lacks any explanatory power. Moreover, supposing a vital force means to cross the border between natural science and philosophical confession!



Mechanism and vitalism are not, as often presupposed, an unavoidable alternative; Bertalanffy tells us that one can and should seek a third way. He calls his concept *organismic biology*. Important for him is the close verbal relation between *organism* and *organization*. The latter notion belongs to *system theory* and is nowadays mostly replaced by the synonyme *structure*.

A *system* generally may have *subsystems*, on one side, and may belong to a *supersystem*, on the other side. The subsystems of a system are ‚wired‘ like in a network. Thus, a hierarchy of structures can be established. Typical examples from biology are living beings, having *organs* as subsystems and belonging to a *population* as a supersystem. Also, organs have *tissues* as subsystems consisting of *cells*, and so on.

For complex systems the holistic principle holds: „The whole is more than the sum of its parts.“ This principle particularly applies to living beings or organisms. Therefore, so Bertalanffy, life has a higher quality than purely physico-chemical systems. This view contrasts to both, mechanism and vitalism, and is a philosophical statement. Also today, after so many years, essentially there is choice only between these three explanations of life: mechanism, vitalism, and the concept of *higher quality by holistic integrity*. Some new concepts that

have appeared since then, only facilitate conversation: *Emergence* means that complex systems can show other, higher properties than their building blocks [15]. *Synergetics* just models the cooperative interplay of such subsystems [12].

The philosophical dimension of Bertalanffy’s work, explicitly or implicitly given there, is not exhausted by our discussion. We refer to [21] for a more detailed investigation, which also shows that Bertalanffy’s opinions still appear to be modern, even today.

The first volume of his „Theoretische Biologie“ [2] is basically a program; and in relation to it, the second volume [4], published 10 years later, is just a realization. Today, the topics treated in [4] would be associated partially to *biophysics*, partially to *biochemistry* and, finally, to *biomathematics*. With [4] Bertalanffy has opened a series of later books on mathematical biology. Himself, he had started a third volume on Theoretical Biology, however, the manuscript was burned in April 1945 during a *razzia* of his apartment in Vienna. The further topics that he intended to treat therein were the *life cycle*, including reproduction and aging, *heritage*, *phylogeny* and *developmental physiology*.



*Growth* was one of the preferred themes of Bertalanffy. In [4] he proposed a plausible generalization of the *logistic growth model*. It contains one or two more parameters than the latter and can be recommended in applications to such situations, where the logistic model is not sufficient any more. Two key concepts developed in [4], *open system* and *flow equilibrium* (*Fließgleichgewicht*), have found a wide-spread acceptance and are generally attributed to Bertalanffy. It has been shown in [1] that Bertalanffy took over the term *Fließgleichgewicht* from the physicist and philosopher Gustav Theodor Fechner (1801 – 1887), on

whom he wrote his dissertation in 1926. Here one can recognize a direct line of ideas from classical German natural philosophy over Fechner to Bertalanffy and his followers. The „power of word“, i.e. the suggestive force of a well-chosen term, had a feed-back effect on the author himself: Later books published by Bertalanffy and co-workers were named „*Biolphysik des Fließgleichgewichts*“ [7, 9].

An anthology collecting some of his articles is titled „*General System Theory*“ [8]. In the series of books from [2] to [9] one recognizes a conclusive development: The system concept becomes a central point in [7, 8, 9] and is applied to more and more fields of research, particularly to psychology and psychiatry.

## 5. How general can a system theory be?

Ontology knows and uses the term ‚*thing*‘. It is material, limited in space and carries properties, in particular individuality. This very general term is given more precision by mathematical set theory and by system theory. Both, *sets* and *systems*, can first be imagined as *containers*. A set encodes only what is contained in it, namely *elements*; but it abstracts from all other aspects. A system encodes more information: it has an interior, the *proper system* itself, and an exterior, its *environment*. The environment effects the system by *inputs* and, in the other direction, the system effects the environment by *outputs*. This picture is usually visualized by a box, representing the proper system, and by arrows representing the inputs and outputs.

Essential for the system concept is the possibility of connecting various systems, then called *subsystems*, into a larger system: the output of one system can simultaneously be the input of another system. The ‚wiring‘ schedule for these connections constitutes a *directed graph* (being a network). Already on this elementary level, the system concept is able to make precise philosophical categories or, rather, pairs of categories as *thing – environment*, *part – whole*, *simple – complex*. The next modelling step takes into consideration *time*. Then categories as *structure – function – process*, *cause – effect*, and *development* can be specified. The *(inner) state of a system*, the inputs and outputs become functions of time. The inputs and earlier states determine the current state, the latter together with the inputs determines the outputs. This determination is interpreted as a *cause-effect relation* and drives development.

Numerous terms describe phases and types of development: *initial state – transient state – final state*, *rising – passing (Werden – Vergehen)*, *growth – decline*, *progression – stagnation – regression*, *evolution – revolution – catastrophe*, *equilibrium – cyclicity – chaos*, *stability – instability*, ....

A theory of systems in the framework of philosophy is desirable and realizable; it condenses and sharpens several philosophical concepts. However, attempts to formulate a mathematized *General System Theory* were not successful, at least so long as they tried to keep generality. On the contrary, *special system theories*

considering separate aspects, have emerged and proved worthwhile, in particular

*automata theory*,  
*signal theory*,  
*theories of control, regulation and optimization*,  
*theory of flow networks*,  
*symbolic dynamics*,  
*theory of dynamic systems*,  
*information theory*,  
*theory of stochastic processes*.

Special attention should be paid to the story of *cybernetics*. The term had been created in 1948 by the mathematician Norbert Wiener (1894 – 1964) in his famous book [19], whose full title is a definition: „Cybernetics or control and communication in the animal and the machine“. Seen from now, the excitement in those days about cybernetics can hardly be understood. The book [19] is an essay, which substantially does not contain anything more than was already published somewhere else, only presented the material under a unifying view and with a new name. The cover text of the later edition [20] exaggerates: „Like Darwin or Freud, for example, Wiener created the foundations of a new science“. Meanwile, the euphoria has calmed down since a long time. Especially curious was the reception of cybernetics in the Soviet Union and the East European countries: From a condemned bourgeois doctrine it advanced to a kind of prophecy and was integrated into the socialistic ideology. Cybernetics was the attempt to comprise special system theories as signal theory, control theory, information theory and others, into a „supertheory“. The success did not last long, due to the high autonomy of the specialized theories.

Bertalanffy is mentioned neither in [19], nor in prefaces of later editions [20], at a time when his work could well have been acknowledged.

Just to mention for completeness: a straight-forward application of the system concept to social sciences, as one would have expected sooner or later, has been worked out by the modern philosopher Niklas Luhman (1927 – 1998) in his „Systemtheorie der Gesellschaft“ [14].

## 6. Theses

Let us summarize the contents of this contribution in form of theses:

1. Both, the mathematical set concept and the general system concept sharpens the philosophical concept of a ‚thing‘.
2. *System* is a richer notion than *set*. In particular, several systems can be connected (‘wired’) into a larger system. Thus, hierarchic structures of arbitrarily high complexity can be modeled.
3. A *philosophical system theory*, partly existing and partly still being a program, comprises and sharpens numerous old and new ideas, whereas a mathematized *general system theory* turns out as not

- appropriate: it spontaneously disintegrates into special theories. This fate particularly hit *cybernetics*.
4. Ludwig von Bertalanffy made the system concept productive for the biosciences. Based on this he founded a holistic, non-mechanistic and non-vitalistic explanation of life.
  5. The key terms *open system* and *flow equilibrium* (*Fließgleichgewicht*) introduced by Bertalanffy, have found their way into general use.
  6. Bertalanffy's books served as a pattern for later monographies and course books on *Mathematical Biology*. Particularly important are his contributions to *growth models*.
  7. Up to now, the great aim of a *Theoretical Biology* after the model of *Theoretical Physics* is not reached. Nevertheless, Bertalanffy's vision, namely his system theoretical approach, is of continuing importance.

### Acknowledgements

The author is grateful to Wolfgang Alt, who encouraged him to write this article, enriched it by valuable hints, and translated the original manuscript from German into English. The author has never met Ludwig von Bertalanffy, but in 1967 at Leipzig he attended a *studium generale* lecture course by Walter Beier, one of the co-authors of Bertalanffy, which essentially relied on his work. These lectures, being rather modern at their time and place, had a long-lasting influence on the author.

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## Past Activities

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### Spring School: Modelling and simulation of biological processes in the context of genomics Dieppe (France) May, 11-16 2003

This second edition of the spring school (the first one was organised in Autrans in 2002, see the report in ECMTB 4: 23-26, January 2003) brought together biologists, physical chemists, physicists, statisticians and

computer scientists. During one week, this school gave leading specialists the opportunity to address an audience of doctoral and post-doctoral students as well as colleagues from other disciplines. Several themes structured the sessions, corresponding to the research activities of a multi-disciplinary group of scientists who have been meeting regularly at Genopole, a leading centre for genomics in France.



### ***Interpretations of high throughput biological data***

The introductory tutorial by *François Képès* aimed at demonstrating through two examples how a qualitative understanding of cellular dynamics could be used to ask fertile questions in biology and how bioinformatics could be particularly useful in providing the answers. The first example was the translational control of membrane protein assembly which has led to the '+70 pause' hypothesis. The second example was the regular positioning of coregulated genes along yeast chromosomes which has led to the 'solenoidal DNA' hypothesis of chromosome structure. This hypothesis-driven approach that feeds on large bodies of data was contrasted with the data-driven approach which is increasingly proposed despite its relative lack of success. The seminar by *Eduardo P. C. Rocha* illustrated nicely the hypothesis-driven approach. Starting from well-formulated hypotheses, he showed how the asymmetrical nature of the replication of the leading and lagging strands can induce biases in gene distribution and nucleotide composition that even affects the amino acid compositions of proteins. These constraints, which structure bacterial genomes, are opposed by the intense shuffling between the high number of repeats present in some genomes. Rocha then demonstrated how this trade-off between order and disorder has shaped modern-day genomes. *Bernard Vandebunder's* tutorial covered a wide range of concepts and practices in the fields of transcriptomics and of networks of transcriptional interactions. He rightly insisted both on the necessity for multidisciplinary work in these fields and on the importance of a dialogue between experimentalists using local or global approaches. 'Horizontal' exploration includes the inference of regulatory networks, modelling, analysis of subnetworks and bench experimentation. 'Vertical' exploration requires a proper consideration of multilevel events of chromatin structure and of the stochastic character of gene expression. *Vincent Schächter* and *Bertrand Séraphin* discussed the intricacies of proteomics from two different perspectives. Schächter tackled the two-hybrid approach which provides data on binary protein-protein interactions. He compared various technologies and results in detail. Séraphin described the TAP method, which uses tags to purify protein complexes and mass spectrometry to identify them, and compared it with the only other available technology. Both speakers pointed to the conceptual and technological pitfalls of each method, thus outlining very useful guidelines for the proteomics-oriented modeller.

*Marie Dutreix* and *Christine Froidevaux* have been using micro-array transcriptional analysis to detect the effects of low level exposure to radiation and pollutants on the yeast, *Saccharomyces cerevisiae*. They analysed their data using the RELIEF technique which is based on the level of activation of transcription within each class of instances versus variation between classes. They then compared the results of the RELIEF analysis with those from a standard analysis of variance and another standard deviation-based technique. Although these analyses did give some different results, they were in agreement in implicating genes associated with the

functions of the mitochondrial membrane such as oxidative phosphorylation and ATP synthesis.

### ***Membranes and hyperstructures***

*Chauouqi Misbah* devoted his talk to the dynamics of vesicles and membranes as observed *in vitro*. Firstly, he explained the physics of vesicles tumbling over or sticking to a surface in a flow of liquid. Critical dynamic regimes can be observed that depend on the ratio between the external fluid viscosity and the internal vesicle viscosity. The vesicle undergoes shearing stress and competition between adhesion onto the surface and a lift force. As the flow increases, the vesicle is deformed and can be detached from the surface. Above a threshold of the viscosity ratio, another dynamical regime appears in which the vesicles roll and tumble. Secondly, he discussed the fluctuations and deformations induced in phospholipid membranes by the binding of macromolecules. By considering the binding energy of the membrane and the possible diffusion of macromolecules within the membrane, he showed how a self-sustained increase of membrane curvature can be obtained by local recruitment of macromolecules. This phenomenon could provide a theoretical framework for explaining vesicle formation from almost planar membranes, for example, from the endoplasmic reticulum.

The lecture of *Georgia Barlovatz-Meimon* was devoted to the links between cell migration and extracellular matrix (ECM) remodelling. The underlying global regulation scheme is the feedback loop – biochemical and biomechanical signals from the micro-environment induce cellular responses that in turn modify the characteristics of the cell's environment. The plasminogen activator system (Pas) was given as an example of such coupling between the cell and the extracellular matrix. In this system, the type I inhibitor of the plasminogen activator (PAI-1) exists both in a diffusible form and as linked to an ECM protein such as vitronectin. This dual role was used to explain how the anti-proteolytic activity of PAI-1 on the ECM is nevertheless compatible with high levels of PAI-1 being a strong indicator of tumour invasiveness. The importance of PAI-1 to cell shape was shown by studying the distribution of F-actin in cells cultured on rigid supports coated with PAI-1 where cells adopted a morphology suitable for rapid migration.

Multi-agent systems are useful for simulating certain self-organising aspects of biological systems. *Abdallah Zemirline* and *Pascal Ballet* described multi-agent systems in which, firstly, the environment is a 3-D space, secondly, the agents exist in several categories and, thirdly, each category has a small set of rules that define the behaviour of the agent. These agents can represent biological objects and they interact with one another according to the composition and decomposition operations defined for dynamic graphs. They have developed software, BioDyn, in which a multi-agent system is combined with a dynamical mass spring system. This allows, for example, antibody binding or membrane deformations to be simulated and they showed how this could be done by building composite

agents out of simpler agents via both top-down and bottom-up approaches. To investigate the assembly and disassembly of large intracellular structures, *Patrick Amar* has developed a program that is a hybrid between multi-agent systems and cellular automata (which are simpler than agents, only interact locally). He explained that a molecule in his program can interact with its neighbours in four ways – association, dissociation, reaction and catalysis – and can diffuse from one voxel to the next. The numbers and biochemical characteristics of molecules, the size and geometry of the simulated cell, and the time-scale for diffusion and reactions are biologically realistic. He showed how his program could be used to investigate the polymerisation of one of the principal constituents of the eukaryotic cytoskeleton, actin, into filaments as well as the interaction of these filaments with the membrane.

### ***Nuclear processes and nuclear hyperstructures***

The lecture of *Danielle Hernandez-Verdun* was about the relationship between nuclear functions and nuclear organisation. She focused on the nucleolus and the pre-nuclear bodies (PNBs) which she presented as highly dynamic structures. Indeed, the nucleolus is not defined by a surrounding membrane but, to a large extent, only exists when engaged in its function of making ribosomes. PNBs are pre-aggregates which form during telophase and travel to transcription sites to form the nucleolus. The dynamics of PNBs was illustrated by videomicroscopy sequences that showed the oscillating features of PNBs formation and propagating concentration waves. The possible roles of PNBs were also reviewed and in particular their possible effects on cell-cycle regulation via modulation of cyclin kinase activity.

Deciphering the code written into chromatin structure and dynamics is one of the great questions of biology. *Arndt Benecke* showed that chromatin has both positive and negative regulatory effects on gene expression and argued that hypercycles of coactivator and corepressor action on the chromatin constitute this code. The numerous enzymatic modifications of an individual nucleosome change its state in a manner that is *a priori* independent from the underlying DNA sequence. He suggested that a chromatin modification code interpreted by transcriptional coregulators might also regulate all DNA-based nuclear processes including functional nuclear organisation in the shape of actively functioning chromatin hyperstructures.

*Bertrand Séraphin* reviewed RNA splicing mechanisms and focused on the recognition of introns and regulation of alternative splicing. The gene encoding troponin T was taken as example since its sequence, which includes five optional exons, allows a large number of different proteins to be generated. In the second part of his talk, he presented the splicing factors (snRNP U1, U2, ...) and showed how their association into complexes helps to finely tune splicing via a multi-recognition process. Transcription and splicing are coupled in time and space, and he discussed the possible regulation of splicing by external stimuli.

### ***Spatio-temporal organisation at different levels in biology***

The course given by *Hans Meinhardt* showed how positional information could be generated by the functioning of the system. He applied a concept of fundamental importance – local activation and long-range inhibition – to explain how a diffusion-reaction schema can operate at many levels in biology to generate dynamic structures. He illustrated his talk by treating the problem of pattern formation in systems as different as flies, hydra, seashells and bacteria. *Jan Traas* based his talk on the aerial growth of the model plant, *Arabidopsis thaliana*. This growth depends on the formation of highly organised, stable groups of cells (shoot apical meristems) despite these cells dividing and differentiating rapidly. The explanation may lie in the network of interactions between the cells which involves a plant hormone and membrane-linked transporters. He presented a ‘virtual meristem’ model which has parameters that should allow the action of genes to be identified and the behaviour of mutants to be predicted.

Many mathematical approaches to biological systems are based on differential equations or on partial derivatives although these approaches are sometimes confounded by the discrete nature of certain biological phenomena. *Alexander Bockmayr* presented a new, hybrid, type of program language, hybrid concurrent constraint programming, which overcomes this problem. The language, ‘Hybrid CC’, is a declarative one (i.e. it obeys familiar mathematical conventions) with a limited set of primitives that can be used to describe both continuous and discrete transitions. He showed how the language can be used to model splicing in HIV. *Marie Aimar* addressed the question of how to design a program that can be used in different simulations – and reused as the data change – and also be easy to validate and maintain. She explained why hybrid systems are valuable and focused on an object-oriented language SBML (a Structured Language for Biology) which she used in the context of the ‘virtual mitochondrion’ project to discuss relevant problems and their solutions.

### ***Physical chemistry and intracellular organisation***

To understand fully the controls over gene expression and progression through the cell cycle, it is essential to appreciate the factors responsible for determining the state of the chromosome. *Conrad Woldringh* explained that, within the bacterial cell, these factors include the behaviour of ‘Kuhn segments’. The chromosome can be considered as a chain of Kuhn segments which are relatively stiff segments of 158 nm that act as springs trying to force the chromosome apart. This self-interaction force is opposed by a cross-interaction energy that acts to increase the volume available for the soluble proteins. The result in the crowded cytoplasm is a phase separation of the nucleoid. He went on to propose that chromosome segregation results from a self-enhancing combination of the Brownian motion of condensed DNA segments plus the attachment of expressed genes to the membrane via the coupled transcription, translation and insertion of proteins into membrane.

If the Holy Grail in the post-genomics era is to obtain a realistic simulation of a cell, that realism is going to have to hold at the molecular level and the interactions of water and macromolecules must be considered. Water is the most abundant molecule within the cell and most of it is within two layers of biomolecules. Moreover, its physico-chemical properties are central to virtually every enzymatic reaction. Pascale Mentré introduced some of the basic concepts needed to understand how the water in contact with the surfaces of proteins and other molecules is structured. She explained that hydrophilic substances can be surrounded by a hydration shell that prevents them from precipitating. The oriented dipolar molecules of water around ionised domains of biomolecules may be in a state of electrostriction in which their density and pressure can reach 1.2 and 34 kbars respectively. Polar domains of biomolecules may also make H-bonds with water; the bonds between  $\delta$  electrons and H<sub>2</sub>O can keep hydrophobic residues on the surface of proteins whilst bonds between CH<sub>2</sub> and H<sub>2</sub>O are important in the structure of both DNA and proteins. Moreover, proton conduction in the water surrounding enzymes may be critical for their activity. The rapid movement of water itself might be facilitated by hydrophobic domains within the cell via the mechanism of hydrophobic hydration. Finally, she made it clear that cells must contain different intracellular compartments characterised by different water properties (affecting for example the concentrations of ions). A physicist's view of intracellular water was provided by *Marie-Claire Bellissent-Funel*. She concentrated on interfacial water (as opposed to bulk water) which includes the water on the surfaces of proteins and lipid membranes. She described neutron scattering studies of the translational and rotational diffusion as well as the vibrational density of states of confined water. Her examples included water confined in porous media, in the presence of organic solutes and on the surface of a deuterated C-phycoyanin protein. She showed how the vibrational density of states of interfacial water vary as a function of temperature and of the degree of hydration of this protein. She proposed a picture of interfacial water at room temperature in terms of an increase of the extension of H-bond network of water as it occurs in supercooled water at a temperature some 25°K lower.

In the context of simulating cells, *Eric Fourmentin* gave a brief review of projects that include Cybercell, Alpha Project and Silicon Cell. He then described a project initiated by the *Fondation Fourmentin-Guilbert*, SIMEBAC, in which the ultimate object is to contribute to a realistic simulation of *E. coli* via a bottom-up, fine-grained simulation of bacterial metabolism. He focused on the transcription of genes by RNA polymerase and discussed the problems that would have to be overcome in simulating it.

### **Epigenesis**

*Janine Guespin* presented the concept of epigenesis, namely, how cells or organisms with the same genotype can have stably different phenotypes as a result of differences in their history. She illustrated epigenesis by citing experiments in which brief exposure to an inducer

of the *lac* operon converted a population of *Escherichia coli* from one in which *lac* expression was stably *off* in a particular medium to one in which it was stably *on* in the same medium. These epigenetic states are examples of positive feedback leading to multistationarity and exhibit hysteresis. She explained that a single positive feedback loop is needed for multistationarity in a system of non-linear interactions whilst a negative loop is needed for homeostasis (with and without oscillations). She then applied these concepts to the case of mucus production in *Pseudomonas aeruginosa*, which is of importance in cystic fibrosis, to show how the operation of feedback circuits may mean that this production is actually due to epigenesis (see below).

*Jean-Pierre Vannier* began by describing how the initial stages in haematopoiesis are responsible for both the production of the different cells that will differentiate into particular types of cells and the maintenance of a population of stem cells that gives rise to these differentiating cells. Autocrine secretion is likely to be a part of positive feedback circuits responsible for epigenetic states in which stem cells are either quiescent or active in multiplying and differentiating. *Vannier* and *David Campard* then presented a model, based on the Boolean method of logical analysis formulated by René Thomas, in which an important role is played by the cells' microenvironment. Plants are able to store environmental stimuli and to respond to them much later. *Janine Guespin*, standing in for Michel Thellier, explained that an asymmetrical growth of cotyledons occurs when the apex of a *Bidens pilosa* L. seedling is decapitated; the asymmetric nature of this growth reflects asymmetric treatments inflicted on the seedling before the decapitation step. This system has been used to study how plants store and integrate signals before committing themselves to a growth strategy adapted to the environment. The logical analysis method can, she revealed, be used to explain the interplay between storage and recall functions and to predict stable states that can be tested experimentally.

The question of how to test the idea that an epigenetic state is responsible for mucus production in *P. aeruginosa* infections of the lung (see above) paved the way for the next speaker, *Gilles Bernot*. Many models in biology contain parameters that at best cannot be measured directly and at worst are uncertain or hidden. Gilles Bernot explained that this leads to the idea that only a class of models – rather than one specific model – can be validated. Development of a program of formal logic to assist in such validation should take into account firstly the coherence of hypotheses and data and secondly, since such coherence does not necessarily mean a hypothesis is correct, the need to generate pertinent experimental tests. He then showed how algorithms used in testing computer programs could be combined with Computational Tree Logic to suggest key experiments.

*Daniel Claude* gave a course on the essentials of control theory and introduced the notions of commandability, observability, and identifiability. Commandability means that there is always a command that allows the system to be driven from one state to another via a defined

trajectory. Observability is about being able to distinguish between different initial states of the system by following the evolution of observable parameters. Identifiability is about identifying the parameters of the system by studying input/output relationships. He said that it is now possible to use a probabilistic algorithm firstly to obtain the set of observable parameters of a system and secondly to decide how many other, non-observable, parameters are required. He illustrated the use of this algorithm in the case of the toxicity of certain antibiotics – aminoglycosides – on the human kidney where it shows that the best time for administration of the antibiotic is 13.30 h.

### **Conclusion**

The advantages of the long-term schedule of regular meetings in Genopole became clear at the Dieppe conference. The friendly, relaxed atmosphere was conducive to fruitful exchanges between specialists from different disciplines and between specialists and students. Indeed, the level of student participation was remarkably high and the (anonymous) evaluation by the

participants was positive. The take-home message of the conference may be that the post-genomic biology is going to be dominated by multi-disciplinary teams formed both from existing specialists and from a new generation of interdisciplinary students. And collaborative interactions between such teams are essential for progress towards an integrated picture of the cell and all the rewards that that will bring.

*Vic Norris, François Képès, Patrick Amar,  
Christophe Godin, Helene Pollard, Jean-Louis  
Giavitto, Philippe Tracqui, and Janine Guespin.*

The seminar work book of Autrans (in English) is available from Dr. H el ene Pollard, Directrice G enopole-recherche ([Helene.Pollard@genopole.com](mailto:Helene.Pollard@genopole.com))

The seminar work book of Dieppe is under preparation.

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## **Recent Theses**

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### **From models to experiments and applications: the optimal foraging theory and Allee effect**

*Michal Berec, Department of Zoology, University of South Bohemia, Ceske Budejovice, December 2002*

This thesis has two main parts. In the first part, one of the models of the optimal foraging theory (Charnov, 1976, Am. Nat. 110:141-151) is experimentally checked in great tits and compared with published data. The potential influence of limited memory capacity is also considered. The second part deals with the development of two-dimensional mathematical model of population growth with respect to the Allee effect and its application to some real data of turtle life history.

In the first section of the first part we test optimal foraging theory with great tits (*Parus major*) feeding on two prey types on a conveyor belt. Contrary to some previous experiments, prey types were given to birds at a random order. Thus, birds could not learn what is going to be the next prey item. At the beginning of each experiment birds could observe prey on the conveyor belt to estimate the proportion of two prey types. We tested a diet choice of birds at four different encounter rates. Our results show that great tits consumed more profitable prey upon each encounter in 95% of cases, while consumption of the less profitable prey type did not differ statistically from "always attack" in 77% of cases below a critical value of encounter rate with more profitable prey and did differ from "always attack" in 67% of cases above the critical value. Contrary to

predictions of the classical prey model of optimal foraging theory, our birds never completely excluded the less profitable prey type from their diet. We also estimated a predator functional response with respect to the more profitable prey type and showed that diet changes were too slow to make the functional response stabilizing.

The memory capacity is often considered as one of the most important characteristics of foraging predator. In the second section of the first part we test which type of memory is perhaps used by the predator during its foraging trials. We develop two basic models of memory --- time and numerical --- which we test in three and four variants, respectively. The classical model assuming fixed encounter rate with more profitable prey and model for memory capacity exceeding the duration of experimental trials are also compared. The statistical analysis does not show any clear result, although the results suggest that the "40 seconds window" model may be the best one. The negative results could be caused by using the same memory windows in different foraging trials.

In the second part we develop a spatially explicit, two-sex, individual-based model (IBM) and a derived spatially homogeneous model (SHM) to describe the Allee effect due to scarcity of mating possibilities at low population sizes or densities. The SHM, based on coupled difference equations, represents the first spatially homogeneous approach to this phenomenon, which discerns between sexes and relies only on measurable population parameters. The IBM reinforces

the findings of the SHM by adopting more realistic mate search strategies of diffusive movement and active search. Both models are characterized by a hyperbolic-shaped extinction boundary in the male-female state space that contrasts with a linear boundary in one-dimensional models of the Allee effect. We examine how the position of the extinction boundary depends on population demography (primary sex-ratio, reproduction and mortality probabilities) and adopted mate search strategies. The investigation of different phases in the IBM dynamics emphasizes the differences between local and global densities and shows the importance of scale when assessing the Allee effect. To demonstrate the potential application of our models, we combine the SHM and available data to predict the impact of

environmental temperature changes on two turtle species with temperature-dependent sex determination.

The content of this thesis has so far been published in the following papers:

Berec L., Boukal D.S., Berec M. (2001), *American Naturalist* 157, 217-230.

Berec M., Krivan V., Berec L. (2003), *Canadian Journal of Zoology* 81, 780-788.

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## Forthcoming Events

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### **International Symposium on Modeling Physiological Flows**

*Lausanne, Switzerland, September, 1-3, 2003*

The aim of the International Symposium on Modelling of Physiological Flows is to gather researchers in various branches of Applied Mathematics and Computational Fluid Dynamics with special focus on bio-flows.

As in many other fields of applied sciences, mathematical and numerical models are about to play an increasing role in biology and medicine. In particular, the mathematical and numerical investigation of physiologic flows, is destined to represent one of the major mathematical challenges of the next decades. The conference will have abroad scope and will include among others the following topics:

Mathematical analysis and numerical simulation of flow in large arteries.

Mathematical modelling of biochemical transport and activation.

Multiscale models for the cardiovascular system.

Non-newtonian models for blood rheology.

Respiratory flows.

Further information about the conference can be found at <http://ima.epfl.ch/cmcs/MPF2003>

### **Alcala 2<sup>nd</sup> International conference on Mathematical Ecology**

*Madrid, Spain. September 5-9, 2003.*

Mathematical Ecology originated in the work of Vito Volterra, although some would date its origins even earlier with Fibonacci's counts. Nowadays it has developed into a vast segment of ecology and has considerably broadened its scope, using mathematical techniques as varied as fractals or stochastic differential equations. It has also evolved towards computer implementation, which is now growing as a separate body but which we believe should still attract the interest of mathematicians. The conference will feature recent advances in mathematical ecology, using new but also classical approaches, in a variety of topics including (but not limited to) the following: population ecology, behavioral ecology, ecotoxicology, evolutionary dynamics, management of living resources, population grouping, spatial aspects of ecology, stochastic models in ecology, individual based models, multiple scaling, etc.. Proposals for organizing sessions on these topics or other related ones are encouraged.

The 2<sup>nd</sup> AICME is a follow-up of the 1<sup>st</sup> one, which was held in September 1998 in Alcalá de Henares attended by more than 200 participants, it gave rise to special issues in four journals (*Ecological Modelling*,

*Mathematical Biosciences, Natural Resource Modeling and Nonlinear Analysis R.W.A).*

More information, e.g. on plenary lectures, special sessions, funding, can be found on the website

<http://euromedbiomath.aicme.free.fr/>.

### **Computational Modelling in Medicine**

*Edinburgh, Scotland, September, 17-19, 2003*

Mathematical modelling and numerical simulation play a major role in many important medical applications. The meeting will be organised around the two interlinked themes of the vascular and pulmonary systems and soft tissue mechanics. The purpose is to bring together people who work on mathematical modelling, numerical analysis, simulation and direct medical applications in these and related areas, and to act as a focus to stimulate further research and the development of even more realistic medical simulations.

Invited speakers:

J Barbenel (Strathclyde, UK), A Cuschieri (Dundee, UK), M Heil (Manchester, UK), N Hill (Glasgow, UK), J Humphrey (Texas A&M, US), O Jensen (Nottingham, UK), C Johnson (Utah, US), S Shaw (Brunel, UK), J A Sherratt (Heriot-Watt, UK), R T Tranquillo (Minnesota, US), P Zunino (Lausanne, Switz)

More information can be found at

<http://www.ma.hw.ac.uk/icms/meetings/2003/cmm/index.html>

### **Dynamical Systems, Wave Based Computation and Neuro-inspired Robots**

*Udine, Italy. September 22-26, 2003*

The aim of the course, which is coordinated by professor P. Arena, is to introduce the participants to the new topics of bioinspired locomotion generation and control in walking and rowing machines, based on the theory of nonlinear, self-organising, dynamical systems. Theory will be argued with lab-like work, with the help of tutors. Participants will be allowed to implement and realize the basic tools for neuro-inspired robots.

CISM (International Centre for Mechanical Science) is a non-profit institution which, through the work of an international Scientific Council, organizes advanced schools addressed to researchers. The lecturers are all well known specialists at an international level.

In <http://www.cism.it/cism/p2003/annC0312> you will find information about the contents of the school and the procedures for admission.

## **Linking mathematical and biological models in cancer research**

*Magdeburg, Germany, September 24-27, 2003*

"We have always underestimated the cell" Bruce Alberts states in his article "The cell as a collection of protein machines" (Cell, 1998) and strongly argues for a new generation of scientists understanding the cell by means of biology, biophysics and mathematics. Given the unexpected low success rate in recent international efforts to fight cancer with new drugs, we are warned to simply translate our logic of molecular pathways into the complex system of a cell, a tissue or an organism. Totally new techniques will have to be developed and existing ones will have to be systematically combined to explore more successfully the mechanisms of cancer in vivo/in situ. In particular, pattern recognition methods and mathematical models are needed to analyze biological data and potentially predict critical functions which can then be tested experimentally.

The goal of this conference is to bring together and to discuss innovative approaches to the analysis of complex biological systems which promise to improve our knowledge on specific cancer mechanisms. Besides presenting highlights in this interdisciplinary field special attention will be given to presentations by young scientists, who, in the near future, are expected to strongly foster a new integrated form of cancer research.

The conference is structured into three main sections

1. Biological model systems
2. Pattern recognition methods
3. Mathematical modelling/simulation

Invited Speakers: Nicola Bellomo, Gerd Binnig, Andreas Dress, David Epstein, Ernst D. Gilles, Mike Khan, Mirosław Lachowicz, Enzo Medico, Luigi Preziosi, Kristin R. Swanson.

## **Dynamics Days 2003: XXIII Annual Conference: Four decades of chaos 1963-2003**

*Palma de Mallorca, Spain, September, 24-27, 2003*

Dynamics Days is an annual interdisciplinary conference designed to stimulate interactions amongst researchers with interests in dynamical systems, particularly those with nonlinear aspects.

Dynamics Days 2003 will take place from Wednesday 23 September to Saturday 27 September, on the campus of the University of the Balearic Islands, Palma de Mallorca, Spain.

Organizers: Oreste Piro (Palma), Julyan Cartwright (Granada)

OPENING SESSION SPEAKER: Edward Lorenz

CONFIRMED INVITED SPEAKERS:

Michael Berry, Oriol Bohigas, Leonid Bunimovich, Yves Couder, Pierre Couillet, Theo Geisel, Ray Goldstein, Celso Grebogi, Mogens Jensen, Rafael de la

Llave, Marcelo Magnasco, Giorgio Mantica, Igor Mezic, Heinz Georg Schuster, Jorge Tredicce, Angelo Vulpiani.

Apart from the plenary talks by the invited speakers, contributed oral and poster communications by participants are expected to form a large and important part of the meeting. Abstract submissions are therefore enthusiastically encouraged. Most of the accepted oral contributions will be arranged together with the plenary talks in a single session.

Additionally, a part of the conference will be devoted to special minisymposium sessions around common selected themes. These sessions will contain both key note talks and contributions. We anticipate having minisymposia on the following themes, but additional ones may be announced later.

### MINISYMPOSIA

<i>Biological systems</i>
<i>Socio- and econodynamics</i>
<i>Quantum chaos</i>
<i>Noise</i>
<i>Chaotic communication</i>
<i>Mixing and fluids</i>
<i>Patterns</i>

Deadlines for submissions: To be considered for an oral presentation, abstracts must be received by the organizers by 31st July. No limit will be placed on the number of posters.

The registration fee is 250 euros; there is a reduced fee of 150 euros for students.

There is a limited amount of funding available to enable students to attend who could not otherwise afford to do so, especially those from eastern Europe. Details of the funding and how to apply for it are given on the conference Web site - see below.

Accommodation for participants may be booked through the conference Web site.

Online registration and further information can be found on the conference web pages at

<http://www.imedea.uib.es/~ddays>

## **ECCB 2003**

*Paris, France, September 27-30, 2003*

The Second European Conference on Computational Biology (ECCB 2003), held in conjunction with the French National Conference in bioinformatics (JOBIM 2003), will be take place at the Centre de Conférences de La Villette, Paris, France, on September 27-30, 2003.

Invited speakers include Hiroshi Akashi, Jürgen Brosius, Nir Friedman, Thomas Lengauer, Pedro Mendes, François Taddei, Janet Thornton and Andy Waters. Thirty-five other speakers will be chosen out of 241 submitted abstracts for long and short papers.

Posters are sought reporting on original research (both theoretical and experimental) in all areas of computational molecular biology.

## ABSTRACT SUBMISSION

Starting from May 6 2003, you may submit at the ECCB'2003 web site your two-page (including figures) poster abstract, uploading a LaTeX source file (dvi format) or Word file (rtf format), AND a .pdf version, following the author's instructions given at:

<http://www.inra.fr/eccb2003/callpost.htm>

SUBMISSION DEADLINE FOR POSTER ABSTRACTS: June 1st, 2003

For further information, please contact

[poster-eccb@jouy.inra.fr](mailto:poster-eccb@jouy.inra.fr)

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## 2004

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### **International Symposium on Dynamical Systems Theory and Its Applications to Biology and Environmental Sciences**

*Shizuoka University, Japan, March 14-17, 2004*

The purpose of conference is to discuss many interests on the rich properties of dynamical systems appeared in biology and environmental sciences. The symposium constitutes of the lectures by about 30 eminent mathematical biologists and contributed oral or poster sessions. Collections of papers based on the presentations made during the symposium may appear as special issues of international journals and as a book.

Invited speakers:

Karl Sigmund, M. G. Neubert, Ulf Dieckmann, Sergej Aksenov, Leon Glass, Josef Hofbauer, J. M. Cushing, E. Beretta, Odo Diekmann, Horst R. Thieme, Hal Smith, Y. Kuang, S. Ruan, L. Chen, Z. Ma, W. Wang, W. Ma, Z. Lu, O. Arino, Jingan Cui, J. So, H. I. Freedman.

<http://yoake.sys.eng.shizuoka.ac.jp/~dynamics/>

### **Gordon Research Conference on Theoretical Biology & Biomathematics**

*Tilton, NH, USA, June 6-11, 2004*

Chairs: Tim C Elston & Raymond Mejia

Vice Chair: Paul C Bressloff

This conference serves to introduce students and bring participants to the forefront of areas of investigation covered by Theoretical Biology & Biomathematics. This

year the topics given below have been selected for discussion at the plenary sessions. Poster sessions will afford participants an opportunity to present and discuss work in all areas of Theoretical Biology & Biomathematics.

Topics for Discussion:

Emergent Species/Diseases and Invasion (Carlos Castillo-Chavez), Theoretical Ecology (Graciela Canziani), Immunology (Ramit Mehr), Neurobiology (Paul Bressloff), Motors and Motility (Ed Pate), Systems Biology/Molecular Regulatory Networks (John Tyson), Stochastic Effects in Gene Regulation and Signal Transduction (Jeff Hasty), Biofluids (Aaron Fogelson), The Future of Biomathematics and Theoretical Biology (Alan Hastings).

### **Joint Meeting of the Seventh International Conference on Mathematical Population Dynamics (MPD7) and the Third International Conference on "Deterministic and Stochastic Modeling of Biointeraction" (DESTOBIO 3)**

*Povo (Trento), Italy, June 21-25, 2004*

Topics of the conference will be the use of mathematical models in different areas of biology, especially ecology (including epidemic spread), cell population dynamics (including immunology, tumour growth), and molecular biology (including molecular evolution and genetics, genomics).

The Conference will consist of plenary lectures, parallel sessions on some of the topics outlined above, plus contributed talks and posters. Everybody is invited to suggest proposals for sessions in related areas any time before January 1, 2004. A proposal form will be made available on the Web page [www.science.unitn.it/~dbio-mpd](http://www.science.unitn.it/~dbio-mpd)

More information on the conference can be found on <http://www.science.unitn.it/~dbio-mpd/>

SCIENTIFIC COMMITTEE:

Agur, Zvia (Institute for Medical BioMathematics, Israel), Axelrod, David (Rutgers), Bellomo, Nicola (Pol. Torino), Bertuzzi, Alessandro (CNR, Roma), Braumann, Carlos (Evora), Chakraborty, Ranajit (Cincinnati), Diekmann, Odo (Utrecht), Gatto, Marino (Pol. Milano), Gyllenberg, Mats (Turku), Herzel, Hanspeter (Humboldt, Berlin), Iwasa, Yoh (Kyushu), Willi Jäger (Heidelberg), Krivan, Vlastimil (Czech Acad. Sci.), Langlais, Michel (Bordeaux), Levin, Simon (Princeton), Mackey, Michael (McGill), Mode, Charles (Drexel), Rudnicki, Ryszard (Silesian Univ.), Stevens, Angela (Max Planck Inst., Leipzig), Webb, Glenn (Vanderbilt)



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