

1st NIH-INRIA : Biomedical & Life Sciences Computing Workshop

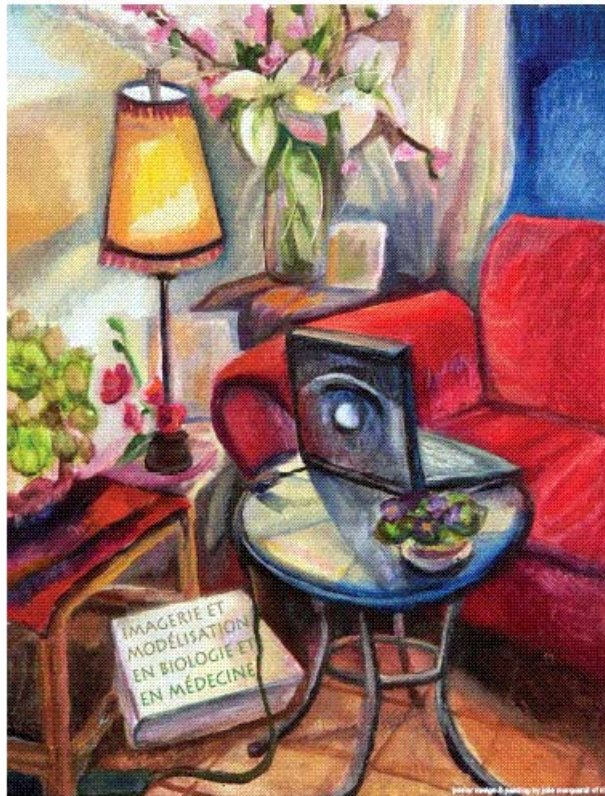
1^{er} séminaire NIH-INRIA : Imagerie & modélisation en biologie et en médecine

April, 16-17 / Avril 2007, Bethesda, US

Workshop report / Bilan du séminaire

<http://www-direction.inria.fr/international/NIHINRIAWorkshop.html>

Organized by the Fogarty International Center and the National Institute of Child Health & Human Development of the National Institutes of Health (NIH) and the Institute for Research in Computer Science and Control (INRIA), with the help of the French Embassy



NIH • INRIA
BIOMEDICAL & LIFE SCIENCES
COMPUTING • WORKSHOP

April 16-17, 2007

Natcher Conference Center, Building 45
National Institutes of Health, Bethesda, Maryland

For more information:

<http://www.inria.fr/international/NIHINRIAWorkshop.html>



INSTITUT NATIONAL
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Introduction

En premier lieu, il nous faut situer le contexte de l'organisation de ce séminaire : les sciences du vivant représentent 2 des 7 défis stratégiques de l'institut, 1/3 des équipes-projets de recherche est impacté par ce domaine. Il est important que les chercheurs de ces équipes puissent collaborer avec les collègues du meilleur niveau scientifique et de grande réputation internationale et particulièrement ceux des National Institutes of Health aux Etats-Unis. (<http://www.nih.gov/icd/>).

Pour inciter et favoriser les collaborations, un des meilleurs moyens est l'organisation d'un séminaire qui puisse réunir les chercheurs INRIA et ceux des NIH. Parmi l'étendue des domaines scientifiques, le choix s'est porté sur trois thèmes principaux : Brain Imaging and Modeling ; Systems Biology, Biological and Molecular Modeling ; Cardiac, Blood Vessels, Imaging & Modeling. Les trois coordinateurs pour l'INRIA étaient Rachid Deriche, Alain Viari et Hervé Delingette. David Monteau de la Direction du Transfert et de l'Innovation a contribué à la coordination scientifique.

Les trois coordinateurs américains étaient Peter Basser, Ruth Nussinov, Elliott McVeigh.

Le séminaire a réuni les 16 et 17 avril, à Bethesda, US, 18 conférenciers de l'INRIA et 15 des NIH. Un peu moins d'une centaine de personnes étaient inscrites comme auditeurs.

L'organisation de ce séminaire a été rendu possible grâce au soutien de l'Ambassade de France à Washington et la contribution du service scientifique, le département des relations internationales des NIH, celui du NIBIB. La coordination générale a été assurée par A. Theis-Viémont à la Direction des Relations Internationales de l'INRIA.

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The context of the organization of this seminar rests on the importance of the Life Sciences research domain which represents 2 of the 7 strategic priorities of INRIA. One third of INRIA project-teams is doing research in this field. It is of prime importance that researchers can collaborate with colleagues whose scientific reputation is worldwide known, especially those from the NIH institutes in the USA.

To incite and bolster such collaborations, the organization of a joint workshop was decided to gather colleagues from both institutions. Among the richness of the field, three main topics were chosen : Brain Imaging and Modeling ; Systems Biology, Biological and Molecular Modeling ; Cardiac, Blood Vessels, Imaging & Modeling. The three American coordinators were Peter Basser, Ruth Nussinov, Elliott McVeigh. The three French ones were Rachid Deriche, Alain Viari et Hervé Delingette. David Monteau from INRIA DTI contributed to the scientific coordination.

The workshop gathered in Bethesda, US, on April 16th and 17th, 2007, 15 American speakers and 18 INRIA ones. Around 100 participants were registered.

The support of the French Embassy and the contribution of its scientific department, the involvement of the International Department of NIH and of NIBIB helped make this workshop a success. The overall coordination was ensured by Annick Theis-Viémont at the INRIA International Affairs Department.

I - Scientific summary by theme / Résumé scientifique par thème

The session "**Brain Imaging and Modeling**" took place on Monday, April 16th, 2007 and included 8 talks, 4 from NIH and 4 from INRIA. The first part of the morning session started with a talk on the neuro-informatics in the context of CNS Diseases and some perspectives given by Christian Barillot (INRIA project Team VisAGes) followed by a talk by Lynn Hudson, OD, NIH on profiling neural cells and moving towards the integration of data sets to predict and preempt neurologic disease. The two following talks of the morning session both addressed the Diffusion MRI, a relatively recent and exciting imaging modality with an overview of the recent contributions on Diffusion Tensor and Q-Ball imaging in the Odyssée/INRIA project by R. Deriche and on some HARDI (High Angular Resolution Diffusion Imaging) models, beyond the Diffusion Tensor at NIH, NICHD by Evren Ozarslan and Valery Pickalov.

The afternoon session included also 4 talks from both institutions. The first part of the afternoon session was dedicated to the exploration of the brain activity with MEEG (Magnetoencephalography) and started with a talk by Maureen Clerc (INRIA Project Team Odysee) focused on the models and the methods and followed by a talk by Richard Coppola (NIMH, NIH) focused on the methods and the applications in Cognitive Neuroscience.

Finally the last two talks of the afternoon session were dedicated to functional MRI with a first talk focused on the fMRI in practice with a list of realword problems by Ziad Saad (NIMH, NIH) and a second talk by Bertrand Thirion (Neurospin/Inria) revisiting the neurospinstructural analysis of fMRI Data to improve the sensitivity and reliability of fMRI group studies

The talks were all of very high quality and clearly illustrated the scientific excellence and the complementarity of the work that is currently performed by all the partners. Many questions were asked to the speakers and some interesting discussions continued even after the talks. Overall, this session clearly highlighted some common subjects of great interest (Diffusion MRI and MEEG, fMRI..) between the NIH and INRIA partners and the aim of this workshop will be fully reached if it will finally contribute to initiate some common projects in the close futur.

The session "**Systems Biology, Biological and Molecular Modeling**" was divided into four subsessions, respectively Monday afternoon, Tuesday morning, noon and afternoon. The subsessions attempted to group the wide range of topics of the overall session into coherent blocks.

Six speakers (four from INRIA and two from the NIH) presented their work during the first subsession of Monday afternoon. Dirk Drasdo presented a spatio-temporal model of tumor growth; David Levens showed his molecular analysis of the regulatory logic of the c-myc promoter; Jean Clairambault modeled the relationship between the circadian rhythm and the cell cycle, again focusing on applications in tumor growth; James McNally explained a novel analysis for measuring binding interactions in vivo using fluorescence techniques; Hans Geiselman presented the qualitative modeling of a bacterial genetic regulatory network and the comparison with experimental data; Ovidiu Radulescu presented a modeling approach for very large genetic regulatory networks in bacteria.

Four speakers (two from INRIA and two from the NIH) presented different aspects of data analysis during the first subsession Tuesday morning. Jean-Charles Lamirel spoke about novel algorithms for efficient data mining; Martin Meier-

Schellersheim presented a user-friendly tool for constructing and modeling genetic regulatory networks; Mireille Regnier showed how information can be extracted from the analysis of DNA sequence data; John Spouge complemented the seminar of Mireille Regnier by focusing on the problem of treating repeats in the analysis of sequence data.

The session between 11h and 12h was dedicated to molecular modeling with two speakers, one from each institution. Stephan Redon presented an innovative tool for molecular modeling that rigidifies parts of the structure in an adaptive manner to efficiently calculate atomic interactions; Eric Henry showed a very detailed model of the folding pathway of a protein.

Three speakers (one from INRIA and two from the NIH) spoke in the final subsession of Tuesday afternoon. Bernie Brooks presented a grid based method, coarse-graining and quantum mechanics for the molecular modeling at large time and length scales; Frederic Cazal presented an algorithm for using geometric constraints to improve docking of molecules; Gerhard Hummer explained a method for defining a "best" reaction coordinate for modeling the molecular transitions such as enzymatic reactions and transient unfolding of proteins.

The topics of the different subsessions were rather divers, but all subsessions showed clear complementarities between the groups of INRIA and the NIH. For certain aspects, e.g., sequence analysis, there are already existing collaborations between the groups at the two institutions. For the participants that had not previously met, there was a clear interest in each others work. A second meeting would certainly help to solidify these first interesting contacts.

The session entitled "**Cardiac, Blood Vessels, Imaging and Modeling**" took place on Tuesday afternoon. On the Inria side, 3 presentations were dedicated to the numerical modeling of the cardiovascular system:

JF Gerbeau on the modeling of cardiac valves,

M. Fernandez on the modeling of electrophysiology and

H. Delingette on the national research action CardioSense3D.

Those presentations were matched with three presentations from NIH researchers around new imaging techniques for measuring myocardial perfusion (A. Arai),

imaging the mitral valve flow (S. Sampath) and

measuring the myocardial motion with Magnetic Resonance Imaging (E. Mc Veigh).

Finally, M. Thiriet presented the research activity of the REO team on modeling the airway flow of the lungs while R. Summers showed the impact of virtual colonoscopy on the detection of polyps in the colon.

This session showed fairly complementary strengths between research activities held at INRIA and in the intramural programs of NIH. Indeed, the INRIA teams are clearly focusing more on the algorithmic and numerical aspects of the modeling while the NIH researchers have built a strong expertise on creating new image acquisition techniques and their validation in a clinical setting.

Programme

Monday, April 16th, 2007

9:00 - 9:50	Opening session, Room E1-E2, (photo)	
	Dr. Roderic I. Pettigrew, Director, National Institute of Biomedical Imaging and Bioengineering	
	Dr. Michel Israël, Science Attache at the French Embassy	
	Dr. John W. Haller, NIBIB, NIH, Program Director, Division of Applied Science and Technology	
	Dr. Malik Ghallab, INRIA Vice President for Science and Technology	
9:50 - 10:10	Coffee break	
10:10 12:00	Brain Imaging & Modeling (session 1) , room E1-E2 (photo) Parallel session Moderators: Peter Basser, Rachid Deriche	
10:10 10:35	Neuroinformatics in the Context of CNS Diseases, the VisAGeS/INRIA Perspectives, Christian Barillot - INRIA Project Team VisAGes (abstract)(presentation)	
10:35 11:00	Profiling Neural Cells: Moving Towards the Integration of Data Sets to Predict and Preempt Neurologic Disease, Lynn Hudson, OD, NIH	
11:00 11:25	Diffusion MRI Processing: From Images to White Matter Fibers, Rachid Deriche, INRIA Project Team Odyssée, (abstract)(presentation)	
11:25 12:00	Diffusion MRI: Beyond the Diffusion Tensor, Evren Özarlan & Valery Pickalov, NICHD, NIH,	
12:00 - 1:00	Lunch break Natcher Cafeteria	
1:00 - 4:00	Brain Imaging & Modeling (session 2) room C1-C2 (photo) Parallel session Moderators: Peter Basser, Rachid Deriche	Systems Biology, Biological and Molecular Modeling (session 1), room G1-G2 (photo) Parallel session Moderators: Ruth Nussinov, Hans Geiselmann
1:00 - 1:25	(abstract)(presentation) Exploring Brain Activity with Magnetoencephalography: Models and Methods, Maureen Clerc - INRIA Project Team Odysee,	A Systems Biology Approach to Multi-Cellular Tissues: Single-Cell Based Modeling of Tumor Growth and Liver Regeneration, Dirk Drasdo, INRIA Project Team Bang, (abstract)(presentation)
1:25 - 1:50	(presentation) MEG Methods and Applications in Cognitive Neuroscience, Richard Coppola, NIMH, NIH,	Reverse Engineering The C-Myc Promoter: Using Statistical and Physical Methods to Infer Molecular Mechanisms, David L. Levens, NCI, CCR, NIH, (presentation)
1:50 - 2:15	(abstract)(presentation) Modeling the Brain Variability, Hervé Delingette, INRIA Project Team Asclepios,	Modelling Normal and Tumoral Tissue Proliferation to Optimise Cancer Treatment, Jean Clairambault, INRIA Project Team Bang, (abstract)(presentation)
2:40 - 3:10	fMRI in Practice: Realword Problems, Ziad Saad, NIMH, NIH, (presentation)	Towards the Measurement of Molecular Binding Rates in Vivo, James McNally, NCI, NIH, (presentation)

3:10 - 3:40	Structural Analysis of fMRI Data Revisited: Improving the Sensitivity and Reliability of fMRI Group Studies, <i>Bertrand Thirion, Neurospin</i> , (abstract)(presentation)	Qualitative Simulation of the Carbon Starvation Response in Escherichia Coli, <i>Hans Geiselman, INRIA Project Team Helix</i> , (abstract)(presentation)
3:40 - 4:10	(abstract)(presentation) Matching categorical object representations in inferotemporal cortex of man and monkey, <i>Niko Kriegeskorte, NIMH, NIH</i> ,	Improving Model Consistency by Qualitative Equations, <i>Ovidiu Radulescu, INRIA Project Team Symbiose</i> , (abstract)(presentation)
4:30 – 6:00	Reception, Lawton Chiles International House, Building 16, Stone House	

Tuesday, April 17th, 2007

8:45 - 10:45	Cardiac, Blood Vessels, Imaging & Modeling (session 1), room C1-C2 Parallel session <i>Moderators: Elliott McVeigh, Hervé Delingette</i>	Systems Biology, Biological and Molecular Modeling (session 2), room G1-G2 Parallel session <i>Moderators: Ruth Nussinov, Hans Geiselman</i>
8:45 - 9:15	Numerical Simulation of Blood Flows, <i>Jean Frédéric Gerbeau, INRIA Project Team Reo</i> (abstract)(presentation)	The MVDA Approach: An Emergent Data Analysis and Data Mining Method for Toxigenomics, <i>Jean-Charles Lamirel, INRIA Project Team Cortex</i> ,(abstract)(presentation)
9:15 - 9:45	Modeling Myocardial Perfusion with MRI, <i>Andrew Arai, NIH</i>	A Biologist-Friendly Approach to Multiscale Computational Cell Biology, <i>Martin Meier-Schellersheim, NIH</i> , (presentation)
9:45 - 10:15	Numerical Simulation of the Lung , <i>Marc Thiriet, INRIA Project Team Reo</i> , (abstract)(presentation)	Algorithms and Statistics on Sequence, <i>Mireille Régnier, INRIA Project Team Algo</i> , (abstract)(presentation)
10:15 - 10:45	Virtual Endoscopy, <i>Ron Summers, NIH</i>	A Mathematical Theory for Detecting Repeats in Biological Sequences and Its Applications, <i>John Spouge, NLM, NCBI, NIH</i> , (presentation)
10:45 - 11:00	Coffee break	
11:00 – 12:00	Cardiac, Blood Vessels, Imaging & Modeling (session 2), room C1-C2 Parallel session <i>Moderators: Elliott McVeigh, Hervé Delingette</i>	Systems Biology, Biological and Molecular Modeling (session 3), room G1-G2 Parallel session <i>Moderators: Ruth Nussinov, Hans Geiselman</i>
11:00 - 11:25	Imaging Mitral Valve Flow and Leaflets, <i>Smita Sampath NIH</i>	Adaptive Molecular Dynamics, <i>Stéphane Redon, INRIA Project team I3D</i> , (abstract)(presentation)
11:25 - 11:50	Numerical Simulation of the Electrical Activity of the Heart , <i>Miguel Fernandez, INRIA Project Team Reo</i> , (abstract)(presentation)	Direct Application of a Simple Model to the Quantitative Analysis of Experiments on An Ultrafast Folding Protein, <i>Eric Henry, NIH</i> (presentation)

12:00 – 1:00	Lunch Break , Natcher Cafeteria	
1:00 – 2:15	Cardiac, Blood Vessels, Imaging & Modeling (session 3, room C1-C2) Parallel session <i>Moderators: Elliott McVeigh, Hervé Delingette</i>	Systems Biology, Biological and Molecular Modeling (session 4), room G1-G2 Parallel session <i>Moderators: Ruth Nussinov, Hans Geiselmann</i>
1:00 – 1:25	CardioSense3D : Towards an Electromechanical Model of the Heart, <i>Hervé Delingette, INRIA Project Team Asclepios</i> (abstract)(presentation)	Multi-scale Methods for Macromolecular Systems in Computational Biophysics, <i>Bernie Brooks, NIH, NHLBI</i>
1:25 – 1:50	Electromechanical Mapping of the Heart with MRI and Electrode Socks, <i>Elliot McVeigh, NIH</i>	Geometric and Topological Algorithms in Computational Structural Biology , <i>Frédéric Cazals, INRIA Project Team Geometrica, (abstract)(presentation)</i>
1:50 – 2:15		Protein Dynamics and Folding: From Transition Paths to Transition States, Reaction Coordinates, and Reaction Rates, <i>Gerhard Hummer, NIH, NIDDK</i>

2:15 – Plenary Session

General Wrap Up: Feedback from Break-out Sessions.

Closing session: Next steps? Joint / Synchronized Call for Proposals? INRIA call for proposals, etc...

III - Feedback from the researchers / Bilan de la part des chercheurs

General remark / Commentaire général

The workshop was well organized, the talks were interesting. As the workshop was organized on the premises of the NIH, the American attendants were attending only the conferences they wanted to listen to. However, the main American researchers interested by this workshop are pleased with this first edition. In particular, Dr Pettigrew, the director of NIBIB, expressed a great interest for this event, although he could not attend all the sessions, he came as often as possible. He insisted on wishing to organize a second edition on the same lines , next year in France.

On the French researchers' side, through the reading of the returned forms, established relationships exist between Rachid Deriche and Peter Basser and between Hervé Delingette and Elliott McVeigh. Promising and interesting collaborations have to be developed between Stéphane Redon and Bernard Brooks, Christian Barillot and Alexander M. Gorbach, Jean-Frédéric Gerbeau and Smita Sampath, Frédéric Cazals and Ruth Nussinov.

It also brought out the need within INRIA to organize intra workshops. It encouraged relationships and contacts between J. Clairambault and J-C Lamirel, M. Thiriet and C. Barillot, Bertrand Thirion and INRIA colleagues.

Furthermore, the initiative was really well perceived and a new edition next spring in 2008 is favourably foreseen.

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Le séminaire s'est bien déroulé, les exposés étaient intéressants. On peut regretter une participation des chercheurs américains moins assidue dans la mesure où ce séminaire était organisé dans leurs locaux. Cependant, les principaux chercheurs américains concernés par ce séminaire sont satisfaits de cette première réunion. On peut relever en particulier l'intérêt du Dr Pettigrew, directeur du NIBIB, qui est revenu assister à plusieurs reprises au gré de ses disponibilités aux exposés et a insisté sur le fait qu'il souhaite que ce séminaire soit le premier d'une série et qu'un séminaire équivalent soit organisé en France en 2008.

Du côté des chercheurs français, on peut faire ressortir à partir des questionnaires retournés, des collaborations établies entre Rachid Deriche et Peter Basser, Hervé Delingette et Elliott McVeigh, des relations intéressantes et prometteuses à développer entre S. Redon et Bernard Brooks, Christian Barillot et Alexander M. Gorbach, Jean-Frédéric Gerbeau et Smita Sampath, Frédéric Cazals et Ruth Nussinov.

Il ne faut pas négliger non plus que ce séminaire a été l'occasion en intra INRIA de favoriser des relations et des contacts entre J. Clairambault et J-C Lamirel, M. Thiriet et C. Barillot, Bertrand Thirion et des collègues INRIA ;

Par ailleurs, l'initiative a été bien accueillie et l'organisation d'une nouvelle édition au printemps 2008 favorablement perçue.

Le détail des commentaires des chercheurs INRIA est disponible sur demande.

Prospects / Perspectives

To run such a workshop and make it fruitful for everybody, it is recommended to avoid parallel sessions. Only plenary sessions should be planned.

A remote location or a location outside the organizer's premises should also be recommended for the next workshop as it should prevent the episodic attendance.

For the next edition, questions such as opening up the workshop to external attendants, Extramural NIH researcher have to be raised.

The topics and the themes should be more refined?

A new scientific committee should be named to start the process of the next edition.

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Il est recommandé, dans la perspective d'organisation d'une nouvelle édition de ce séminaire, d'éviter les sessions parallèles de manière à n'avoir que des sessions plénières ce qui permet une meilleure interactivité. Il est apparu que les chercheurs souhaitaient pouvoir participer à l'ensemble des sessions qui présentent des thèmes connexes aux leurs.

Un endroit en dehors du lieu de travail habituel des chercheurs est aussi à prévoir de manière à éviter la fuite des participants.

De plus, des questions se posent sur l'ouverture de ce séminaire à des participants extérieurs, à des participants extra mural des NIH. Ce point doit être discuté dans le cadre du lancement de la nouvelle édition.

En outre, faut il affiner les thématiques, les séquencer différemment ?

Un nouveau comité scientifique doit être mis en place pour lancer l'organisation de la nouvelle édition.

V - Financial statement / Bilan financier

L'INRIA a fortement investi dans cette opération car la demande était plus forte de ce côté que de celui des NIH. Cependant, le retour investissement/retour est bon car de solides contacts ont été noués.

French expenses / Dépenses françaises

INRIA

<i>Travel expenses : researchers, organizers and Vice Pdt for Science / Missions des conférenciers, des organisateurs et du DGRTI</i>	30 618,08 €
<i>Bills (restaurant, caterer, communication) / Factures (restaurant, traiteur, communication)</i>	1 357,05 €
Total	31 975,13 €

Ambassade de France

<i>Bill (reception caterer) / Factures (traiteur réception)</i>	2 853,09 \$
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American expenses / Dépenses américaines :

NIH

Posters	~300 \$
<i>Free conference & reception rooms rental / Prêt gratuit des salles (salles de conférences, salle pour la réception)</i>	0
Total	300 \$

Grand total	34 321.53 €	or 46 121.27 \$
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The INRIA's investment was financially bigger than the NIH's one as the INRIA demand was also stronger. However, as good connections were established, it is worth the investment.