

**NATIONAL INSTITUTES OF SCIENCE AND TECHNOLOGY – INCT
MONITORING AND EVALUATION**

PERIOD: from 2/4/2012 to 2/4/2013

IDENTIFICATION OF THE PROPOSAL

TITLE: INCT of Complex Fluids (INCT-FCx)

Number: 573560/2008-0

Term: from 2/4/2009 to 2/4/2014

Total funding: R\$ 4 200 000,00 + R\$ 1 466 244,88 = R\$ 5 666 244,88

General expenditures: R\$ 1 320 697,94 + R\$ 732 000,00

Capital: R\$ 2 732 650,00 + 340 000,00

Fellowships: R\$146 652,00 + R\$ 394 244,88

COORDINATOR: Antonio Martins Figueiredo Neto

MAIN INSTITUTION: USP

PARTICIPATING INSTITUTIONS: (see the submission form)

MEMBERS OF THE PROPOSAL: (see the submission form)

RESEARCH PROPOSAL (Attach to the partial report)

Were there any changes of the goals and targets of the proposal? () YES (X) NO

If yes, report these changes:

Were there any changes in the original chronogram? () YES (X) NO

If yes, report these changes:

Were there any problems to develop the proposal? () YES (X) NO

If yes, report these changes:

There was still the problem of a very small number of fellowships from CAPES to the INCT as we have mentioned in the last report. Actually, CAPES has not increased funding to the INCTs at the same pace as the other agencies, CNPq/MCT/FAPs. This led to the allocation of a very small number of scholarships to the INCTs, which forced the members of the INCT to present the same proposals to obtain graduate fellowships from the same agencies supporting the INCTs. The Science Without Borders program failed to alleviate this problem since it does not deal with national fellowships.

MEMBERS

WERE THERE ANY CHANGES IN THE INITIAL COMPOSITION OF THE RESEARCH TEAM? () YES (X) NO

If yes, report these inclusions and exclusions:

DESCRIBE MECHANISMS OF INTERACTION BETWEEN PARTICIPATING RESEARCH GROUPS OF THE INCT:

We used the following mechanisms of interaction:

1. The site of the INCT-FCx (<http://inctfcx.vitis.uspnet.usp.br>) was redesigned to become more attractive to visitors. In this website there are descriptions of the experimental facilities, discussion spaces, video recorded seminars and demonstrations on complex fluids.

2. We organized the annual school for the students of the groups of the INCT-FCx. Also, we organized a scientific meeting, in collaboration with the center for complex fluids at USP (NAP-FCx).

3. There were regular seminars at USP to discuss some features of the ongoing research work. These seminars were video recorded and also transmitted in real time by the IPTV-USP. The Steering Committee had periodic contacts to evaluate work in progress.

REPORT EVENTUAL DIFFICULTIES OF THE PARTICIPATING RESEARCH GROUPS AND THE MECHANISMS TO OVERCOME THESE DIFFICULTIES:

There were none.

WAS THERE EITHER THE INCLUSION OR THE EXCLUSION OF ANY INSTITUTIONS OR COMPANIES? () YES (X) NO

OBTAINED RESULTS / TARGETS

LIST AND COMMENT THE OBTAINED SCIENTIFIC AND/OR TECHNOLOGICAL RESULTS:

A – RESEARCH:

In the attached text, "Research Report", we highlight some topics that deserve to be mentioned. One of the main features of our Institute are to deal with multidisciplinary research. This text is an attempt to point out the interaction between groups, which has been made possible by the organization of the INCT.

B – TRAINING OF HUMAN RESOURCES:

During the last period, we were able to complete the program of training of 33 doctors and 17 masters. Furthermore, we promoted the training of students in various undergraduate research programs, some of them completed and others still ongoing, in different groups and laboratories associated with the INCT. We have tried, wherever possible, to stimulate our students to gain experience in different groups and laboratories of the Institute, instead of restricting the work to their own group of origin.

C – TRANSFER OF KNOWLEDGE AND TECHNOLOGY:

The work at the INCT has led to the generation of patents, processes and products.

In the biological interface, we obtained patent and developed software for the calculation of phytosterols in food intake. Lipidomic data have potential as biomarkers of disease (Unifesp).

We developed a method for the synthesis of silver nanoparticles, by the Unifesp group under the leadership of Lilia Courrol, using an Agar-Agar solution illuminated by a xenon lamp, followed by irradiation by ultrashort laser pulses. Initially, nanoparticles of 100 nm were created by illumination of the xenon lamp. Then, from the application of ultrashort laser pulses, their dimensions were reduced to less than 10 nm.

In a direction still more related to clinical research, the INCT group at the Albert Einstein Hospital, under the leadership of Lionel Gamarra, has been developing research on magnetic nanoparticles for using in treatment models of ischemic stroke, Parkinson, multiform glioblastoma tumors, and in the implementation of the magnetic hyperthermia technique.

The group led by Prof. G. E.S. Brito, from IFUSP, submitted a proposal by Biotec - Plastics and Metal Products Limited and the University of São Paulo, with the participation of the Institute of Physics, to do research for the development of thin layers based on biocompatible materials and silver nanoparticles for surgical dressings. This proposal of technological innovation, "Thin Layers-based biomaterials containing silver nanoparticles for use in infected skin lesions", is awaiting the acceptance of the administrative sectors of USP. Similarly, in cooperation with Bravox (Itu / SP), it has been developed grease with potential application to magnetic refrigeration and the homogenization of magnetic field in coils used as subwoofers.

D – EDUCATION AND DISSEMINATION OF SCIENCE:

1) The INCT-FCx organized a recycling course for high school teachers in the city of São Paulo. We are writing a book in order to help the work of teachers in the classroom, and to give information on

the structure of matter, in particular on complex fluids. In Appendix II we describe in more detail these activities.

2) The INCT provides a webpage with updated information on its activities, staff, specialties, experimental facilities, announcements of schools and meetings, and a discussion forum for researchers, educators and entrepreneurs.

3) The INCT organizes an annual School of Complex Fluids for its students and other interested people (See Annex II).

4) In the last year, we organized an exhibition on proteins at the subway station in Praça da República, São Paulo, providing information on research work carried out by members of the INCT-FCx. This activity reached about 10,000 people who went through the São Paulo subway in a month. In Annex II of this report we give details of this pioneering program.

LIST IMPACT DUE TO THE ACTIONS AND RESULTS OF THE PROPOSAL FOR THE STRENGTHENING AND CONSOLIDATION OF THE NATIONAL COMPETENCE IN SCIENCE AND TECHNOLOGY

A – RESEARCH:

1) Several contributions in the biological area involved the oxidation of lipoproteins, vascular endothelium, atherosclerosis, and pharmacological and nonpharmacological therapies. Another area with important advances was the characterization of the antiphagocytic factor and the expression of toxins involved in infectious diseases. In the area of cancer, we described anti-metastatic and anti-angiogenic properties of a synthetic factor. The lipidomics data are innovative and introduce a new concept in the pathogenesis of some diseases, indicating that changes in the lipid profile may be used as markers of activity and clinical follow-up.

2) The studies on lipoproteins during this period had a significant advance, in particular as regards the identification of the modifications that have atherogenic effect. We found structural changes in LDL oxidized by means of X-ray scattering at low angles. In this work were involved research groups of the Institutes of Physics, Chemistry and of Biomedical Sciences at USP.

B – TRAINING OF HUMAN RESOURCES:

Most of the master students trained by the INCT have continued their work in doctoral programs. Doctors have joined postdoctoral programs both in Brazil and abroad. Most of the undergraduate students, with a better multidisciplinary background, have begun graduate work.

C – TRANSFER OF KNOWLEDGE AND TECHNOLOGY:

In this period we deposited a proposal between Biotec Plastics and Metal Products Ltd. and the University of São Paulo, with the participation of the Institute of Physics, under the leadership of Prof. Dr. Giancarlo Brito, to do research for developing thin layers of biocompatible materials on the basis of and silver nanoparticles to use as surgical dressings. This proposal of technological innovation, "Thin Layers-based biomaterials containing silver nanoparticles for use in infected skin lesions", is waiting for the acceptance from USP. Similarly, in a cooperation with Bravox (Itu / SP), and the leadership of Prof. Brito, it has been developed a grease with potential application to magnetic refrigeration and the homogenization of magnetic field in coils used as subwoofers. In this context, the application of oil-based ferrofluids is not so efficient due to the operating temperatures, which are relatively high and may even produce an ignition. There are ongoing contacts with loudspeaker industries from São Paulo in order to promote an eventual transfer of technology. A patent for this material is under examination at USP. The INCT has led to an integration of knowledge by a combination of biological knowledge with contributions from the knowledge of physical and chemical properties. Thus, changes in lipoprotein oxidation are studied by biological means (antibody / interleukins / endothelial / platelet) as well as by physical changes in nonlinear optical response, by chemical changes and by imaging tests. The meetings between members of the INCT have fostered collaboration on new studies and projects that are gradually integrating the knowledge of different people.

D – EDUCATION AND DISSEMINATION OF SCIENCE:

In this aspect, the INCT holds an annual Summer School and teaches at least one recycling course for high school teachers. We proposed a menu of courses with multidisciplinary character in some universities. Interviews and texts have been used as means of dissemination of the knowledge generated by the INCT. In 2012, we organized a scientific exhibition at the República subway station of São Paulo, during one month, and dealing with research work by members of the INCT.

FOR DISCLOSURE, LIST THE OBTAINED RESULTS THAT DESERVE ATTENTION IN TERMS OF SCIENTIFIC, TECHNOLOGICAL OR SOCIAL DEVELOPMENT:

- 1) Prof. Dr. Marcia Barbosa was the winner of the L'Oréal-UNESCO Award for Women in Science in 2013 for her studies of the anomalies in water.
- 2) In 2012, we organized a scientific exhibition at the República subway station, during one month, and dealing with research work by members of the INCT. This type of activity should be repeated (annually) in areas with large public.
- 3) Dr. Francisco Fonseca presented a view of cardiovascular disease and some aspects of the epidemiological transition in our country and in South America at the Annual Meeting of the American College of Cardiology, on 11/03/2013 in San Francisco (USA). This conference identified approaches to reduce the cardiovascular mortality in our continent and proposals for further accelerating the cardiovascular transition and reducing the premature cardiovascular mortality in our country.
- 4) Dr. Maria Cristina Izar, scientific coordinator of the Department of Atherosclerosis of the Brazilian Society of Cardiology, is completing a new guideline for the prevention of cardiovascular disease in Brazil, for publication later this year.
- 5) There was a collaboration involving several members of the INCT: (i) Dr. Claudette Valduga and Dr. Silvia Carneiro used transmission electron microscopy of nanotechnological products, and pharmaceutical formulations for the treatment of diseases as cancer and leishmaniasis; (ii) Prof. Amando Ito carried out physicochemical analyses of nanoemulsion based pharmaceutical formulations; (iii) and Dr. Marcia R. M. dos Santos performed biological evaluations of formulations of miltefosine and a derivative of curcumin that are used against promastigote and amastigote forms of Leishmania.
- 6) Dr. Rita Ruiz characterized a new factor capable of interfering with adhesion and phagocytosis of bacteria, yeasts and inert particles, which is secreted by an emerging bacteria, and whose identification will contribute to the understanding of the pathogenicity of atypical enteropathogenic Escherichia coli. There is increasing interest in identifying economic products secreted by microorganisms, due to the facility to be obtained and the low cost of industrial production. It is thus possible that progress in the identification and characterization of this factor may generate innovative information to control infection.
- 7) Dr. Sergio Bydlowski has shown the link between the immune response and antibody-mediated responses antiLDLox of antiretroviral therapy in HIV + individuals. It has been pointed out the interesting and anti-angiogenic and antimetastatic role of the synthetic phosphoethanolamine.
- 8) Dr. Niels Olsen Camara obtained results involving lipidomics and inflammation in IgA nephropathy, and lipidomics and inflammation in diabetes (in collaboration with Dr. Mario Saad, from Unicamp and the INCT on diabetes).
- 9) Dr. Yan Levin is the winner of the CBPF prize of 2012.

RESULTS IN NUMBERS

A – INDICATORS OF RESEARCH	
NUMBERS OF THE TECHNICAL, SCIENTIFIC AND ARTISTICAL PRODUCTION IN THE PERIOD (enclose references):	
TYPE	QUANTITY
BOOKS	1
CHAPTERS OF BOOKS	34
ARTICLES IN NATIONAL JOURNALS	~10
ARTICLES IN INTERNATIONAL JOURNALS	217
ARTICLES WITH AUTHORS FROM SEVERAL GROUPS OF THE INCT	24
PAPERS IN NATIONAL MEETINGS	~70
PAPERS IN INTERNATIONAL MEETINGS	~190
SOFTWARE	1
PATENTS	
PRODUCTS	1
PROCESSES	
ARTISTIC PRODUCTION (SPECIFY)	
OTHER (INVITED TALKS)	32

B – INDICATORS ABOUT THE FORMATION OF HUMAN RESOURCES	
NUMBERS ON THE FORMATION OF HUMAN RESOURCES IN THE PERIOD	
TYPE	QUANTITY
COMPLETED:	
SCIENTIFIC INITIATION	7
MASTER	33
DOCTOR	17
POST-DOCTOR	15
OTHER (SPECIFY):	
ONGOING:	
SCIENTIFIC INITIATION	35
MASTRE	44
DOCTOR	87
POST-DOCTOR	21
OTHER (SPECIFY):	

C – INDICATORS OF KNOWLEDGE AND TECHNOLOGY TRANSFER	
NUMBERS OF THE PRODUCTION IN THE PERIOD (specify and enclose references):	
TYPE	QUANTITY
(1) magnetic grease (product)	1
(2) phytosterols (software under development)	1

D – INDICATORS OF EDUCATION AND DISSEMINATION OF SCIENCE	
NUMBERS OF THE PRODUCTION IN THE PERIOD (specify and enclose references):	
TYPE	QUANTITY
Recycling courses	1
Summer Schools	1
Science Exhibition	1

ADDITIONAL INFORMATION

DESCRIBE OTHER FORMS OF MAKING PUBLIC THE RESULTS OF THE PROJECT:

- 1) Results obtained by the INCT-FCX were available in the webpage.
- 2) Schools on Complex Fluids are directed both to our students at different levels as well as to interested students (undergraduate, masters, doctoral, PhD and post-docs) of the different areas involved in the INCT.
- 3) Seminars are regularly organized at the headquarters in São Paulo with wide announcements. They are video recorded, made available at our site, with real-time transmissions by IPTV-USP. The recycling course for high-school teachers is also a form to make available our research results.
- 4) Interviews of the INCT members to the press.

DESCRIBE THE IMPROVEMENTS IN THE PHYSICAL INSTALLATIONS IN THE HOME INSTITUTION AND IN THE ASSOCIATED LABORATORIES, AS PHYSICAL ADAPTATIONS, EQUIPMENT, ETC:

- 1) UFAL: The Inct-FCx has been the main source of funds to support the creation of the Laboratory of Anisotropic Liquids and Polymers. In the last year, the INCT-FCx contributed to creating another laboratory at the Institute of Physics, UFAL, with the purchase of a theta-tension optical tensiometer. With this fully automated equipment it will be possible to characterize the dynamics of wetting of complex fluids on solid and liquid substrates in a time scale of a few milliseconds. This equipment is already installed in a recently established laboratory of optical tensiometry, in a space of 16 m². This laboratory is planned to be used by graduate students investigating interfacial phenomena involving complex fluids.
- 2) Laboratory at Uniban: funds from the INCT were used to buy a gas chromatograph, a lyophilizer, a no-break equipment, ultrasound baths, and an analytical balance.
- 3) Laboratory at UNIFESP, in Diadema: funds were used to purchase optical and opto-mechanical components, an optical shutter, a moving stage, detectors for optical nonlinear measurements in complex fluids (organic compounds, nanoparticles, liquid crystal, and analytes related to metabolic disorders in different pathologies, and circulating plasmatic DNA for cancer studies).
- 4) Expansion of computational resources with the purchase of 6 octocore Intel Xeon with 24 GB of RAM and 2 TB of HD each, totaling over 48 processors with 144 Gb of RAM and 12 TB of hard disk extending the computational resources of the cluster. These new features are being implemented.

WERE THERE ACTIVITIES OF INTEGRATION WITH OTHER INCT'S: (X) YES () NO IF YES, GIVE SOME DETAILS:

- 1) Dr. Rita de Cassia Ruiz: Interactions with the INCT-TOX in the investigation of the action mesoporous silica SBA-15 in cell cultures, mainly from professional phagocytes.
- 2) Dr. A. M. Figueiredo Neto: Strong research interactions with members of the INCT REDOXOMA, in particular with Prof. Dr. Sayuri Miyamoto, from IQUSP.
- 3) UFMG Group: AFM measurements of some samples in the laboratory of Prof. Bernardo Neves, member of the INCT on Carbon Nanomaterials.
- 4) UFAL Group: Interactions with groups associated with several INCTs: on nanotechnology of integrated markers; on nanobiostuctures and nanobiomolecular simulations; on photonics and optical communications; and on organic electronics.
- 5) UFRGS Group: Interactions with INCT-SC.
- 6) Dr. Claudette Valduga, at Uniban: Joint orientation of a thesis work with Prof. Suzana N. Diniz, member of the INCT on Pharmaceutical Innovation. Investigation of the epigenetic action and of the cytotoxicity of a derivative of Curcumin in a lipid nanoemulsion in tumoral lineages. Participation in thesis and dissertation committees of members of the INCT on Pharmaceutical Innovation. Beginning of a collaboration with members of the INCT on obesity and diabetes for the analysis of short-chain fatty acids.
- 7) Dr. Sarah Alves, from Unifesp, in Diadema: Work in collaboration with members of the INCT on Pharmaceutical Innovation: (i) with Prof. Luiz S. Long Jr., on the investigation of nonlinear optical effects in organic compounds and nanoparticles, and (ii) with Prof. Virginia B. Campos Junqueira in the study of nonlinear optical properties of analytes associated with metabolic disorders in several pathologies and of circulant DNA in cancer studies.

CONSIDERAÇÕES FINAIS

COMMENT ON OTHER RELEVANT ASPECTS FOR THE GENERAL DEVELOPMENT OF THE PROJECT:

What is the role of the INCT for the formation of a network of research

The INCT has been instrumental in promoting both the consolidation of the experimental facilities in many laboratories of the network and the interactions between the team members and their students. The resources have been applied in a quick and efficient way for the collaboration between researchers and emergency replacement of equipment and consumer items. It has been possible the installation of a computational cluster of national use. The INCT-FCx gave an important contribution to the expansion of the network of research from the participating institutions. In fact, new collaborations have emerged as a result of the meetings and events organized by INCT-FCx. In the activity report, we give detailed examples of work in collaboration with researchers from different participating research groups, with the production of theses and dissertations of multidisciplinary approach and joint publications. During the period of this report, we published 217 articles in journals with international circulation, and 24 of them had the authorship of researchers from more than one group of the INCT. These data provide a measure of the synergy between the different groups.

EVALUATE THE DIALOGUE OF THE INCT WITH CNPq AND OTHER FINANCING AGENCIES OF THE PROGRAM:

The dialogue between the INCT and the CNPq has been adequate.
The dialogue of the INCT with FAPESP is very good. However, there is a problem to be solved to turn the proposal more flexible. It would have been very helpful to have a flexible enough budget to take into account eventual needs of the INCT. Since FAPESP works on the basis of the initial terms of the grant, any small change in the allocation of funds has to be asked for, analyzed again, and formally accepted by the administration of Fapesp. A new grant is then issued to be signed again. These procedures could be much more flexible, at least in the case of the long-term grants of the INCTs. We should be able to use the funds without so many item restrictions, and to use them in any emergency. Of course, we certainly agree that changes involving large amounts of funds should be treated more carefully. However, small changes could be a responsibility of the coordinator, without lengthy procedures to issue the terms of a new grant.

Enclose a report of partial results, **with a maximum of 50 pages**, with the following items:

1. Steering Committee – meetings and decisions;
2. Activities of cooperation between groups of participants of the INCT;
3. Activities of cooperation between the INCT and other institutions (companies, nongovernmental institutions, etc);
4. Main technical-scientific results;
5. National and international meetings: presentation of works, organization of courses, seminars, talks, round-tables;
6. Activities of formations of human resources;
7. Perspectives and future developments.

Place and date: São Paulo, April 24, 2013.

Signature:

National Institute of Science and Technology of Complex Fluids (Partial Report of Activities – Year 4)

Introduction

This report contains a presentation of the main results of the research work developed by the INCT-FCx in the fourth year of existence. There are also two appendices:

Annex I – scientific publications, invited presentations in scientific meetings, participation in scientific meetings, training of personnel (complete work), training of personnel (work in progress), chapters of books, patents, and prizes.

Annex II – teaching activities, dissemination of science, updating courses, research Summer School, Workshop about Membranes held in São Paulo and the exhibition held in the São Paulo Subway.

The steering committee

Composition

Prof. Dr. Antônio Martins Figueiredo Neto (Coordinator)

Prof. Dr. Luis Juliano Neto (Vice-Coordinator)

Prof. Dr. Francisco Antonio Helfenstein Fonseca

Prof. Dr. Iolanda Midea Cuccovia

Prof. Dr. Lia Queiroz do Amaral

Prof. Dr. Luiz Roberto Evangelista

Prof. Dr. Niels Olsen Saraiva Camara

Prof. Dr. Sylvio Roberto Accioly Canuto

The Steering Committee keeps close contact electronically.

Main results from the research activities

Initial considerations:

In this fourth year of activities of INCT-FCx, all of the laboratories with new equipment and material were already working. This was essential to provide the synergy between different research groups, leading to the publication of articles that represent real collaboration between members of these groups. In this period, there are 24 published articles in journals with international circulation with the participation of authors from more than one group of the INCT. The total number of papers published in the period was also a record, 217, which represents an average of more than 4 articles per researcher at

the Institute in the year. The number of graduates was also significant (see the form with the numerical data). Also, it is worth noting that many of these students have supervisors and co-supervisors from different groups, which is an indication of the complementary and multidisciplinary character of much of the ongoing research work.

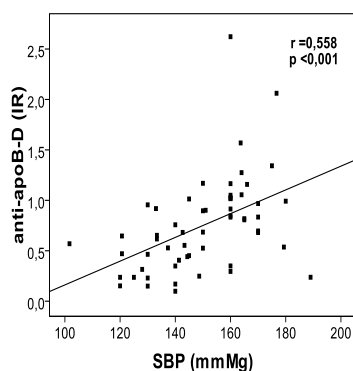
Another important point that should be emphasized in this report is the interaction between theoretical and experimental workers in this INCT. A doctoral student of the theoretical research group of Prof. Sylvio Canuto worked on a topic related to the interaction of tetracycline in aqueous medium in the presence of low-density lipoproteins. The research group led by Dr. Lilia Coronato Courrol, at the Paulista School of Medicine, UNIFESP, carried out measurements of absorption electronic spectrum and fluorescence, and the theoreticians carried out modeling calculations of these properties. The results of this kind of research are related to the behavior of atherosclerosis biomarkers.

In the following sections we report the main research results of the INCT, with an emphasis on the effective collaboration between members of different groups. The report is divided into research subjects, with emphasis on interactions and interdisciplinary work.

Topic of Research: Lipids and Biological Interactions

We begin by referring to the research work on lipids and their biological interactions. In this area, the work is carried out by professionals with several backgrounds (including physics, medicine, immunology, biotechnology, and chemistry). The results are presented as topics, part of them with interinstitutional collaboration, and pointing out the more important contributions obtained in the last year.

Studies regarding LDL oxidation with clear biological implications were finished. These studies included the presence and the severity of classical cardiovascular risk factors, mainly hypertension, pharmacological therapies, exercise and obesity. A peptide from the apolipoprotein B, which had been synthesized by the group of Prof. Juliano and tested among hypertense patients, was used to show the increasing of systolic and diastolic blood pressure with the presence of titers of antibodies of this peptide (Fig. 1).



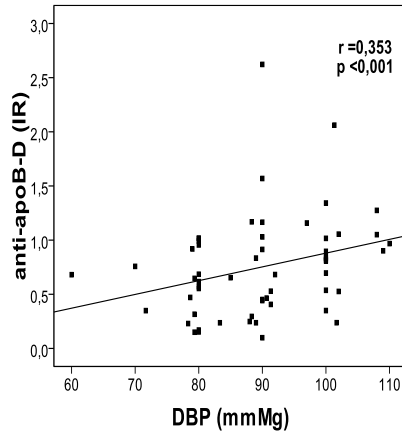


Figure 1: Relation between BP levels and adaptive immunity.

Other promising research line involved new endothelium and platelets biomarkers (microparticles and endothelial progenitor cells, quantified by specific CDs by flow-cytometry). Initial results were shown among HIV+ subjects naive of antiretroviral therapy, and an imbalance between these markers was demonstrated, suggesting a new pathophysiological basis for the cardiovascular disease related to AIDS. In fact, as showed in Figure 2, HIV+ subjects had lower amount of endothelial progenitor cells and an increase in endothelial microparticles, suggesting a vascular injury by the virus, even before the drop on CD4 titers.

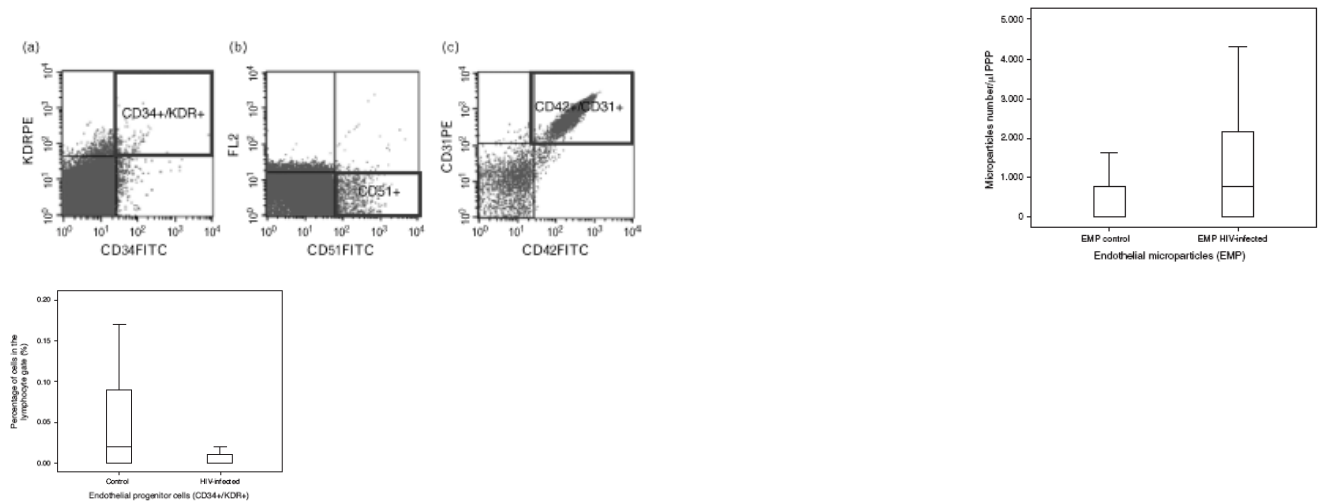


Figure 2: Imbalance between endothelial progenitor cells and endothelial microparticles. Upper left – flow cytometry; upper right endothelial microparticles; bottom left endothelial progenitor cells.

Another study involving high performance athletes revealed interesting data, such as lower titers of oxLDL correlated with lower subclinical atherosclerosis in carotids (carotid intima-media thickness), as well as differences on the Z-scan results when compared with control subjects. In addition, echocardiography findings revealed myocardial hypertrophy, increased left atrium volume, and lower left

ventricular ejection fraction. The study also showed differences among athletes and control subjects in the number of endothelial and platelet microparticles.

Studies involving lipid lowering therapies (statins, ezetimibe and combined therapies) and their effects on synthesis and absorption of cholesterol were concluded and revealed new aspects related to the balance of microparticles and endothelial progenitor cells, amount of small and dense LDL, and inflammatory markers (C-reactive protein). Figure 3 summarizes part of these findings.

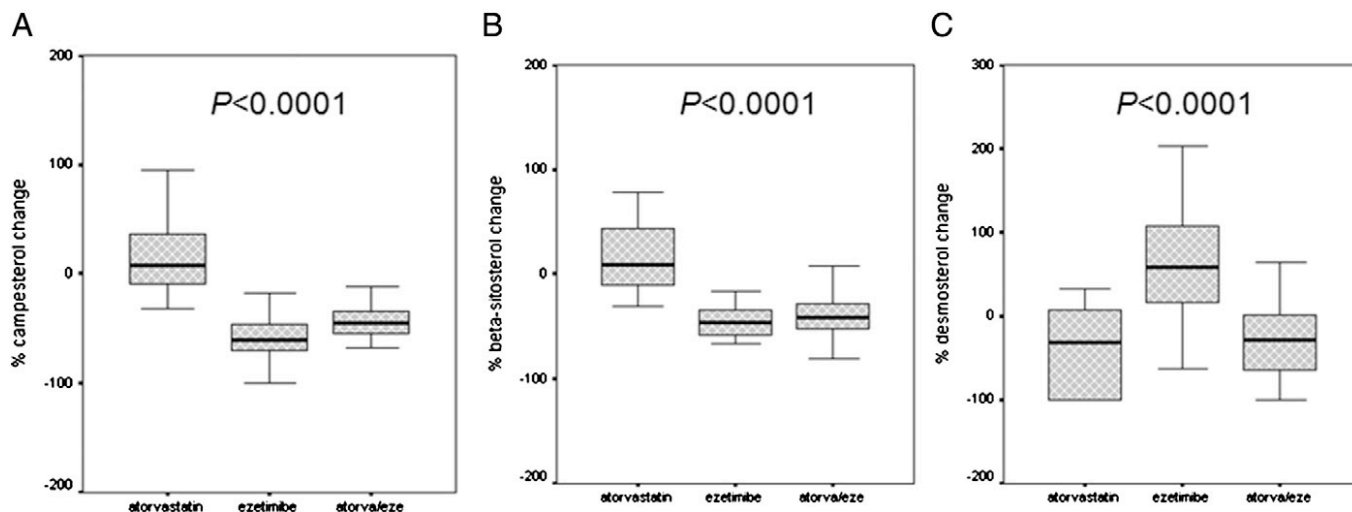


Figure 3: Changes in markers of synthesis and absorption of steroids.

In the field of pharmacokinetic interactions between statins and clopidogrel, three studies were concluded, and we found clear differences between statins, and on the vascular protection among coronary heart disease patients. Figure 4 shows that the use of rosuvastatin 40 mg determines a substantial increase in the flow-mediated dilation (approximately 250% in 24h), suggesting important benefit on the endothelial function. Furthermore, the use of rosuvastatin showed favorable interaction with clopidogrel in the platelet aggregation tests. Conversely, the withdrawal of the statin for a week was associated with increased number of platelet microparticles, despite the continuous use of clopidogrel. We also found interactions between atorvastatin and clopidogrel, influencing the concentrations of both drugs affecting the titers of platelet microparticles (Figure 6). All these results are of relevance in subjects with coronary heart disease because they are largely used in the acute phase of the disease.

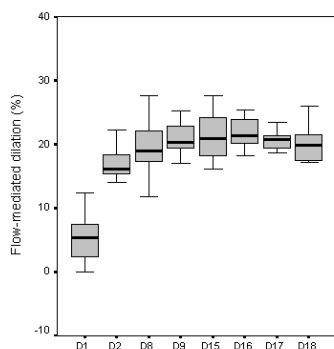


Figure 4: Flow-mediated dilation following the use of rosuvastatin 40 mg in patients with stable coronary heart disease.

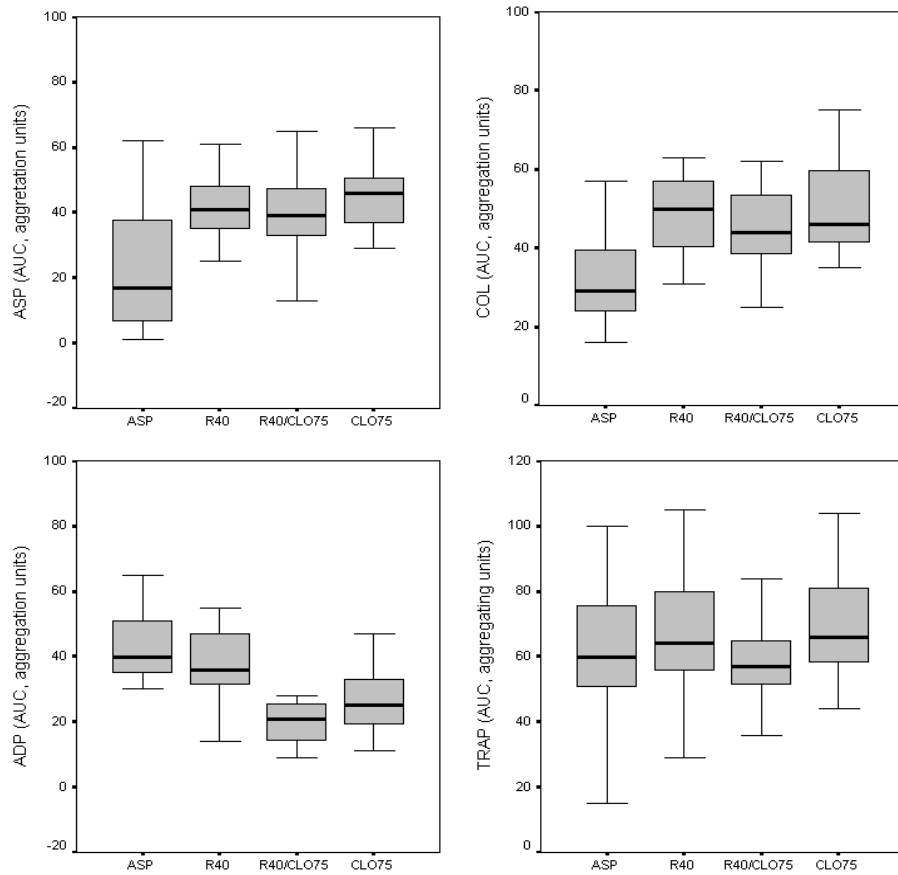


Figure 5: Platelet aggregation in subjects with coronary heart disease in response to agonists tested for therapies with aspirin, clopidogrel, alone or combined with rosuvastatin.

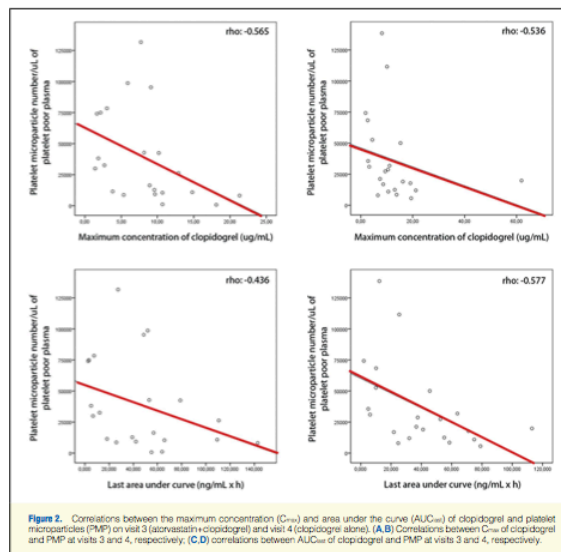
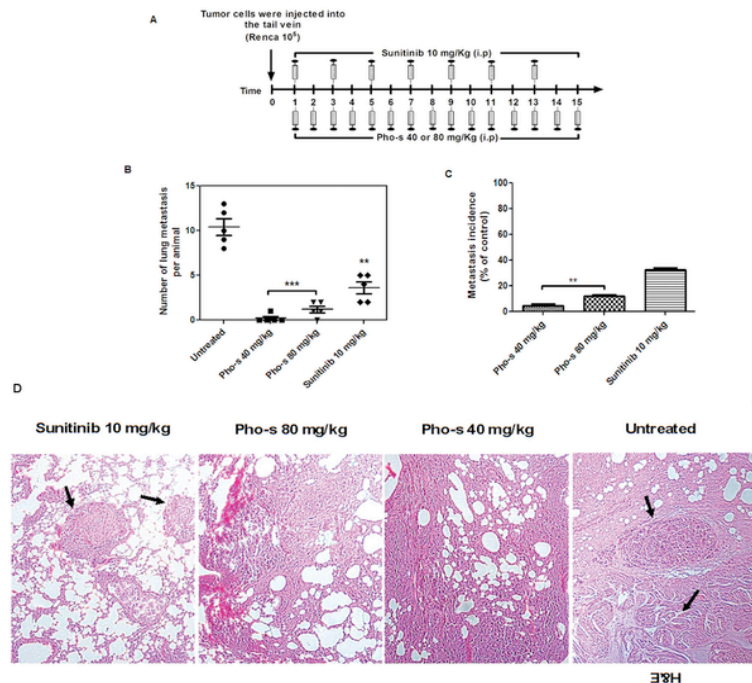


Figure 6: Correlations between clopidogrel serum levels and the amount of platelet microparticles.

An interesting contribution in the field of cancer involved the study of the anti-angiogenic and anti-metastatic action of phosphoethanolamine, published this year and showed in Figure 7.



Ferreira AK, Freitas VM, Levy D, Ruiz JLM, et al. (2013) Anti-Angiogenic and Anti-Metastatic Activity of Synthetic Phosphoethanolamine. PLoS ONE 8(3): e57937. doi:10.1371/journal.pone.0057937 <http://www.plosone.org/article/info:doi/10.1371/journal.pone.0057937>

Figure 7: Antineoplastic activity of the synthetic phosphoethalonamine

Other important contribution was the use of methotrexate inside nanoparticles (LDE) for the treatment of cancer (Figure 8). As the neoplastic tissue requires cholesterol for its proliferation, by the use of nanoparticles, greater amount of chemotherapies can be delivered locally. This is an example of the cooperation between institutes, showing the interaction between Prof. Claudete Valduga and Prof. Raul C Maranhão.

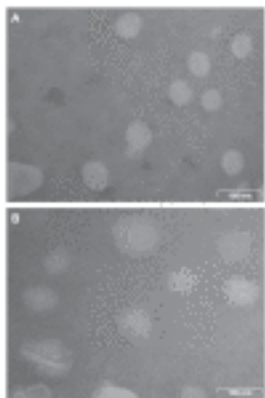


Figure 8. Transmission electron microscopy of (A) lipid nanoemulsion and (B) LDE- ddMTX (methotrexate).

Other interesting contribution was the report of Lp-PLA2 related to visceral obesity among adolescents (Figure 9).

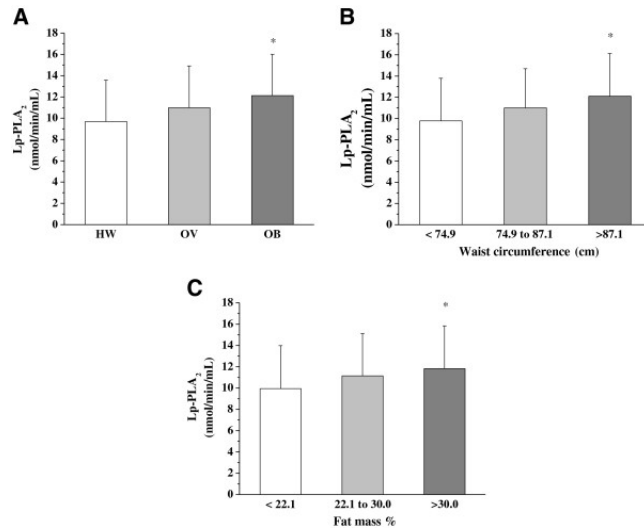


Figure 9: Parameters of obesity or waist circumference and Lp-PLA2 activity.

By the collaboration of physics, immunologists, chemists, and physicians the behavior of thermal diffusivity of human LDL native and oxidized was investigated using the Zs technique. Our results showed that both types of LDL have similar values of density, and thermal-optical coefficient. On the other hand, the linear optical absorption decreases with the oxidation time. The ZS technique was used to measure the thermal diffusivity of native LDL and oxidized native LDL with a diversity of oxidation time. The thermal diffusivity of oxLDL were higher than native LDL. The larger the time of oxidation, the larger the value of thermal diffusivity. The decrease in the observed linear absorption in oxidative samples is partially due the carotenoids consumption during the lipid peroxidation process. The increase in the thermal diffusivity with the oxidation was due the formation of hydroperoxides. The PLOOH and ChOOH are changed between different LDL particles, spreading the heat between different particles of LDL. This hypothesis is reinforced by HPLC measures showing that the hydroperoxydes production is directly related with the increase of thermal diffusivity. In this scenario, for larger hydroperoxydes production, it is more efficient the spreading of the heat on the LDL solution. This aspect leads to a fast thermal homogenization of the solution, avoiding the formation of the thermal lens observed before the oxidation. This result can be used in the determination of the oxidative status of LDL in humans, as a complementary technique in the diagnosis of atherosclerosis.

Finally, to illustrate another area of interest in lipids, the researches of INCT showed an experimental model of parasitic renal injury, in which the oxidative stress, lipoprotein oxidation and inflammation are related processes in the progressive organ dysfunction, a form of parasitic pathogenicity (Figure 10).

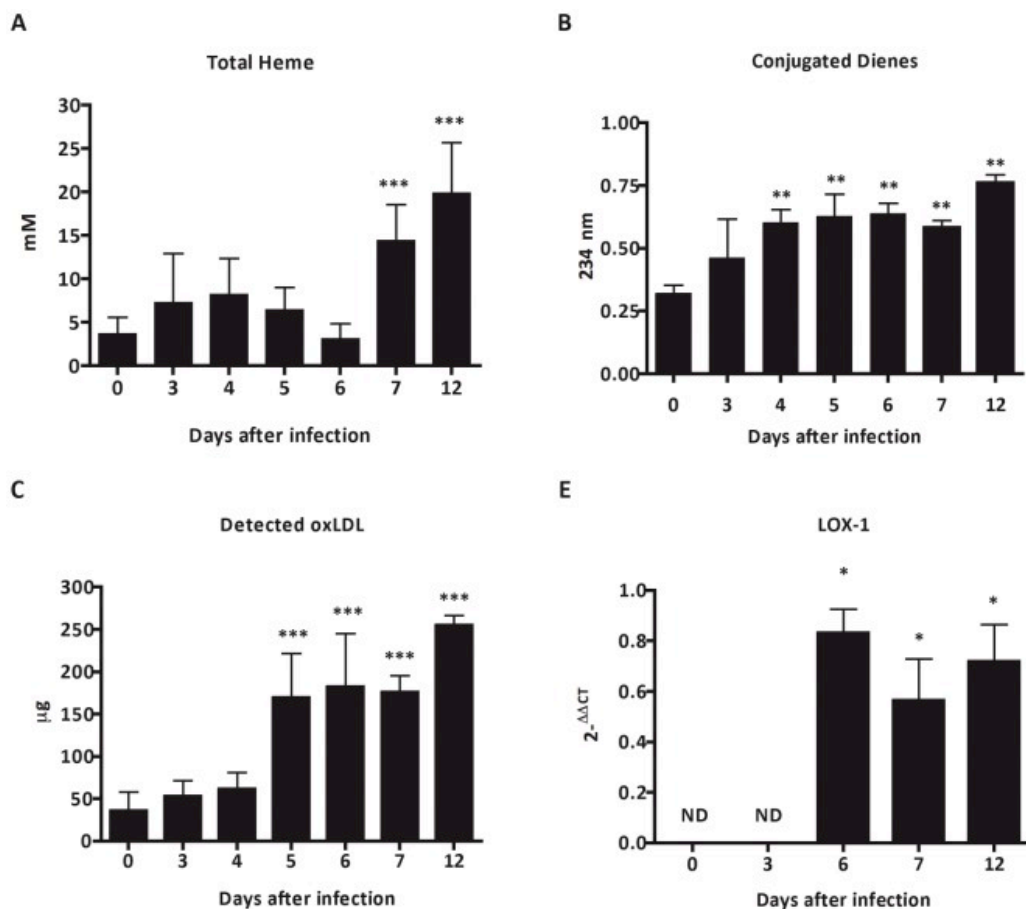


Figure 10: evaluation of oxidative stress products during malaria associated with acute kidney lesion. (A) Quantification of toxic plasma heme (B) Detection of conjugated dienes, (C) Quantification of plasma levels of ox LDL in BALB/c mice infected with 10^6 erythrocytes by *P. berghei* ANKA. (D) Expression of mRNA of LOX-1 in renal tissue during infection in BALB/c mice. One-way ANOVA followed by Bonferroni post-test Analysis using GraphPad Prism. * $P < 0,05$ vs control group - day 0, ** $p < 0,01$ vs control group - 0 day, *** $p < 0,001$ vs control group - 0 day.

Topic of research: Liquid Crystals

The INCT-FCx occupies a remarkable position in the international scenario regarding the studies dealing with liquid crystals (LC) and anisotropic media, in general. As it has been pointed out in previous reports, in the period covered by this one, the Institute has obtained relevant results in several areas in which it is pioneer in Brazil.

The study devoted to the dermatological emulsions in aqueous matrix, started in 2009 with amphiphilics and natural oils, has involved researchers from IFUSP (Lia Q. Amaral) and from Faculdade de Ciências Farmacêuticas of USP of Ribeirão Preto (Pedro A. Rocha Filho) and was complemented by diffraction and scattering of X-ray measurements. These studies have shown gel phase structures at room

temperature, with liquid-crystalline phase transition at high temperature, and were connected with the works of master degree students from Ribeirão Preto. Besides the results have been presented at the World Congress of Emulsion, held in Lyon, France, detailed scientific papers have been recently published or accepted by the Journal of Dispersion Science and Technology.

For what concerns the studies with lyotropic liquid crystals (LCCs), a field in which the INCT-FCx is proud to have some leadership around the World, a complete set of measurements of the refraction indices and birefringence, embodying several regions of the phase diagram of the system composed by sodium dodecyl sulphate (SDS)/water/decanol, covering also the biaxial island, with a transition to the coexistence region with the cylindrical and isotropic phase, has been obtained in the framework of the collaboration between researches from IFUSP (Lia Q. Amaral) and Universidade Estadual de Maringá – UEM (A. J. Palangana) and are part of a Ph. D. thesis of David A. Oliveira (assistant professor of UTFPR – Campo Mourão). The published results demonstrate the coexistence between the discotic nematic and cylindrical nematic phases without the presence of an intermediate biaxial phase.

Part of these results has been presented at the 24th International Liquid Crystal Conference, Mainz, August 19th - 24th, 2012, and, after that, at the 1st Italian – Brazilian Workshop on Liquid Crystals, Erice, Italy, in August 26-30, 2012. This second work, evidencing the differences between the biaxial island and the coexistence region of the preceding work, was also accepted for publication in the Proceedings of the Workshop, to appear in Molecular Crystals and Liquid Crystals. The interest this investigation line has attracted was the main reason for several invited talks in scientific meetings in the field of liquid-crystalline physics. In this regard, it is worth mentioning that the organization of this first Italy-Brazil meeting was a joint initiative of members of INCT with Italian researchers. It has been partially supported by INCT. The Scientific Advisory Boarding of this pioneering Workshop was composed by eight Brazilian scientists, seven of them members of the INCT (A. M. Figueiredo Neto, A. J. Palangana, Fernando Moraes, Lia Q. Amaral, L. R. Evangelista, M. L. Lyra e M. Simões). In addition, the next programmed meeting, to be held in 2013, is also under the responsibility of the members of INCT.

The phase diagram of the quaternary mixture of KL (potassium laurate)/K₂SO₄/alcohol/water has been investigated as a function of temperature and number of carbon atoms in the alcohol alkyl chain (**n**), where three nematic phases are present. It has been shown that the biaxial nematic phase domain exists in a window of values of **n** varying around the number of carbon atoms of the KL chain, with $n = n_{KL} \pm 2$. The higher the value of **n** the larger the calamitic nematic phase domain, when compared with the discotic nematic and biaxial nematic phase domains. Assuming that micelles have an orthorhombic symmetry (Intrinsically Biaxial Micelle model in the nematic phases), our results suggest that the alcohol molecules segregate in different ways, depending on the value of **n** with respect to **n**_{KL}: for **n** < **n**_{KL} there is a tendency of the alcohol molecules accumulate more in the flattest surface of the micelles, favoring the discotic nematic phase; for **n** > **n**_{KL} alcohol molecules tend to accommodate preferentially in the curved surfaces of the micelle, favoring the calamitic nematic phase. This segregation of the alcohol molecules seems to maintain the orthorhombic symmetry of the micelles, probably due to the fact that similar molecules tend to remain together.

The phase diagram of lyotropic mixtures of KL (potassium laurate)/K₂ SO₄ / alcohol/H₂ O doped with brucine was constructed as a function of the alkyl chain length of the alcohol, keeping constant the mole fraction of all the mixture constituents. The mixtures with the number of carbon atoms $n = 9, 10, 11,$ and $12,$ i.e., with $9 < n_{\text{KL}} < 12,$ where n_{KL} is the number of carbons of the KL, presented the three cholesteric phases. As the alkyl chain length of the alcohols increases the cholesteric uniaxial to cholesteric biaxial phase transitions is shifted to the higher temperatures, and the cholesteric biaxial domain got smaller. Measurements of the biaxial order parameter in the vicinity of the transition ChD (cholesteric discotic) -to-ChB (cholesteric biaxial) revealed that this transition is continuous. The chiral elastic field imposes a chirality-induced biaxiality in the ChD phase. The order of magnitude of this chirality-induced biaxiality in the ChD phase agrees with the estimations for the magnetically induced biaxiality in the uniaxial discotic nematic to biaxial nematic phase transition. The bare correlation length calculated agrees that evaluated by light-scattering measurements in lyotropic nematics, being larger than the typical micellar dimensions. This result suggests that the structural changes responsible for the transitions occur in a length scale bigger than the micellar dimensions, supporting the IBM model. Mixtures with alcohols of $n = 8$ and $n = 13$ carbon atoms presented a first-order phase transition between the ChD to- ChC (cholesteric calamitic). This result was interpreted as a consequence of the nanosegregation of the alcohol molecules in the micelles with respect to the main amphiphile molecules (KL).

In the framework of a well-established collaboration between researches from UEM (A. J. Palangana, D. A. Oliveira) and UEL (M. Simões) and their co-workers and students, a pioneer investigation of the absorption coefficient and of the order parameter in the re-entrant phase of a calamitic lyotropic liquid crystal was carried out for the first time in the phase sequence of the lyotropic mixture formed by the potassium laurate, decanol and deuterated water. In a subsequent work, this group was able to show that the concept of nematic order parameter and a generalization of the concept of optical indicatrix may join to give rise to a new geometrical representation of the anisotropies found in lyotropic liquid crystals. Also along this research line, the universality of the nematic phase of liquid crystals was investigated by means of a detailed comparison of experimental data involving the nematic order parameter. This investigation was conducted in UEL (M. Simões) and the results have shown that all the experimental data of all the nematic phases coalesce along a common line that extends over the entire range of mesophases, thus evidencing a universal feature of these mesophases.

Nonlinear optical techniques (**Z**-scan) were employed in a detailed investigation of the optical absorption in the nematic-isotropic phase transition in an eutectic mixture (thermotropic LC E7) in the framework of the collaboration between researches from IFUSP (A. M. Figueiredo Neto and S. Salinas) and from the Complex Fluids Group of UEPG (S. L. Gomes) and UFSC (I. H. Bechtold) pursuing a collaboration inaugurated by the INCT. They investigated the tricritical-like behavior of the nonlinear optical refraction at the nematic-isotropic transition in the E7 thermotropic liquid crystal. They have performed **Z**-scan experiments to measure nonlinear optical refraction and nonlinear optical absorption properties of the E7 thermotropic liquid crystal mixture in the neighborhood of the nematic-isotropic transition. The data for the nonlinear optical birefringence show a pronounced divergence, which can be associated with an effective critical exponent, $\beta = 0.28 \pm 0.03,$ and which is thus compatible with the hypothesis of a virtual tricritical point. They have also presented some statistical-mechanics calculations,

for a site-diluted Maier-Saupe model, which provide a justification for the scenario of this virtual tricritical behavior

Pattern formation in chiral (thermotropic) nematic liquid crystals was investigated by researches from UEM (L. R. Evangelista and R. S. Zola) in collaboration with researches from the Liquid Crystals Institute - LCI (Kent, Ohio USA) in the presence of a wetting transition. In the isotropic-liquid crystal transition, a surface-enhanced effect happens and a thin liquid crystal layer forms at the substrates of the cell. In this confined system, chirality, elastic anisotropy, surface anchoring, and wetting strength interplay. A striped pattern is formed due to the chiral nature of the material and the tilted anchoring at the isotropic boundary. As the wetting layer grows from cooling the sample, first the stripes rotate through a process where dislocation defects are formed. As the wetting layer grows further, the periodicity of the stripe structure changes, and finally a splitting of the stripes occurs. Because of the unique properties of this system, new insights about pitch-thickness ratio, interface anchoring, and elastic anisotropy effect are found. Since the anchoring at the isotropic boundary is weak, the critical ratio between the thickness of the wetting layer and the helical pitch is different from the one reported in the literature. It was also discovered that the elastic anisotropy and elastic constant ratios play a critical role in stripe formation. Because of the similarity with biological fibrous composites (twisted plywood), the system may be used as a synthetic version to mimic the naturally occurring one. A simulation study was carried out to explain the experimental results. This is a very original result because it involves the wetting in chiral phases, a behavior scarcely investigated until now an even less understood, despite its importance.

After the facilities of Laboratory of Anisotropic Liquids and Polymers have been accomplished, aiming at studying viscoelastic and nonlinear optical properties of liquid crystals and polymers, the nucleus of researches from IF-UFAL has obtained some significant results in the experimental investigation of nonlinear optical properties of complex fluids. In particular, they have obtained some results concerning the determination of photo-induced reorientation phenomena in liquid crystals doped with azo dyes. Using the time resolved Z-scan technique, it was possible to identify the suppression of the reorientation of the optical axis of the sample in view of the high energetic cost associated to the compression of the smectic layers, in a phenomenon known as Helfrich-Huraut effect. This result may open the doors for new applications of smectic liquid crystals, mainly in devices requiring a large non-linear response with fixed optical axis.

Another relevant advance obtained by the researches from UFAL can be found in the characterization of spectroscopic and interfacial properties of polymers, emphasizing the studies devoted to the luminescence of new polymeric compounds, and in the investigation of wetting phenomena in doped polymeric films. For what concerns the investigation of the fluoresce in new polymeric compounds, they have determined how the polarity and the environment temperature affect the intermolecular charge transfer in those compounds containing donor and acceptor groups of electrons. Concerning the wetting phenomena in polymeric films, they have investigated how the number of layer of self-assembled films based on chitosan and azo dyes determines the surface energy of the produced films. In addition, they have investigated the possibility of producing structures whose hydrophobicity may be controlled.

From a more theoretical point of view, the researchers from IF-UFAL continue to pursue investigations devoted to the propagation of electromagnetic waves in multilayers structures containing liquid crystals, devoted to the hydrodynamic phenomena associated to the elastic deformations in freely suspended smectic films. In this regard, using the harmonic approximation, they have analytically determined the elastic-mediated interaction between colloidal nanoparticles adsorbed on the surface of smectic films under the influence of an external field. Both cases of freestanding films and films deposited over a solid substrate have been considered. In this way, it was possible to show that the asymptotic decay ($1/R$ in freestanding and exponential in deposited films) is not altered by the external field. However, the external field plays distinct roles according to the film configuration, the inter-particle distance, the film thickness, and the surface tension at the film-gas interface. In addition, they have provided a detailed discussion under the light of the distinct mechanisms controlling the undulations of the surface layer.

Another significant research line developed at IF-UFAL is dedicated to the spectroscopic properties of some compound with bactericide activity by means of computational algorithms using first principle techniques. For this later activity, the financial support from INCT has been crucial.

Finally, it is worth mentioning some new results obtained in the investigations dealing with impedance or admittance spectroscopy carried out by the UEM group (L. R. Evangelista) using, for the first time in this context, fractional calculus and anomalous diffusion techniques. Some fundamental aspects of the Poisson-Nernst-Planck (PNP) model, extended to the anomalous effects, have been the object of detailed investigations from the theoretical point of view and its predictions were furthermore validated using experimental data obtained with liquid-crystalline samples.

Topic of Research: Magnetic colloids

Magnetic fluids and colloidal suspensions are widely investigated in the framework of the INCT-FCx. Some of these investigations involve pioneering partnerships with companies and other agencies and unveil varied practical applications, including the medical ones.

During the period covered by this report, methods for synthesizing silver and gold nanoparticles were developed by research groups of Unifesp (Lilia C. Courrol). One of these strategies was to create gold nanoparticles of different sizes and shapes using agar-agar water solution and irradiation with light from a xenon lamp, followed by ultra short laser pulses. No additives, such as solvents, surfactants or reducing agents, were used in the procedure. Laser irradiation (laser ablation) was important to the reduction of the nanoparticles diameter and formation of another shapes. Distilled water was used as solvent and agar-agar (hydrophilic colloid extracted from certain seaweeds) was important for the stabilization of gold nanoparticles, avoiding their agglomeration. The formation of gold nanoparticles was confirmed with ultraviolet-visible absorption and TEM microscopy. The gold nanoparticles acquired spherical, prism, and rod shapes depending on the laser parameters. Variations of laser irradiation

parameters as pulse energy, irradiation time and repetition rate were assessed. The relevant mechanisms contributing for the gold nanoparticles production were clarified. Similar methodology was employed to synthesize silver nanoparticles. Spherical nanoparticles of ~100 nm were created by the xenon lamp illumination, and after the ultra short pulses irradiation their sizes were reduced to under 10 nm. Bideionized water was used as solvent and surfactants or reducing agents were substituted by agar-agar and light, characterizing the process as a "green" synthesis, a completely inoffensive procedure for the environment. The xenon light was used to reduce silver ions (Ag^+) into metallic silver (Ag^0), and the laser irradiation was important to decrease the nanoparticles diameter. Average particles size, size distribution, morphology, and structure were determined by dynamic light scattering (DLS), transmission electron microscopy (TEM), energy-dispersive X-ray spectroscopy (EDX) and UV/visible absorption spectrophotometry.

Metallic nanoparticles have attracted much attention because of their special properties and potential applications, which result mostly from its large surface area and the surface plasmon resonance (SPR) effect (collective oscillation of surface electrons). Silver nanoparticles present a strong bactericidal effect and are known to be powerful antibiotics and, besides being used in anticancer and antiviral therapies.

In a direction towards clinical researches, the group of the INCT working in connection with other groups from Albert Einstein Hospital, under the leadership of Lionel Gamarra, has carried out investigations based on magnetic nanoparticles to be used in treatments of the ischemic cerebral vascular accident (ICVA), Parkinson, glioblastoma multiform tumors and the implementation of the magnetothermia technique. For what concerns the ICVA, the group made collects of samples of umbilical human chord and have standardized the processing of these samples to obtain mesenchymal stem cells (MSCs), as well as the characterization process of these cells by means of genotyping, immunophenotyping and evaluation of the multipotenciality of these MSCs by means of cellular differentiation in the three mesoderm lineages.

In the same manner, protocols for marking MSCs with different superparamagnetic iron oxide nanoparticles (SPION), with different coatings (Dextran and Chitosan) complexed with a transfection agent designated as Poly(L-Lysine) and fluorescent multimodal SPIONs (Rhodamine) have been established. The characterization of the MSCs mentioned above was also accomplished in those MSCs marked with the described SPIONs in order to evaluate their integrity and maintenance after the marking process. Cytotoxicity and viability tests of the cells ((MTT: 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide, Annexin/propidium iodide CFSE: Carboxyfluorescein Succinimidyl Ester) have been standardized to evaluate the marked cells.

The quantification of internalized SPIONs by the marked MSCs was also standardized by means of in vivo essays (phantoms) using Magnetic Resonance Image (MRI). These essays were important to obtain the correct dosage MSCs/SPIONs along the different times for monitoring and tracing of these cells in vivo, in the ICVA model. In this manner, the in vivo essay of the ICVA model was also standardized and applied to the occlusion of the animal middle cerebral artery. This kind of investigation is important for the evaluation of the destination and therapeutic efficacy of the MSCs marked in the

tissue and functional repairing of the ischemic cerebral region in the experimental models for ICVA, using MRI.

With respect to Parkinson disease, experimental procedures using MSCs of the umbilical cord wall, marked with multimodal SPIONs in Parkinson model by 6-OHDA, have been performed using the MSCs marking in vitro, with a multimodal particle.

We performed a lesion in the medial forebrain bundle of rats with the neurotoxin 6-OHDA and subsequent infusion of marked MSC in the striate region of the animals. The brains of these animals were examined post-mortem by MRI and histology. It was possible to visualize and locate the MSC by both techniques, as well as the identification of the migration of mesenchymal stem cells from the site of cell infusion (splined) to the site of injury (medial forebrain bundle), which supports the hypothesis that nanoparticles are an effective tool for the localization of cells in the CNS, and that MSCs are able to migrate to the lesion sites. This experimental design will enable a more detailed analysis of possible structural and functional regeneration of the nigrostriatal pathway that the stem cell therapy may cause.

Another investigation that has been successfully conducted by the group is connected with the immunophenotyping and ultra-structural characterization of glioblastoma multiform tumors. For this investigation, samples of human tissue have been collected and several procedures have been performed, embodying the standardization or primary cultures of glioblastoma, isolation, cultivation and characterization of human glioblastoma stem cells CD133+, as well as the establishment of a protocol for obtaining tumor neurospheres. As a part of this investigation, a monitoring in vivo, by means of MRI, was processed for the C6 glioma cells, marked with SPIONs. These nanoparticles were covered with Dextran and complexed with Poly (L-Lysine).

In the same direction, the group carried out an investigation, using MRI, of the tumor growth in the C6 model for glioblastoma, marking the cells with nanoparticles of iron oxide covered with aminosilane, aiming to applications in the magnetothermia therapy. For this study, a pattern for the tumor growth was established for Wistar rat submitted to the C6 model for glioblastoma.

All the activities described above were also accompanied by experimental procedures devoted to the synthesis of SPIONs. In particular, during the period covered by this report, synthesis and standardization of SPIONs with different coverage (chitosan\PLL, dextran\PLL) and fluorescent NOF (Rhodamine) have been performed. Specific Software was developed for the optimization of the use of nanoparticles for cellular marking, aiming at the applications in therapy and diagnosis.

A series of studies and experimental investigations have been carried out at IFUSP, under the leadership of Daniel Cornejo, as a part of an intensive work dedicated to the synthesis and characterization of magnetic nanoparticles (as, for instance Ni-Zn, $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$ e $\text{Mn}_{0.65}\text{Zn}_{0.35}\text{Fe}_2\text{O}_4$ ferrites) using some complementary techniques like the conventional oven, the microwave oven, and combustion reaction. The combined use of these techniques permits a detailed study of the essential characteristics of these particles, whose applications are an important target of the INCT.

The Z-scan technique has been applied to determine the optical Kerr coefficient and two-photon absorption coefficient of magnetite nanoparticles colloidal suspension. The nonlinear two-photon absorption coefficient and optical Kerr coefficient, and the third-order electric susceptibility of an oil-based magnetic colloid of magnetite nanoparticles were measured using the Z-scan technique. The frequency, pulse width, and intensity were carefully adjusted to avoid the occurrence of any other

nonlinear process in the experiment. This procedure assured obtaining reliable values of these parameters, namely, $n_2 = -(3.5 \pm 1.5) \times 10^{-14} \text{ cm}^2 / \text{W}$, $\beta = (1.6 \pm 0.8) \text{ cm} / \text{GW}$ and $|\chi^{(3)}| = (4.3 \pm 1.9) \times 10^{-20} \text{ m}^2 / \text{V}^2 (\sim 3.2 \times 10^{-12} \text{ esu})$. It has been observed that increasing the frequency of the femtosecond laser pulses, the thermal lens and Soret effects take place, increasing artificially the absolute values of β and n_2 .

Moreover, the optical absorption of a magnetic colloid has been investigated from the thermal to the electronic time-scale regime, and the free-carrier absorption cross-section was measured. The free-carrier absorption cross section of the oil-based magnetic colloid of magnetite was measured using the ZS technique, giving a value of $\sigma = (3.1 \pm 0.5) \times 10^{-18} \text{ cm}^2$. It has been shown that, in the particular case of this type of magnetic colloid, this order of magnitude can be obtained in experiments with both pulsed (picosecond) and cw chopped (millisecond) laser beams. In the case of chopped cw laser, the interval time between the $\tau = 17 \text{ ms}$ pulses, with peak energy $E_p \sim 25,000 \text{ nJ}$, should be at least $\Delta t = 17 \text{ ms}$. In the case of picoseconds pulsed laser, $E_p \sim 3,000 \text{ nJ}$, Δt should be at least ~ 50 ms. Femtosecond pulsed laser beams, even with $E_p \sim 0.09 \text{ nJ}$, also need large values of Δt to avoid the additional thermal triggered Soret effect. In the investigated case, results obtained with pulse sequences with $\Delta t \leq 15 \text{ ms}$ (chopped or fs) are affected by the Soret effect and the FCA cross section calculated is not that reliable.

With respect to the partnership of the INCT-FCx with private companies to investigate magnetic fluids, in the last year an agreement was submitted, joining the Biotec – Produtos Plásticos e Metálicos Ltda. and São Paulo University, intermediated by IFUSP (Giancarlo E. S. Brito), aiming at the research for developing a thin layer based on biocompatible materials and silver nanoparticles for surgical uses as an innovative technological application. Indeed, the project titled “Thin layers based on biomaterials containing silver nanoparticles for utilization in infected cutaneous lesions” is waiting for the approval of appropriate agents.

Likewise, in a meeting with a company (electronic equipment) whose name is Bravox (Itu/SP), researches from IFUSP presented a magnetic grease with potential application to the refrigeration process and field homogenization in coil. The application of oil-based ferrofluids is not efficient enough in this context because of the temperature at which they have to operate, which is relatively high, thus increasing the risk of firing. This grease under investigation could effectively help the refrigeration process because the temperatures in the coil can arrive at 230 a 300 °C.

Researches from UFSC (under the leadership of Wagner Figueiredo) are performing detailed investigations, using Monte Carlo methods, simulating the properties of a system composed of nanoparticles presenting uniaxial anisotropy, with easy axes that are randomly distributed in space. These particles interact through the long-range dipolar interactions, and we study the magnetic properties as a function of temperature and the ratio between the magnetic dipolar energy and the magnitude of the uniaxial anisotropy. The properties considered in this investigation are the hysteresis loop, coercive field and remanence, as well as, the zero field cooled (ZFC) magnetization as a function of temperature, in order to determine the blocking temperature of the system. These properties are calculated for the case of noninteracting, as well as, for interacting nanoparticles placed on the sites of cubic and face centered

lattices and a liquid-like structure. These methods permit the determination of the structures that are more appropriate to understand the fundamental properties of the systems with this kind of anisotropy.

The group from UFPE, under the leadership of J. A. Miranda, continues the study of ferrofluids and their properties, focusing the effects of these nanoparticles on the medium incorporating them. Moreover, the group is responsible for the pioneering investigation of the inertial effects in pattern formation of confined fluids and rotating confined fluids. In this direction, they have conducted a very fruitful theoretical investigation of the nonlinear dynamics in ferrofluids in the Hele-Shaw cells. Indeed, in the last years one can observe a continuous growing in the interest of studying the process of controlling flux in Hele-Shaw cells. These studies have proposed several different strategies to avoid the arising of different morphologies. A first set of investigations was not able to avoid the arising of viscous fingering, but succeeded in replacing the typical bifurcated structures with more symmetric forms, in which the finger still persisted, but were not accompanied by bifurcation. Such control processes of the fluid-fluid interface are of essential importance in some areas like, for instance, petrol prospecting.

A second line of investigation was inaugurated by a pioneer work published by the group in 2012, in the *Physical Review Letters* (PRL). In this framework, they search for mechanisms that are not only able to avoid the bifurcations but are able to inhibit the establishment of large deformations at the interface. In this context, the final goal of the research was to find stable propagating fronts that generate patterns in which the interface is approximately circular. In that work (PRL), the possibility of a systematic control of the interface instability was investigated by theoretical and experimental methods. An article in the *Revista da Fapesp* (titled “Tension under control”, November 2012) has highlighted and commented this work (PRL 109, 144502 (2012)).

Other investigations performed by the group have been featured in the prestigious *Physics Today* [*Physics Today* 65 (10), 15 (2012)]. Using the title “Flow geometry controls viscous fingering”, R. Mark Wilson underlines and comments the results presented in the article published by the group in *Phys. Rev. E* **82**, 056319 (2010).

The main effects of the dispersed ions in isotropic and anisotropic media, or in electrolytic cells in general, continue to be the focus of several investigations carried out by INCT. Recently, the group of UEM (P. R. G. Fernandes, H. Mukai, e E. K. Lenzi – INCT-SC) obtained analytical results that have been validated by experimental data regarding ionic solutions of salt diluted in water. The agreement between the theoretical predictions and the experimental results was very good, thus reinforcing the necessity to consider the dynamics of the ions as being governed by anomalous diffusive processes. Therefore, one step more was given in considering anomalous diffusion effects in the context of complex fluids. The theoretical model considered is another particular application of a general model proposed in the ambit of INCT. This general model considers the fractional diffusion equation of distributed order to describe bulk behaviour using boundary conditions that employs also some kind of fractional calculus and embodies a series of relevant boundary conditions as particular cases (E. K. Lenzi- INCT-SC and L. R. Evangelista). As pointed out in a previous report, this is one of the first applications of an anomalous diffusion model to the problem of the admittance or impedance response of a cell containing mobile charges, and taking into account surface effects that can be described by boundary conditions not restricted to blocking effects, as usual.

The group of IF-UFRGS, under the leadership of Y. Levin, in collaboration with Márcia C. Barbosa and researchers from others INCTs, continues the proposition of new theories that permit investigations in electrolytic cells in presence of long range forces, as the ones occurring in plasmas and gravitational systems. Particularly relevant is a work recently published (Faraday Discuss., 2013, 160, 75–87) in which a theory able to account for quantitative aspects of the surface and interface tensions of different electrolytic solutions has been proposed. It was found that, near the interface, ions can be separated into two classes: the kosmotropes and the chaotropes. While the kosmotropes remain hydrated near the interface and are repelled from it, the chaotropes loose their hydration sheath and become adsorbed to the surface. The anionic adsorption is strongly correlated with the Jones–Dole viscosity B-coefficient. Both hydration and polarizability must be taken into account to obtain a quantitative agreement with the experiments. To calculate the excess interfacial tension of the oil–electrolyte interface, the dispersion interactions must also be included. The theory can also be used to calculate the surface and the interfacial tensions of acid solutions, predicting a strong surface adsorption of hydronium ion.

Along the same line of investigations, the group obtained a series of other relevant results to understand the behaviour of electrolytic cells. These analyses involved different approaches as, for instance, the study of non-equilibrium phase transitions, the analysis of excluded volume effects inside the double-layer, Monte Carlo simulations, investigation of adsorption effects, in general, and detailed studies of equation of state, among others.

Topic of Research: Membranes

1) MORPHOLOGY OF AMPHIPHILIC SYSTEMS

In 2013 the work on the structure of micelles DTATf, was completed accepted for publication in the journal Langmuir. The work was conducted in collaboration with several authors, many of them belonging to the group of membranes INCT (in bold below): - Lima, F. S., **Cuccovia, I. M.**, Horinek, D., **Amaral, L. Q.**, **Riske, K. A.**, Schreier, S., **Salinas, R. K.**, Bastos, E. L., Pires, P. A. R., Bozelli Jr, J. C., Favaro, D. C., Rodrigues, A. C. B., Dias, L. G., El Seoud, O. A., Chaimovich, H..

This collaboration was initiated with measures of small angle X-ray scattering (SAXS) at the Laboratory of Crystallography of IFUSP, under the responsibility of L. Q. Amaral. Dr. Karin joined the project participating in the SAXS measurements, along with Filipe, and on the analysis with theoretical modeling. A thorough analysis of various micellar forms was done this last year, using GENFIT program, developed by Dr. Francesco Spinozzi (Ancona, Italy), who came to Brazil in February 2012, and passed information on how to work with the interface Windows tuning curves, developed in Fortran. Dr. Francesco visited us with some daily support from INCT.

The data show that the basic structure formed by this detergent was the same in the various conditions of concentration of detergent and salt studied. As [DTATf] increased and/or [salt] decreased a peak appeared from interference between objects at distances in the order of 20 nm. The broad peak from

the geometry of the object was set with some simple models, such as sphere, infinite cylinder and infinite lamella, with three levels of electron density: aqueous solvent, polar region and paraffinic region. We have seen that only the last model was able to satisfactorily fit the data, which was surprising because we expected that this detergent formed micelle-like structures. In testing more sophisticated geometries, as prolate ellipsoid and oblate, and bicelle, it became evident that data can only be adjusted using parameters with physical meaning if we use the model of infinite lamella or, better yet, the bicelle model. We could then verify that the geometry of the aggregates formed by DTATf is actually a bicelle, with size compatible with the aggregation number measured by other techniques and with the distance between objects as measured by SAXS. The final work added other techniques such as the use of molecular dynamics and NMR relying on collaboration of Dr. Robert K. Salinas also participating of INCTFCx, and is part of the PhD program of Filipe S. Lima, under the guidance of Hernan Chaimovich and collaboration with Iolanda M. Cuccovia, Lia Q. Amaral, Karin A. Riske and Roberto K. Salinas.

2) INTERACTION OF ANTIMICROBIAL PEPTIDES WITH MEMBRANE.

Antimicrobial peptides are part of the natural defense system in plants and animals and exhibit lytic activity against the membrane of microorganisms. For this reason, these peptides offer a promising alternative to already known anti-microbial therapies. Our focus is the study of the interaction between antimicrobial peptides (synthesized by other collaborating groups) and membrane models (lipid bilayers of different compositions) in order to unravel the mechanism of action of these peptides.

2a) EFFECT OF CHARGE ON THE INTERACTION OF LIPID MEMBRANE MODELS WITH BP100

The BP100 (KKLFFKKILKYL-NH₂) is a hybrid peptide of cecropin and melittin obtained by combinatorial chemistry. We conducted studies of conformational and functional properties of BP100 on membrane models - large unilamellar vesicles, LUVs and giant unilamellar vesicles, GUVs - composed of PC and PG. The CD spectra showed that the peptide in aqueous solution provides a balance between different conformations, acquiring α -helix conformation in the presence of trifluorethanol (TFE) in the presence of LUVs containing PG. NMR data showed that the α -helix is composed of residues 3-10. The CD spectra also indicated the occurrence of aggregation of peptides on the membrane and / or aggregation of vesicles, which is dependent on the ratio peptide: lipid membranes due to the peptide. Measurements of quasi-elastic light scattering confirmed aggregation of lipids, which could be prevented by increasing the ionic strength. This aggregation process was initiated when the ratio peptide: lipid reached the electroneutrality of the system. The BP100 increases the zeta potential of LUVs with low molar ratios of PG. At higher concentrations of surface charge, zeta potential remained constant and increased only when about 80% of charges were neutralized. Furthermore, the peptide induced leakage of carboxyfluorescein LUVs of PC: PG in both low and high in ionic strength. The presence of the peptide caused the appearance of denser structures on the surface of vesicles GUVs both PC and PC: PG. This subject is part of the Master's degree (completed) by the student Mariana C. Manzini supervised by Iolanda M. Cuccovia, co-supervision of Katia R. Perez and collaboration with Karin A. Riske.

2b) INTERACTION OF ANTIMICROBIAL PEPTIDE GOMESIN AND ITS ANALOGUES WITH MODEL MEMBRANES.

This study aimed to investigate the influence of different amino acid residues of the antimicrobial peptide gomesin, Gm, in their ability to interact with membranes, using vesicles composed of mixtures of neutral lipids (POPC palmitoyl oleoyl phosphatidylcholine) and anionic (POPG, palmitoyl oleoyl phosphatidylglycerol) as membrane model. For this, peptides were synthesized with substitution of some amino acids by alanine residues (in positions 1, 3, 5, 7, 9, 10, 12, 14) by changing both the total charge of the peptide as its hydrophilicity total. The interaction between gomesin and with Ala^x-Gm with model membranes was studied by ITC, light scattering and fluorescent leakage of the probe carboxyfluorescein (CF) previously encapsulated in the inner compartment of the lipid vesicles.

During the past year, we completed the analysis of ITC data, using a model of partition together with the Gouy-Chapman theory, thus obtaining thermodynamic data for the interaction of gomesin analogues with model membranes. The kinetics of CF leakage was analyzed and it was concluded that the leak occurs basically with two characteristic times, a fast one (process 1, seconds), related to leakage of individual vesicles, and another much slower (process 2, several minutes), which is associated with the leakage of aggregated vesicles. The data showed that the interaction of various peptides with membranes is mainly dependent on the hydrophobicity of the peptide, showing that the interaction of hydrophobic residues of gomesin is crucial for their antimicrobial activity.

In addition, we are finalizing a paper on the interaction of gomesin with membranes composed of POPC: POPG in the absence and presence of PEG2000 polymer on the surface of the vesicles, with the aim of studying the effect of this peptide in lipid aggregation. This work is being done in collaboration with Prof. Joachim Seelig, University of Basel, Switzerland. Completed Master thesis of the student Bruno Mattei under the supervision of Karin A. Riske and co-supervision of Katia R. Perez and Antonio Miranda.

2c) BIOPHYSICAL ASPECTS OF THE INTERACTION OF BIOLOGICALLY ACTIVE PEPTIDES WITH MODEL MEMBRANES: RELATIONSHIP BETWEEN STRUCTURE AND ACTIVITY.

During the period, the peptide Esc [1-18] was chemically synthesized using solid phase strategy, purified by semi-preparative HPLC and characterized by mass spectrometry. Moreover, studies of the interaction of Esc [1-18] with membrane models were performed using fluorescence techniques, isothermal titration calorimetry (ITC), and turbidity of large unilamellar vesicles (LUVs), optical microscopy and of giant vesicles (GUVs). Carboxyfluorescein (CF) leakage assays from large unilamellar vesicles (LUVs) by the peptide action showed that the binding of Esc [1-18] to the membrane depends on the concentration of negative charged phospholipids on the membrane surface, showing a higher percentage of leakage for vesicles composed by mixtures of POPC:POPG with molar ratio higher than 50 mol% POPG. Moreover, the leakage of CF increases with the peptide/lipid molar ratio for the same POPG concentration.

ITC experiments showed that ESC [1-18] did not interact with LUVs composed of POPC 100 mol% showing no significant variation of heat variation as compared with dilution heat of these LUVs in the working buffer. However, when the peptide is titrated with LUVs composed of POPC: POPG 50 mol% and 100 mol% POPG it was possible to measure a positive heat variation showing that the

association of Esc [1-18] on the surface of these vesicles follows an overall endothermic process which is indicative of the opening of pores in the membrane. The variation of enthalpy per mole of peptide, ΔH , calculated for the association of the peptide to LUVs composed of POPC 100 mol% POPC: POPG 50 mol% and 100 mol% POPG were 0.5 cal / mol, 1.18 kcal / mol and 0.65 kcal / mol, respectively. Additionally, lipid/peptide ratio for titration with LUVs of POPC: POPG 50 mol% and 100 mol% POPG were 2.34 and 1, respectively, showing that the peptide is consumed more quickly when the vesicles are composed only of POPG. The more positive ΔH obtained for the association of the peptide to LUVs composed of POPC: POPG 50 mol% when compared with the LUVs composed only of POPG, show that there is a direct relationship between the surface charge of the membrane and ΔH , indicating that other semi-processes may be occurring during the interaction and consequently influencing the ΔH of the interaction. It could be due the vesicles aggregation after the addition of the peptide and, in fact, it is possible to note from turbidity measurements that the aggregation of both LUVs, POPC:POPG 50 mol% and 100 mol% of POPG, seems to be different for each one. The GUVs composed of POPC:POPG 50 mol% showed that the addition of Esc [1-18] induces the formation of stable pores in the membrane causing loss of contrast of these vesicles without disrupting membranes. For GUVs composed of 100 mol% POPG the fast rupture of membranes occurred without observing the loss of contrast. Isabela Moreira Silva Masters student- Work in progress supervised by Katia R. Perez and co-supervision of Karin A. Riske and collaboration of Maria A. Juliano.

3)PROTEASES

3a) INHIBITORS OF PROTEOLYTIC ENZYMES.

Cysteine proteases have been described in several malaria parasites, and confirmed by analysis of sequencing the genome of *Plasmodium falciparum* genome. Studies with inhibitors showed that cysteine proteases are involved in the hydrolysis of haemoglobin, in the disruption of erythrocytes and invasion by the parasite. The cysteine proteases characterized are falcipains, enzymes of papain family (clan CA). Falcipain-2 and falcipain-3 are also haemoglobinases whose function was confirmed for falcipain-2 by gene deletion, which prevent the haemoglobin hydrolysis. New drugs for malaria are necessary and cysteine proteases may be good targets. The specificity of the protease inhibitors is always a problem with not trivial solution, because the most of these inhibitors targets are centered into the protease catalysis site, such as SH group of a cysteine or the OH group of serine, in cysteine and serine proteases, respectively. However, the falcipain-2 has a structural feature not found in any other cysteine protease, a loop conformation that seems to be the portion of the falcipain 2 that attach to haemoglobin to trigger the cascade of proteases to cleave the haemoglobin. Figure 1 shows an illustration of the structure of falcipain-2 that is conserved in several Plasmodium species and the binding loop in detail.

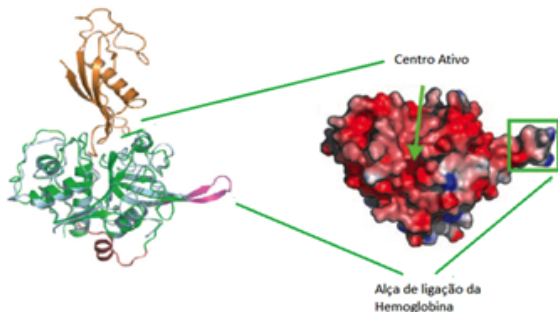


Figure 1. Structure of falcipain-2 in model sheets. The structure model of filled balls showing the surface rather negative (red) is shown to the right. The binding loop of the active falcipain-2 is indicated.

Interestingly, the deletion of the binding loop of a falcipain mutant (FP2^{-10Δ}) does not change its hydrolytic efficiency for synthetic substrates or other proteins such as albumin and casein, but the total loss of the haemoglobinase activity. The loop present in the different falcipains have the following amino acid sequences – Falcipain-2: E-I-V-N-P-L-T-K-K-G; Falcipain-3: D-I-Y-N-E-D-T-G-R-M; Vivipain 2: D-A-Y-D-F-D-T-K-T-M; Vivipain 3: E-M-Y-D-A-M-S-R-R-K-N. (vivipain comes from *Plasmodium vivax*).

4) SOLUBILIZATION OF MEMBRANES CONTAINING STEROLS

Our objective was to study the process of solubilisation of lipid bilayers composed of lipids found in abundance in biological membranes, aiming to understand the physical and chemical aspects of the process of solubilisation and the reasons that lead to resistance to detergents of certain lipid compositions containing sterols (both cholesterol and phytosterols). The results obtained by optical microscopy, light scattering and ITC showed that the solubilisation process strongly depends on the lipid composition employed. Vesicles in liquid-ordered phase (SM / sterol) were virtually insoluble, whereas vesicles in the fluid phases (POPC) and gel (SM) were completely solubilized. POPC vesicles / sterol were only partially solubilized. From the results, it can be concluded that resistance to solubilisation takes place only at the liquid-ordered phase (SM / sterol). However, the composition POPC / sterol was partially insoluble, probably due to a low miscibility TX-100/cholesterol.

Research work of the theoreticians and their interactions

The theoretical research work is carried out by the following groups of the INCT and their collaborators:

1. Prof. Tânia Tomé and Prof. Mário J. de Oliveira, from the Institute of Physics at USP, and Prof. Everaldo Arashiro, from the Federal University of Ouro Preto. They investigate mathematical models of biologically motivated problems, which are treated by statistical mechanics and stochastic dynamics

methods, with particular attention to the modeling of spreading of epidemics and other problems of the dynamics of biological populations.

2. Prof. Silvio Salinas and Prof. Antonio M. Figueiredo Neto, from IFUSP, and the group of Prof. Sergio L. Gomez, from the Universidade Estadual de Ponta Grossa. They have proposed a model to account for the effective virtual tricritical behavior in the vicinity of the isotropic-nematic transition.

3. Prof. Sylvio Canuto and Prof. Kaline Coutinho, from IFUSP, and Prof. Marcelo Leite Lyra and Prof. Ítalo M. Nunes de Oliveira, from the Institute of Physics at UFAL. A recently hired faculty at UFAL, Vinicius Manzoni, also collaborates in the work, although he is not a member of the INCT. This team is performing quantum calculations of the birefringence in molecules belonging to some liquid-crystalline systems, with the goal of explaining some experimental measurements. Also, they are carrying out studies of the effects of solvents on the optical properties of model molecules. These investigations are supported by experimental data obtained at the laboratories at UFAL.

4. Prof. Sylvio Canuto and Prof. Kaline Coutinho, from IFUSP, and Prof. Claudete Valduga, from the Universidade Bandeirante de São Paulo, UNIBAM. They are performing measurements and molecular modeling of lipoaffinity in compounds of Curcumin.

5. Prof. Sylvio Canuto, Prof. Kaline Coutinho, and Prof. Antonio Martins Figueiredo Neto, from IFUSP, and Prof. Lilia Coronato Courrol, from the Escola Paulista de Medicina, UNIFESP. There is doctor student, Lucas Modesto da Costa, involved in this work. They have carried out measurements of the electronic spectrum of absorption and fluorescence and the molecular modeling of these properties in the complexed tetracycline with Europium, EuCTc, in water solution, with a view to learn how to model biomarkers for the LDL solutions.

6. Prof. Viviana Giampaoli from the Institute of Mathematics and Statistics and Prof. Sergio Bydlowski, from the School of Medicine, at USP. They have performed statistical analyses of data related to inducers of cerebral death and their inclusion in the lipid nanoemulsions to treat cancer.

7. Prof. Marcia Barbosa and Prof. Yan Levin, from the Institute of Physics of the Federal University of Rio Grande do Sul. They are working in problems related to ionic fluxes through nanopores.

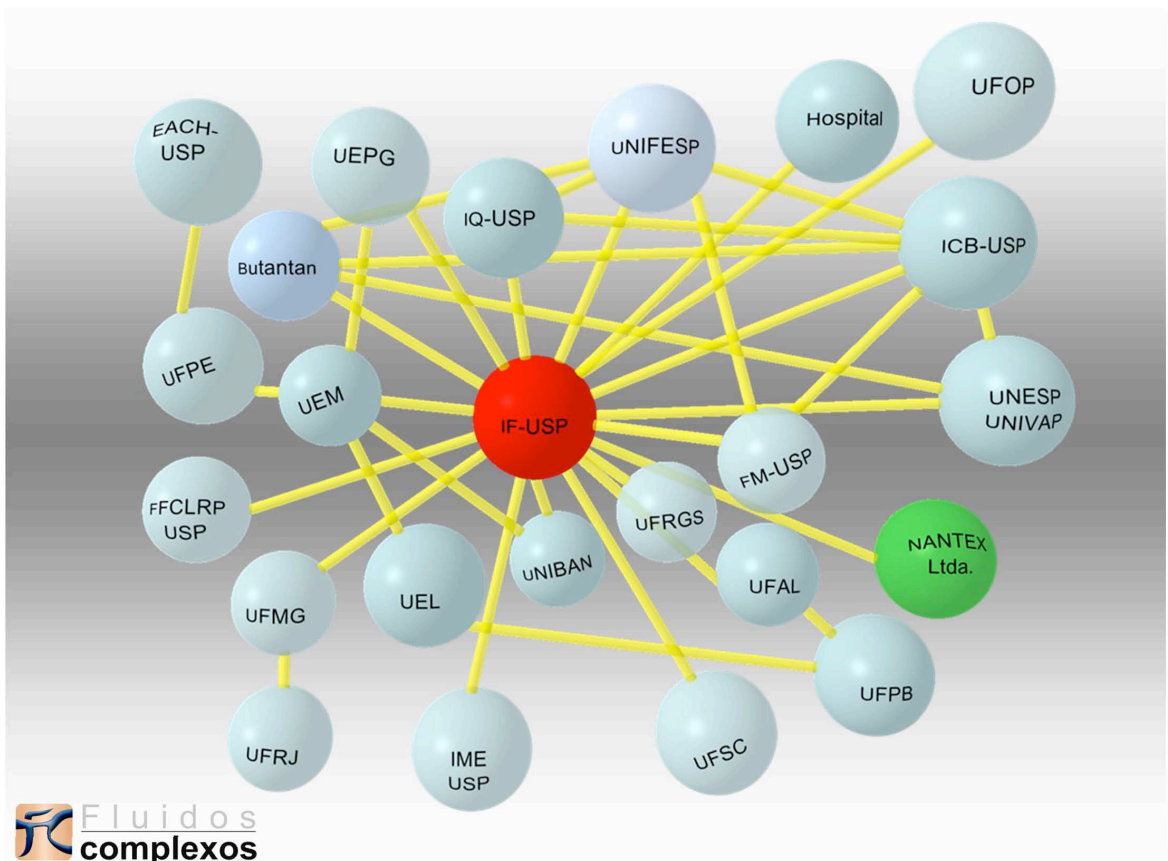
8. Prof. Silvio Salinas, from IFUSP, keeps collaborating with members of the INCT to describe the nematic-isotropic transition and the several properties of nematic elastomers.. He was responsible for short course “Elementary statistical models for the behavior of some complex systems”, in the VI Summer School of the INCT on Complex Fluids, and by an invited talk at the Second French-Brazilian Meeting on Nanoscience, Nanotechnology and Nanobiotechnology, at International Centre for Condensed Matter Physics, University of Brasília, in December, 2012.

Computational Facilities:

The existence of the INCT gave rise to the installation of a computer cluster in IF/USP for the use of all theoretical researchers of the INCT. We remodeled a room (205, at the DFGE/IFUSP), with adequate temperature, logic and electric networks, to receive a computer cluster with the a configuration of Intel Xeon octocores, with 24 GB of RAM and 2 TB of HD each. This means that we have a total of 48 processors with 144 Gb of RAM and 12 TB of hard drive. The management of user accounts and monitoring of cluster resources are made through the homepages and <http://gauss.if.usp.br/cluster> and <https://gauss.if.usp.br/monitor>, respectively. Currently, this cluster has 30 users in 6 groups: IFUSP/FGE, UFPR, UEPG, IFUSP/FEP, UFRGS, FFCLRP, and IIEP. In 2012 we have bought 6 additional Intel Xeon octocores, with 24 GB of RAM and 2 TB of HD each, which leads to more than 48 processors, with 144 Gb of RAM and 12 TB of hard disk, and extends the computational resources of this cluster. These new features of the cluster are in the process of installation.

Matrix of Collaborations

We now present the relationships of collaboration among the different institutions of the INCT-FCx. We represent in red the headquarters of the INCT, and in green a company that has been incorporated to the proposal.



(INCT-FCx) Annex I

Scientific publications*

(*) In red are the publications involving more than one research group belonging to the INCT-FCx, the result of collaboration (total of 24)

1. A.C. Ferreira, M.B.C. Costa, A.G. Coelho, C.S. Sobrinho, J.L.S. Lima, J.W.M. Menezes, M.L. Lyra, and A.S.B. Sombra. Analysis of the nonlinear optical switching in a Sagnac interferometer with non-instantaneous Kerr effect. *Opt. Commun.* 285 1408 (2012).
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216. Yonamine, Camila M.; Kondo, Marcia Y.; Juliano, Maria A. ; Icimoto, Marcelo Y.; Baptista, Gandhi R. ; Yamane, Tetsuo ; Oliveira, Vitor; Juliano, Luis; Lapa, Antônio J.; Lima-Landman, Maria Teresa R.; Hayashi, Mirian A.F. Kinetic characterization of gyroxin, a serine protease from *Crotalus durissus terrificus* venom. *Biochimie (Paris. Print)*, v. 94, p. 2791-2793, 2012.
217. Zola, R.S.; Evangelista, L.R.; Yang, Y.C; Yang, D.K. Surface Induced Phase Separation and Pattern Formation at the Isotropic Interface in Chiral Nematic Liquid Crystals. *Physical Review Letters*, v. 110, p. 057801, 2013.

Invited presentations at scientific meetings

1. “Poder Prospectivo o Poder Retrospectivo: Aclarando las Ideas a Partir de un Problema de Periodontia”. Viviana Giampaoli
2. 14th Internacional Conference on Organized Molecular Films. Structure and Dynamics of DNA confined in between non-cationic lipid membranes. 2012. Elisabeth Andreoli de Oliveira.
3. 14th International Conference on Molecular Organized Films. Elastic Properties of lipid bilayers. 2012. Elisabeth Andreoli de Oliveira.
4. 14th International Conference on Organized Molecular Films. Gaussian Deconvolution: A powerful method for modeling scattering profiles of mono and multilamellar vesicles. 2012. Elisabeth Andreoli de Oliveira.
5. 2013 Photonics West SPIE. New lyotropic mixtures presenting the biaxial nematic liquid crystalline phase. 2013. Antônio Martins Figueiredo Neto.
6. 24th International Liquid Crystal Conference - ILCC 2012. Nonlinear properties of Lyotropic-like human lipoproteins. 2012. Antônio Martins Figueiredo Neto.
7. BIT s 3rd Annual World Congress of Nanomedicine-2012. Nonlinear optical response of oxidized and native human low-density lipoproteins investigated by using the Z-Scan technique. 2012. Antônio Martins Figueiredo Neto.
8. Encontro Nacional de Física da Matéria Condensada (ENFMC). New lyotropic mixtures presenting the biaxial nematic liquid crystalline phase. 2012. Antônio Martins Figueiredo Neto.
9. IADR General Session, 2012, Foz de Iguaçu. IADR General Session, 2012. Interation RANK/RANKL/OPG in the GBR in rats with estrogen deficiency. Maria Aparecida Neves Jardim.
10. II Encontro de Física do Centro-Oeste. Propriedades ópticas não-lineares de lipoproteínas humanas aterogênicas LDL colesterol. 2012. Antônio Martins Figueiredo Neto.
11. II Latin American Federation of Biophysical Societies Congress / XXXVII Brazilian Biophysical Society. Congress. Buzios, 2012. A.S. Ito.
12. II Workshop on Complex Physical Phenomena in Materials. Structural characterization of liquid crystalline cellulosic networks. 2012. Antônio Martins Figueiredo Neto.

13. Interaction between gold nanoparticles and bovine serum albumin. XXXV ENFMC, 2012, Águas de Lindóia – SP – Brazil.
14. International Centre of Condensed Matter Physics (ICCMP). Application of The Z-Scan Technique to Determine the Optical Kerr Coefficient and Two-Photon Absorption Coefficient of Magnetite Nanoparticles Colloidal Suspension. 2012. Antônio Martins Figueiredo Neto.
15. International Workshop on Soft Matter Physics and Complex Flow. Elastômeros não-liquido cristalinos, com e sem o doping com nanopartículas magnéticas. 2012. Antônio Martins Figueiredo Neto.
16. Light and Life. Quantum Optics VI. 14/11/2013, Piriapolis (Uruguay), homenageado da Conferência. H.M. Nussenzveig.
17. Lorentz Center ESF Casimir Physics School-Workshop. Mini-curso convidado. Dispersive interactions with non-trivial geometries. 2012. H.M. Nussenzveig.
18. Magnetic properties of $\text{Fe}_{1-x}\text{Rh}_x/\text{Ta}$ ($0,20 < x < 0,54$) thin films. Daniel Cornejo.
19. Magnetization and magnetoresistance first-order-reversal-curves analysis in spin-valves. Daniel Cornejo.
20. Quo Vadis, Quantum Physics? IIP, Natal, RN. Recent developments in Casimir physics. 2013.
21. Second French-Brazilian Meeting on Nanoscience, Nanotechnology and Nanobiotechnology, International Centre for Condensed Matter Physics, Universidade de Brasília, 10 a 14 de dezembro de 2012, Elementary lattice models for the nematic transitions in liquid-crystalline systems. Silvio Roberto Salinas.
22. Simpósio em Homenagem ao Professor João Antonio Plascak, Belo Horizonte, 03/11/2012. "Processos de contato interagentes em uma dimensão". W. Figueiredo.
23. Simpósio em Homenagem ao Professor Silvio Salinas, Instituto de Física, Departamento de Física Geral, 23/03/2012. "Diagrama de fases de pequenas partículas antiferromagnéticas". W. Figueiredo.
24. The 24th International Liquid Crystal Conference Italo-Brazilian Meeting. Nonlinear optics of complex fluids by using the Z-Scan technique: I) General approach; II) application to lyotropic liquid crystals and biological fluids. 2012. Antônio Martins Figueiredo Neto.
25. The International Congress of Oral Implantologists, 2012, Orlando - Florida. Word Congress XXIX, 2012. Immuno-localization of FGF-2 and TGF-B1 during guided bone egeneration early healing events.
26. The New Horizons of Colloidal Science: Fundamentals and Applications. Nonlinear properties of magnetic colloids, investigated with the Z-Scan technique. 2012. Antônio Martins Figueiredo Neto.
27. Transition from negative to positive exchange-bias in AF-FM bilayers: a phenomenological model. 2012. Daniel Cornejo.
28. X Décimo Congreso Latinoamericano de Sociedades de Estadística (CLATSE), 16 a 19 de outubro de 2012, Córdoba, Argentina. Elisete Aubin

29. XIII Escola de Modelos de regressão – Maresias, SP, 24 a 27 de Fevereiro de 2013. “Poder prospectivo ou poder retrospectivo: esclarecendo ideias a partir de um problema prático em Periodontia”. Elisete Aubin.
30. XX - Simpósio Nacional de Probabilidade e Estatística (SINAPE) – João pessoa, PB, 30 de Julho a 03 de Agosto de 2012. “Validação do Inventário de Estilo de Aprendizagem (Learning Style Inventory – LSI) de David A. Kolb para Idosos Brasileiros”. Elisete Aubin.
31. XXXV Encontro Nacional de Física da Matéria Condensada, Águas de Lindóia, 14 a 18 de maio de 2012, Elementary lattice models for the nematic transitions in liquid-crystalline systems. Silvio Roberto Salinas.
32. XXXV ENFMC, 2012, Águas de Lindóia – SP – Brazil. Computer simulation studies on pH dependent spectroscopic properties of o-Abz. Galembeck and A.S.Ito.

Participation in scientific meetings

1. SAS2012 International Small-Angle Scattering Conference”, Sidney, Austrália. 18-23 de Novembro de 2012.
2. 10th International Congress on Cell Biology - Rio Centro - Rio de Janeiro – Brasil. Atypical enteropathogenic Escherichia coli (aEPEC) secretes a soluble anti-phagocytic factor.
3. 14th International Conference on Organized Molecular Films (ICOMF14) - LB14”, Paris, França. 10/06/2012 – 13/06/2011.
4. 1st Brazil-France meeting on nanomagnetism, spin electronics and carbon-based materials, and quantum optics. Búzios, Rio de Janeiro. Casimir effect and applications. 2012.
5. 1st Italian-Brazilian Workshop on Liquid Crystals. Erice, Italy, August 26-30, 2012. Dynamics of topological defects annihilation in lyotropics.
6. 22^a Reunião Anual de Usuários do Laboratório Nacional de Luz Síncrotron. 8/02/2012 – 29/12/2012. In situ SAXS experiment during DNA and liposome complexation.
7. 22^a Reunião Anual de Usuários do Laboratório Nacional de Luz Síncrotron. 8/02/2012 – 29/12/2012.
8. 244th ACS National Meeting, Filadelfia, EUA, 2012
9. 24th International Liquid Crystal Conference. Erice, Italy, August 26-30, 2012
10. 24th International Liquid Crystal Conference. Mainz, Germany, August 19th-24th, 2012. Liquid Crystals Cosmology.
11. 2nd French-Brazilian Meeting on Nanoscience, Nanotechnology and Nanobiotechnology, Brasilia, 2012.. "Nanosize effects in the third order optical nonlinearities of magnetite ferrofluids".
12. 2nd International Workshop on Complex Physical Phenomena in Materials, Porto de Galinhas, 2012.
13. 56th Annual Meeting of the Biophysical Society, San Diego 25-29/02/2012.

14. 61st Annual Scientific Session and Expo of the American-College-of-Cardiology (ACC) Location, 2012, Chicago. Journal of the American College of Cardiology. New York: Elsevier Science Inc, 2012. v. 59. p. E1542-E1542.
15. 67 American College of Cardiology – Annual Session. San Francisco 2013. Circulation Abstract 1275-15. Effects of Phytosterol Supplementation to the Maximum Lipid-Lowering Therapy in Familial Hypercholesterolemia.
16. 67º Congresso Brasileiro de Cardiologia, 2012, Recife. Arq Bras Cardiol. Rio de Janeiro: SBC - Núcleo Interno de Design, 2012. v. 99. p. 33-33.
17. 80th EAS Congress, 2012, Milão. Atherosclerosis Supplements, 2012. Inflammatory Environment and Immune Responses to Oxidized LDL are Linked to Systolic and Diastolic Blood Pressure Levels in Hypertensive Subjects.
18. 8th Liquid Matter conference. “Ions at Air-Water Interface: Surface Tensions and Surface Potentials of Electrolyte Solutions.” 2011.
19. Amazonian Workshop on quantum vacuum effects. UFPA, Belém, Pará. Efeito Casimir e aplicações. 2012.
20. APS March Meeting. “Ion Specific Effects at Interfaces.” 2012.
21. Biomembrane Days in Potsdam, Potsdam 19-21/09/2012. “Electroporation of giant unilamellar vesicles: Pore resealing vs. vesicle bursting in anionic membranes”.
22. Biophysical Society 56th Annual Meeting, 2012, San Diego. Livro de Resumos, 2012. Study of the Affinity of Structurally Different Antimicrobial Peptides to Model Membranes and their Ability to Induce Membrane Permeabilization.
23. CECAM workshop Equilibrium and out-of-equilibrium properties of systems with long-range interactions. “Statistical Mechanics of Systems with Long-Range Interactions.” 2012.
24. Colloids and Nanomedicine, 15-17 July, 2012, Amsterdam, The Netherlands. Size, Electrophoretic Mobility, Zeta Potential and Dissociation Degree of Vesicles prepared with Mixtures of Charged and Zwitterionic Lipids suggest that ion condensation determines surface potential above ten percent charged lipid in the mixture.
25. Encontro Regional de Ciências, Matemática e Educação, 2012. (Encontro) Perspectivas em História da Física: "Luz, Mais Luz!".
26. ESC Congress 2012, Munique. European Heart Journal Supplements, 2012. Pharmacokinetic interactions between clopidogrel and rosuvastatin: effects on vascular protection in subjects with coronary heart disease.
27. Faraday Discussion 161: Lipids & Membrane Biophysics, Londres 11-13/09/2012. “Solubilization of membranes of different composition/phase induced by the detergent Triton X-100”.
28. I Encontro Regional do Ensino de Física. Universidade Estadual de Maringá, 24 e 25 de novembro de 2012. Determinação do Número de Avogadro via Método de Langmuir: Proposta Multidisciplinar para o Ensino Médio. I Seminário de Estudos Técnicos e Tecnologia do Instituto Federal de Educação do Paraná, 2012. (Seminário) Técnica, Sociedade e Ambiente. Luiz Roberto Evangelista.
29. II Latin American Federation of Biophysical Societies (LaFeBS)/XXXVII Brazilian Biophysical Society Congress, 2012, Búzios. Livro de Resumos, 2012. A Thermodynamic Study Of The Interaction Of The Antimicrobial Peptide Esculentin 1b (1-18) With Model Membranes.
30. In vitro toxicity of cholesterol, 7-ketocholesterol and cholestentriol in different hematological cancer cell lines. 2012. (Apresentação de Trabalho/Congresso).

31. INLN - Nice: Recent developments in Casimir physics. 2013 Seminário para o grupo Info. et Optique Quantique do LKB-Jussieu, Paris, França: Electrostatic patch effect in Casimir force measurements. 2012
32. Laser Science XXVIII, Rochester, EUA, 2012. "Digital Holographic Microscopy applied to neglected diseases analysis"; OSA's 96th annual meeting frontiers in optics 2012.
33. Recent Developments in Computer Simulation Studies in Condensed Matter Physics. Thermodynamic, dynamic and structural anomalies in models for liquid water. 2012.
34. Recent Progress on Coulomb Many-Body Systems. " Ions at interfaces: Surface tensions and surface potentials of electrolyte solutions." 2012.
35. Reunião Anual do Instituto Butantan São Paulo – Brasil. Antimicrobial activity of silver nanoparticles synthesized by Brazilian mangrove fungi.
36. Reunião Anual. T0845-1. Águas de Lindóia, SP, 2012. Simulação computacional da interação de íons triflato em interfaces hidrofóbicas. S. SBQ-35^a
37. Reunião Anual da Sociedade Brasileira de Química. T1228-1.
38. SBQ-35^a Reunião Anual. Águas de Lindóia, SP, 2012. Synthesis of Pyrimidine derivatives of Medicinal Importance. A geometrical relation between the Miesowicz's coefficients.
39. Wetting and Capillarity in Complex Systems. "Ions at interfaces: Surface tensions and surface potentials of electrolyte solutions." 2013.
40. Workshop NAP-Fluidos complexos. 29/06/2012. "Obtendo informações estruturais de sistemas lipídicos por espalhamento de raios X a baixos ângulos".
41. Workshop on structure and dynamics in supercooled, glassy and nanoconfined fluids. Thermodynamic, dynamic and structural anomalies in models for liquid water. 2012.
42. World Congress of Cardiology 2012, 2012, Dubai. Circulation. Philadelphia: Lippincott Williams & Wilkins, 2012. V. 25. P. E708-E708. Comparison between two highly effective lipid-lowering therapies on markers of cholesterol synthesis and absorption.
43. World Congress of Cardiology 2012, 2012, Dubai. Circulation. Philadelphia: Lippincott Williams & Wilkins, 2012. v. 125. p. E922-E922. Effect of angiotensin-converting enzyme inhibitor on DNA damage and inflammatory molecules expression in rabbit aortic endothelial cells cultured in vitro in hypercholesterolemic and hyperglycemic conditions.
44. X Congreso Latinoamericano de Sociedades Estadísticas, Córdoba, Argentina, 16 ao 19 de outubro de 2012. Estudio de la sensibilidad del criterio gaic para modelos mixtos con distribución beta o beta inflacionada.
45. XLI Reunião Annual da Sbbq, 19 a 22 de maio, 2012, Foz do Iguaçu. Effect of Mixtures of Charged and Zwitterionic Lipids on Vesicles Properties: Size, Electrophoretic Mobility, Zeta Potential and Dissociation Degree.
46. XXI Congresso Latinoamericano de Microbiologia - Centro de Convenções Mendes Santos –SP Brasil. Autotransportadoras serino-proteases das enterobacteriaceae (SPATEs) em Escherichia coli enteropatogênica (EPEC) atípica.
47. XXII Semana da Física, 17 a 21/09/2012, DFI/UEM
48. XXX Encontro de Físicos do Norte e Nordeste. Uma abordagem geométrica para os coeficientes de Miesowicz. 2012. (Encontro

49. XXXIII Congresso de Cardiologia da SOCESP, 2012, São Paulo. Revista da Sociedade Brasileira de Cardiologia. São Paulo: Diretoria de Publicações SOCESP, 2012. v. 22. p. 102-102. Aumento dos níveis de mieloperoxidase em duas estratégias hipolipemiantes. In:
50. XXXV Encontro de Física da Matéria Condensada, 2012, Águas de Lindóia. Anais do Evento, 2012. Characterization of Low-Density Lipoprotein modified by ultrashort laser pulse.

Training of personnel (work already completed)

Post-doctors

1. Ana Carolina Ribeiro-Teixeira. Início: 2012. Universidade Federal do Rio Grande do Sul, Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul.
2. Andrea Cecília Dorion Rodas. 2013. Universidade Federal de São Paulo. Niels Olsen Saraiva Câmara.
3. Bruno Marcos. Início: 2013. Universidade Federal do Rio Grande do Sul, Conselho Nacional de Desenvolvimento Científico e Tecnológico.
4. Dariusz Frydel. 2011-2012. Universidade Federal do Rio Grande do Sul, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Yan Levin.
5. Ednilson Orestes. 2012. Instituto de Física da USP. Sylvio Roberto Accioly Canuto.
6. Erol Akpinar. Estudo sobre novas fases liotrópicas nemáticas biaxiais e investigação das transições de fase uniaxiais-biaxial. 2012. Instituto de Física da Usp, . Antonio Martins Figueiredo Neto.
7. Felipe Siqueira da Rosa. 2012. Universidade Federal do Rio de Janeiro, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Paulo Americo Maia Neto
8. Jean Pierre Schatzmann Peron. 2012. Universidade de São Paulo, . Niels Olsen Saraiva Câmara.
9. Jorge Alexandre Nogueira Santos. Estudo de especificidade e inibição as hKLLK 1, hKLLK 5, hKLLK 6 e hKLLK 7.. 2012. Universidade Federal de São Paulo, Fundação de Amparo à Pesquisa do Estado de São Paulo. Maria Aparecida Juliano.
10. José Ricardo Gonçalves Mendonça. 2012. Instituto de Física da Universidade de São Paulo. Mario Jose de Oliveira.
11. Marcia Martins Szortika, “Transição de Fases em Modelos de Crescimento”. Colaboração a nível de Pós-Doutorado do programa PRODOC da CAPES, 08/2011 a 02/2013.
12. Maristela Vitta Landgraf. 2012. Universidade de São Paulo, Fundação de Amparo à Pesquisa do Estado de São Paulo. Niels Olsen Saraiva Câmara.
13. Milton Rocha de Moraes. 2012. Universidade de São Paulo, Fundação de Amparo à Pesquisa do Estado de São Paulo. Niels Olsen Saraiva Câmara.
14. Patricia Semedo. 2012. Universidade Federal de São Paulo, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Niels Olsen Saraiva Câmara.

15. Paula Andreia Jaramillo Garcia. 2012. Instituto de Física da USP. Sylvio Roberto Accioly Canuto.

Doctors

1. Alexandre Pereira dos Santos. Estudos em Sistemas Eletrolíticos: Interfaces e Coloides. 2012. Universidade Federal do Rio Grande do Sul. Orientador: Yan Levin.
2. David Rodrigues de Souza. Transições de fase em modelos estocásticos para descrever epidemias. 2012. Instituto de Física Universidade de São Paulo. Orientador: Tania Tome Martins de Castro.
3. Débora N. Okamoto. Kinetic Analysis of Salting Activation of a Subtilisin-Like Halophilic Protease. 2012. Tese (Doutorado em Ciências Biológicas (Biologia Molecular)) - Universidade Federal de São Paulo. Orientador: Luiz Juliano Neto.
4. Enio José Bassi. Estudo das propriedades imunomoduladoras das células-tronco mesenquimais sobre a geração, expansão e diferenciação de células T CD4+CD25+Foxp3+ e células Th17. 2012. Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
5. Isis Tande da Silva. Papel dos lipídeos e antioxidantes dietéticos nas propriedades oxidativas e inflamatórias do PPAR γ e do PAF-AH em adolescentes. 2012. Faculdade de Saúde Pública. Orientador: Nágila Raquel Teixeira Damasceno.
6. João Lucas Correia Silva. Viscosidade em Cristais Líquidos - Uma Aproximação Geométrica para os Coeficientes de Leslie. 2012. Universidade Estadual de Londrina. Orientador: Manuel Simoes Filho.
7. Joel da Cunha. Estudo da atividade e polimorfismos da paraoxonase-1 em indivíduos infectados pelo vírus da imunodeficiência humana tipo-1 (HIV-1) tratados com inibidores de protease. 2012. Universidade de São Paulo. Orientador: Sergio Paulo Bydlowski.
8. Lilian de Mello Gil. A densidade de colágeno I (COL I) e sua influência no comportamento de células osteoblásticas humanas (HOB) em cultivos 3D. 2012. Universidade Federal do Rio de Janeiro. Co-Orientador: Nathan Bessa Viana.
9. Marcia Konda. Caracterização do Mecanismo Catalítico das Glutamil Peptidases. 2012. Universidade Federal de São Paulo. Orientador: Luiz Juliano Neto.
10. Rafael Luiz Pereira. Participação dos receptores B1 e B2 da bradicinina na glomerulosclerose segmentar e focal experimental. 2012. Universidade Federal de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
11. Ricardo Gobato. A Indicatrix Liotrópica. 2012. Universidade Estadual de Londrina, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Orientador: Manuel Simoes Filho.
12. Rodolfo Teixeira de Souza, Estudo de efeitos de superfície e fenômenos de adsorção dessorção em cristais líquidos nemáticos e suas influências sobre a resposta elétrica. Universidade Estadual de Maringá – Orientador: Luiz Roberto Evangelista. 2012

13. Rodrigo do Monte Gester, "Propriedades Eletrônicas e Magnéticas de Moléculas Solvatadas", orientador: Sylvio R A Canuto, IF-USP, 2012.
14. Rogério Chinen. Detecção e prevenção de disfunção renal em transplantados renais. 2012. Universidade Federal de São Paulo. Co-Orientador: Niels Olsen Saraiva Câmara.
15. Tarcísio Nunes Teles. Mecânica Estatística em Sistemas com Interações de Longo Alcance: Estados Estacionários e Equilíbrio. 2012. Universidade Federal do Rio Grande do Sul. Orientador: Yan Levin.
16. Thiago Escobar Colla. Efeitos de correlações eletrostáticas na equação de estado de suspensões coloidais carregadas. 2012. Universidade Federal do Rio Grande do Sul. Orientador: Yan Levin.
17. Yoelvis Orozco-González, "Fotofísica e Propriedades Dinâmicas de Sistemas Moleculares", orientador: Sylvio R A Canuto, IF-USP, 2012

Masters

1. Alessandra Fagiolli. Desenvolvimento de formulação contendo itraconazol para tratamento de micoses fúngicas. 2012. Universidade Bandeirante de São Paulo. Orientador: Claudete Justina Valduga.
2. Alessandra Mara da Silveira Cappelaro. Desenvolvimento de nanoemulsão combinando os fármacos leishmanicidas miltefosina e fluconazol para uso oral. 2012. Universidade Bandeirante de São Paulo. Orientador: Claudete Justina Valduga.
3. Alexandre Penteado Furlan. Comportamento de um modelo para a água em sistemas porosos. 2013. Universidade Federal do Rio Grande do Sul. Orientador: Marcia Cristina Bernardes Barbosa.
4. Augusto Cesar de Andrade Meyer. Enxerto ósseo autógeno em ratos diabéticos: Análise Histomorfométrica. 2012. Faculdade de Odontologia do Campus de São José dos Campos - UNESP, . Orientador: Maria Aparecida Neves Jardim.
5. Bárbara B. Gerbelli. Instituto de Física da USP. Orientadora: Elisabeth Andreoli. Novembro/2012.
6. Carolina Martinez Romão. Expressão da P-gp, MPR1 e LRP em células-tronco mesenquimais humanas derivadas do líquido amniótico e medula óssea. 2012. Universidade de São Paulo. Orientador: Sergio Paulo Bydlowski.
7. Celma Muniz (ME-programa de PG em ciências da saúde da disciplina de cardiologia da Unifesp). Orientadora: Maria Cristina Izar.
8. Claudia Assef Sanibal. Influência da Obesidade em adolescentes sobre a paraoxonase e a lipoproteína e alta densidade. 2012. Faculdade de Ciências Farmacêuticas. Orientador: Nágila Raquel Teixeira Damasceno.
9. Danilo Silva Olivier - "Propriedades espectroscópicas do ácido orto-aminobenzóico: estudo computacional e experimental de efeitos de pH". FFCLRP USP. 2012.
10. Fernanda Pereira da Cruz Benetti. Estados de equilíbrio e não equilíbrio em dois sistemas com interações de longo alcance: HMF e gHMF. 2012. Universidade Federal do Rio Grande do Sul. Orientador: Yan Levin.
11. Flavia D Angelo Maculan. O papel do meio condicionado de células-tronco mesenquimais no processo de apoptose de células tubulares proximais renais induzido por hipóxia. 2012. Universidade Federal de São Paulo, Fundação de

- Amparo à Pesquisa do Estado de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
12. Franco Valduga de Almeida Camargo. Estudo da Dinâmica de Íons em Canais Iônicos. 2012. Universidade Federal do Rio Grande do Sul. Orientador: Yan Levin.
 13. George Barbosa Araujo, “Estudo Teórico das Propriedades Óticas e Magnéticas de Derivados e Intermediários da Reação de Oxidação do Triptofano”, orientador: Sylvio R A Canuto, IF-USP, 2013.
 14. Guilherme Bastos dos Santos Travassos. Efeito Casimir Dinâmico com Superfícies Rugosas. 2012. Dissertação (Mestrado em Física) - Universidade Federal do Rio de Janeiro, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Orientador: Paulo Americo Maia Neto.
 15. Janaína Gusmão Romeiro. Avaliação da ação epigenética e da citotoxicidade de um derivado da curcumina veiculado em nanoemulsão lipídica em linhagens tumorais. 2012. Universidade Bandeirante de São Paulo. Co-Orientador: Claudete Justina Valduga.
 16. Jose Jardes da Gama Bitencourt. Desenvolvimento de formulação para uso oral contendo os fármacos miltefosine e itrac
 17. Karolline Santana Da Silva. Estudo dos polimorfismos dos genes das paraoxonases 1 e 2 em pacientes com linfoma difuso de grandes células B. 2012. Universidade de São Paulo. Orientador: Sergio Paulo Bydlowski.
 18. Leandro Batirolla Krott. Um Modelo de Duas Escalas (Tipo Água) sob Confinamento. 2012. Orientador: Marcia Cristina Bernardes Barbosa.
 19. Letícia Bonfante Sicchieri. Determinação de Lipoproteínas no sangue por meio de fluorescência. 2012. Instituto de Pesquisas Energéticas e Nucleares. Orientador: Lilia Coronato Courrol.
 20. Lucas Bello Gonçalves – Indução de Ordem nas Fases Isotrópicas de Cristais Líquidos Liotrópicos: uma investigação experimental. DFI/UEM 17/09/2012. Ervin Kaminski Lenzi (Orientador), Paulo Ricardo Garcia Fernandes (co-orientador).
 21. Maria Aparecida dos Santos. Desenvolvimento de Método Bioanalítico para um Derivado da Curcumina e Análise de sua Formulação para Uso Endovenoso. 2013. Universidade Bandeirante de São Paulo. Orientador: Claudete Justina Valduga.
 22. Moniellen Pires Monteiro. Efeitos térmicos e da polaridade de solventes sobre as propriedades espectroscópicas de compostos orgânicos com transferência intramolecular de carga. 2012. Universidade Federal de Alagoas. Orientador: Italo Marcos Nunes de Oliveira.
 23. Oscar Alberto Barbosa Bohorques. Irreversibilidade por competição para um modelo de Glaber-Ising a partir da produção de entropia. 2012. Instituto de Física Universidade de São Paulo. Orientador: Tania Tome Martins de Castro.
 24. Rafaela Quintanilha Abrahão. Avaliação do efeito antiroceptivo induzido por oligopeptidases B de trypanosoma cruzi e trypanosoma brecei em camundongos. 2012. Universidade Federal de São Paulo. Orientador: Maria Aparecida Juliano.
 25. Renato Ribeiro Guimarães – Investigação da Dinâmica de Defeitos Topológicos em Sistema Líquido-Cristalino. DFI/UEM 05/10/2012. Orientador: Rênio dos Santos Mendes, Co-orientadora: Hatsumi Mukai.
 26. Rodrigo Maia Cardozo, “Estudo do modelo monômero-monômero com mecanismo de Eley-Rideal”. UFSC dezembro de 2012.

27. Tamires Cristina da Silva Ribeiro. Biofísica Quântica da ligação de adutos da Isoniazida às Enzimas Redutase do Mycobacterium Tuberculosis. 2012. Universidade Federal de Alagoas. Orientador: Marcelo Leite Lyra.
28. Thiago Bento dos Santos. Efeitos da topologia da rede de Apolônio sobre as propriedades termodinâmica de gases quânticos não-interagentes. 2012. Universidade Federal de Alagoas. Orientador: Italo Marcos Nunes de Oliveira.
29. Thiago Marques de Andrade. Dispositivo eletro-optico utilizando fase nemática líquida cristalina. Universidade Estadual de Maringá. Orientador: Antonio José Palangana
30. Thiago Petrucci Rodrigues – Medidas de Impedância Elétrica em Água Milli-Q e Difusão Anômala. 2013. Universidade Estadual de Maringá. Ervin Kaminski Lenzi (Orientador), Paulo Ricardo Garcia Fernandes (co-orientador).
31. Tiago Boff Pedro, “Modelo de Crescimento de Tumores em Redes”. UFSC 2012.
32. Viviane Dias Faustino. Inibição simultânea dos genes antiapoptóticos Bcl-2 e Bcl-XL em células de leucemia linfóide aguda e células de linfoma do manto mediante RNA de interferência. 2012. Universidade de São Paulo. Orientador: Sergio Paulo Bydlowski.
33. Wallance Moreira Pazin - "Anisotropia de fluorescência: aplicações em membranaas modelo". Mestrado, FFCLRP USP, 2012.

Undergraduate research

1. Bergerson Van Hallen Vieira da Silva. Estudos Introdutórios de Teoria Elástica Contínua de Fluidos Complexos. Orientador: Luiz Roberto Evangelista
2. Eduardo Sell Gonçalves. Medida da absorção óptica não-linear de ferrofluidos. Instituto de Física da USP, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Orientador: Antonio Martins Figueiredo Neto.
3. Fabiana Rossan. Instituto do Cérebro, Hospital Israelita Albert Einstein. Orientador: Lionel Fernel Gamarra
4. Felipe Grabarz. Papel das células NKT na lesão pulmonar induzida pela bleomicina. 2012. Universidade de São Paulo, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Orientador: Niels Olsen Saraiva Câmara.
5. Liza Miyaki. Instituto do Cérebro, Hospital Israelita Albert Einstein. Orientador: Lionel Fernel Gamarra
6. Milene Nakagawa. Papel do estresse oxidativo na lesao renal pela malaria. 2012. Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
7. Yuri Felipe Guise. Papel da Acetilcolina na fibrose renal. 2012. Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.

Training of personnel (work in progress)

Doctors

1. Alexander Ramos Duarte. Investigação do fenômeno de adsorção iônica e condutividade ôhmica em eletrólitos e fluidos complexos por meio da técnica de espectroscopia de impedância no intervalo de frequências de 100μHz a 30MHz. Início: 2010. Instituto de Física da USP.
2. Ana Carolina Bassi Stern. RNAi anti MDR em linfomas. Início: 2011. Universidade de São Paulo.
3. Ana Paula Alves. Vasculogênese no embrião de galinha. Início: 2010. Universidade Federal de Minas Gerais.
4. Ana Paula Perdigão Praxedes. Propriedades ópticas e termodinâmicas de filmes poliméricos biocompatíveis. Início: 2011. Universidade Federal de Alagoas.
5. Andressa Antonini Bertolazzo. Gas de rede associativo. Início: 2010. Instituto de Física da Universidade Federal do Rio Grande do Sul.
6. Andrezza Steudel. Difusividade Térmica. Início: 2007. Universidade Estadual de Londrina.
7. Angela Castoldi. Sepsis e obesidade: estudo da relação entre a obesidade e a regulação imunológica em um modelo de sepsis experimental. Início: 2011. Universidade de São Paulo.
8. Antonio Rodrigues da Cunha. Estudos de Propriedades Estruturais e Eletrônicas das Moléculas Emodina e Barbaloina em Meio Solvente e em Bicamadas Lipídicas. Início: 2009. Universidade de São Paulo.
9. Arquimedes Luciano, Início: 2012. Universidade Estadual de Maringá. Orientador: Polônia Altoé Fusinato, Co-orientador: Paulo Ricardo Garcia Fernandes.
10. Áttila Leães Rodrigues. Dinâmicas estocásticas: fenômenos de relaxação e transições de fase cinéticas. Início: 2009. Instituto de Física Universidade de São Paulo.
11. Bárbara B. Gerbelli. Instituto de Física da USP. Orientadora: Elisabeth Andreoli.
12. Bárbara Hissa de Carvalho Vieira Couto. Estudo do envolvimento de microdomínios de membrana ricos em colesterol na internalização celular de tripomastigotas de Trypanosoma cruzi. Início: 2009. Universidade Federal de Minas Gerais.
13. Carlos Eduardo Bistafa Da Silva. Dinâmica do estado excitado de bases nitrogenadas em meios solventes. Início: 2011. Instituto de Física da USP.
14. Carlos Eduardo dos Santos Ferreira. Efeitos crônicos da terapia hipolipemiante em biomarcadores cardiovasculares. Início: 2011. Universidade Federal de São Paulo.
15. Cassiano Donizetti De Oliveira. Papel das células-tronco derivadas do tecido adiposo na progressão da doença renal. Início: 2010. Universidade Federal de São Paulo.
16. Cassio Alves. Simulação e Modelagem Computacional de Dados de Espalhamento a Baixos Ângulos Enfoque em Estruturas de Alta Simetria. Início: 2011. Universidade de São Paulo. [Participated in the Science Without Borders program: - the period remained there; 15/09/2012 - 15/03/2013; - country, Italy; - institution; Universita di Roma - Tor Vergata di Scienze Permits; - Advisor:](#)

- [Alessandro Desideri; - work there; Apredizado Molecular Dynamics, modeling and simulation of a nanocage geometry of truncated octahedron.](#)
17. Celso Luiz Sigoli Risi. Estudo da dinâmica do diretor em materiais celulósicos líquido cristalinos por meio da correlação de fótons. Início: 2010. Instituto de Física da USP.
 18. Cíntia Barbosa Passos. Modelos Físicos para Terapia Genética. Início: 2010.
 19. Clarice Silvia Taemi Origassa. Modulação da Transição Endotélio Mesenquimal pela Heme oxigenase 1: relevância para o estudo da progressão da doença renal. Início: 2010. Universidade Federal de São Paulo.
 20. Daniel Inoue Koga. Técnicas físicas no estudo da interação peptídeo - membrana. Início: 2011. Universidade de São Paulo, Conselho Nacional de Desenvolvimento Científico e Tecnológico. (Co-orientador).
 21. Daniel May de Oliveira. Papel dos ácidos graxos de cadeia curta na inflamação glial. Início: 2009. Universidade de São Paulo.
 22. Danilo Candido De Almeida. Caracterização do perfil de expressão de micrnas no reparo tecidual e celular induzido por células-tronco mesenquimais derivadas do tecido adiposo em modelos in vitro e in vivo de lesão renal aguda.. Início: 2010. Universidade Federal de São Paulo.
 23. Danilo Degan Luders. Parâmetro de ordem e Índice de refração não linear em cristais líquidos nemáticos. Início: 2010. Universidade Estadual de Maringá. Orientador: Antonio José Palangana.
 24. David da Silva Simeão. Início: 2009. Universidade Estadual de Londrina.
 25. Diego M Assis. Síntese e ensaio de inibidores pra KhKL 1. Início: 2009. Universidade Federal de São Paulo.
 26. Douglas de Andrade. Estudo especificidade da calicreina 8 humana. Início: 2008. Universidade Federal de São Paulo.
 27. Eduardo Olímpio Ribeiro Dias. Física-UFPE
 28. Elíseo Joji Sekiya. Avaliação de Produtos Celulares Implantáveis para tratamento de Lesão da Medula Espinhal em ratos Wistar. Início: 2010. Universidade de São Paulo.
 29. Evanildo Gomes Lacerda Júnior. Estudo Teórico de Solvatocromismo em Misturas Binárias. Início: 2009. Universidade de São Paulo.
 30. Fabiana Rodrigues Arantes. Propriedades magnéticas de nanopartículas e nanofios dispersos em matrizes de cristal líquido. Início: 2010. Instituto de Física da Universidade de São Paulo.
 31. Fernanda Montiel Dalio. Desenvolvimento de Novos Inibidores para a Thimet oligopeptidase e Neurolisina. Início: 2009. Universidade Federal de São Paulo.
 32. Fernando da Silva. Estudo Teórico de Complexos de Transferência de Carga entre Derivados de Piridínio com Iodeto e Brometo em Solução. Início: 2011. Universidade de São Paulo.
 33. Francisco C. de Alcântara. Desenvolvimento de produto nanotecnológico para saúde animal. Início: 2013. Universidade Bandeirante de São Paulo.
 34. Francisco Mariano Neto. Aplicabilidade de Sílica Mesoporosa Ordenada como Adjuvante Imunológico Polivacínico. Início: 2008. Universidade de São Paulo.

35. Henrique Andrade Rodrigues da Fonseca. Papel da imunidade adaptativa na modulação dos fatores de risco cardiovasculares.. Início: 2009. Universidade Federal de São Paulo
36. Henrique Tria. Estudo GOLD prospectivo. Início: 2008. Universidade Federal de São Paulo, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior.
37. Jamile Lorena de Paula. Início: 2012. Universidade Estadual de Maringá. Orientador: Luiz Roberto Evangelista.
38. José Rafael Bordin. Difusão de água e sal através de canais de celulose. Início: 2010.
39. Joyce Meire Gilio. Produção e Caracterização da Metacaspase (YCA1) de *Saccharomyces cerevisiae*. Início: 2009. Universidade Federal de São Paulo.
40. Juan Pablo Badilla Orozco. Propriedades Magnéticas De Multicamadas Heterogêneas Ferromagneto/Supercondutor. Início: 2012. Instituto de Física da Universidade de São Paulo.
41. Juliana Rodrigues de Oliveira. Estudo da Especificidade da calicreína tecidual 5. Início: 2010. Universidade Federal de São Paulo.
42. Karel Montero Rey. Efeitos do campo elétrico no magnetismo de filmes finos ferromagnéticos. Início: 2012. Instituto de Física da Universidade de São Paulo.
43. Keyde Cristina Martins de Melo. Caracterização do efeito antifagocítico induzido pela *Escherichia coli* enteropatogênica (EPEC) atípica sorotipo O55:H7. Início: 2011. Universidade de São Paulo.
44. Larissa Alvarim. Hospital Israelita Albert Einstein. Orientador: Lionel Fernel Gamarra
45. Leandro Bartirolla Krott. Anomalias Dinâmicas e Termodinâmics na Água. Início: 2012.
46. Leonardo Alonso. Injeção, Difusão e Detecção de Spin em Válvulas de Spin Laterais. Início: 2008. Instituto de física.
47. Letícia Bonfante Sicchieri. Análise de Imagem Óptica para mapeamento de lipoproteínas por meio de sondas fluorescentes. Início: 2012. Instituto de Pesquisas Energéticas e Nucleares.
48. Lidiane Maria Omena da Silva. Propriedades ópticas de cristais líquidos dopados com nanopartículas. Início: 2009. Universidade Federal de Alagoas.
49. Livia Nascimento de Matos. Preditores de eventos cardiovasculares em indivíduos diabéticos seguidos em longo prazo. Início: 2011. Universidade Federal de São Paulo.
50. Livia Rosa Fernandes. Efeito de oxisteróis em tumores. Início: 2011. Universidade de São Paulo.
51. Livia Siman de Oliveira. Motilidade de células vivas. Início: 2009. Universidade Federal de Minas Gerais.
52. Lucas Modesto da Costa. Caracterização espectroscópica de indicadores de tetraciclina complexada em europio. Início: 2010. Instituto de Física da USP.
53. Marcelo Hidalgo Cardenuto. Efeitos de solvente em betaínas e relações solvatocrômicas. Início: 2009. Universidade de São Paulo.
54. Marcos João Correia: “Nanomagnetismo”, Doutorado, início: 2010.

55. Marcus Vinicius Araujo Damasceno. Estudos Teóricos dos Efeitos de Solventes em Espectros de Absorção Eletrônica de Derivados da Merocianina de Brooker. Início: 2010. Universidade de São Paulo.
56. Maria Aparecida dos Santos. Síntese de Diidropirimidinonas e Diidropirimidinotonas com Potencial Atividade Anti-hipertensiva. Início: 2013. Universidade Bandeirante de São Paulo.
57. Matheus Correa Costa. Mecanismos celulares de resposta ao estresse em modelos experimentais de insultos renais. Início: 2010. Universidade de São Paulo.
58. Natalia Mastantuono Nascimento. Fator von Willebrand e ADAMTS13 em pacientes com síndrome antifosfolípide. Início: 2010. Universidade de São Paulo.
59. Oscar Rodrigues dos Santos. Estudo de parâmetros anisotrópicos de fases nemáticas. Início: 2012. Universidade Estadual de Maringá. Orientador: Antonio José Palangana.
60. Paula Fernanda Bienzobaz, Quantização canônica e integração funcional no modelo esférico médio, IFUSP, 2012.
61. Pedro Henrique Guimarães dos Santos. Modelos estocásticos. Início: 2013. Instituto de Física da Universidade de São Paulo.
62. Perseu Angelo Santoro. Equação de difusão fracionária, adsorção iônica e espectroscopia de impedância em cristais líquidos nemáticos. Início: 2010. Universidade Estadual de Maringá. Orientador: Luiz Roberto Evangelista.
63. Priscila Ribeiro dos Santos. Características ópticas não lineares de lipoproteínas humanas. Início: 2009. Instituto de Física da USP.
64. Rafael Bezerra de Lira. Estudo de propriedades biofísicas de vesículas unilamelares gigantes como modelo para entrega intracelular de materiais: eletroporação e fusão de membranas. Início: 2012. Universidade Federal de São Paulo.
65. Rafael de Carvalho Barbosa. Anomalias termodinâmicas em água em sistemas biológicos. Início: 2011. Instituto de Física da Universidade Federal do Rio Grande do Sul.
66. Rafael Rocha da Silva. Propriedades espectroscópicas de filmes de cristais líquidos com propriedades fotônicas. Início: 2010. Universidade Federal de Alagoas.
67. Raphael José Ferreira Felizardo. Efeitos dos ácidos graxos de cadeia curta na progressão da glomeruloesclerose segmental e focal. Início: 2011. Universidade Federal de São Paulo.
68. Reinaldo Faria de Melo Souza. Efeitos inerciais do vácuo quântico. Início: 2011. Universidade Federal do Rio de Janeiro.
69. Ricardo Gobato. Singularidades cosmológicas e defeitos em cristais líquidos. Início: 2008. Universidade Estadual de Londrina.
70. Roberta Rarumy Ribeiro de Almeida. Início: 2012. Universidade Estadual de Maringá. Orientador: Luiz Roberto Evangelista.

71. Roberta Viana Ferreira. Hospital Israelita Albert Einstein. Orientador: Lionel Fernel Gamarra
72. Rosa Carolina Pinto Carvalho. Propriedades magnéticas de sistemas híbridos de spins localizados e delocalizados. Início: 2012. Universidade Federal de Alagoas.
73. Sara Maria Moreira Lima Verde. Obesidade E Câncer De Mama: Avaliação Dos Fatores De Risco Associados Ao Excesso De Peso E Tecido Adiposo. Início: 2010. Faculdade de Saúde Pública.
74. Sérgio Henrique Albuquerque Lira. Física-UFPE
75. Tamires Cristina da Silva Ribeiro. Bioquímica quântica das interações fámaco-proteína para o tratamento da Tuberculose. Início: 2012. Universidade Federal de Alagoas.
76. Tércio Teodoro Braga. Balanço Th1/Th2 e o desenvolvimento de fibrose renal em modelos experimentais. Início: 2009. Universidade de São Paulo.
77. Tatiana Moreira Domingues. Estudos de síntese, conformação e atividade biológica da gomesina e análogos através de diferentes metodologias. Início: 2010. Universidade Federal de São Paulo.
78. Thaíla Figueiredo Assunção. Propriedades de transporte em meios não-lineares sem simetria de inversão. Início: 2011. Universidade Federal de Alagoas.
79. Thais Azevedo Enoki. Interação de peptídeos antimicrobianos com membranas modelo. Início: 2011. Universidade de São Paulo.
80. Tiago Boff Pedro, "Processos de Contato Competitivos em Redes", início agosto de 2012.
81. Ulisses Moreira Silveira Andrade. Defocusing Microscopy. Início: 2009. Universidade Federal de Minas Gerais.
82. Valdemir Lino Chaves Filho. Universidade Federal de Alagoas.
83. Vanessa Cristina Rescia. Desenvolvimento de formulações nanotecnológicas baseadas em produtos naturais. Início: 2012. Universidade Bandeirante de São Paulo.
84. Vinicius de Andrade Oliveira. Ácidos Graxos de Cadeia Curta (SCFA) como moduladores da resposta inflamatória na lesão renal aguda e crônica experimental. Início: 2010. Universidade de São Paulo.
85. Vinicius Mariani Lenart. Propriedades ópticas não lineares de nanopartículas magnéticas imersas numa matriz líquida cristalina. Início: 2010. Universidade Estadual de Ponta Grossa.
86. Vinicius Otavio da Silva.. Síntese de Inibidores para as Calicreínas Teciduais Humanas. Início: 2012. Universidade Federal de São Paulo.
87. Wladimir Sergio Braga. Conoscopia óptica em fases nemáticas uniaxiais/biaxial. Início: 2012. Universidade Estadual de Maringá. Orientador: Antonio José Palangana.

Post-Doctors

1. Andréa M. Monteiro. Início: 2010. Instituto de Física da USP.

2. Andrea Moro Caricilli. Início: 2012. Universidade de São Paulo.
3. Carolina Nunes França. Início: 2011. Universidade Federal de São Paulo.
4. Cíntia Cristina Vequi-Suplicy. Estudo Teórico de Nucleosídeos Lipofílicos em Solventes e em Monocamadas Lipídicas Utilizando Métodos Híbridos de Mecânica Quântica e Mecânica Molecular. Início: 2011. Universidade de São Paulo.
5. Claudio Ccapa Ttira. Início: 2011. Universidade Federal do Rio de Janeiro.
6. Daniel Luiz da Silva. Início: 2013. Universidade de São Paulo.
7. Eduardo Roberto de Lascio. Início: 2012. Instituto de Física da Universidade de São Paulo.
8. Felipe Alves Moraes. Início: 2012. Faculdade de Medicina da Universidade de São Paulo.
9. Gabriel Teixeira Landi. Início: 2012. Instituto de Física da USP.
10. Hardeep Kumar. Início: 2011. Instituto de Física da Universidade de São Paulo.
11. Javier Bustamante Mamani. Hospital Israelita Albert Einstein. Orientador: Lionel Fernel Gamarra
12. João Pedro Bettencourt Cepeda Malhado. Início: 2012. Universidade de São Paulo.
13. Joel da Cunha. Início: 2012. Faculdade de Medicina da Universidade de São Paulo.
14. Jorge Luis Maria Ruiz. Início: 2012. Faculdade de Medicina da Universidade de São Paulo.
15. Lorena F. Pavon, Leopoldo Nucci. Hospital Israelita Albert Einstein. Orientador: Lionel Fernel Gamarra.
16. Mariane Tami Amano. Início: 2012. Universidade de São Paulo.
17. Milton Rocha Moraes. Início: 2012. Universidade de São Paulo.
18. Paula Andreia Jaramillo Garcia. Início: 2013. Instituto de Física da USP.
19. Paula Fernanda Bienzobas. Início: 2012. Instituto de Física da USP.
20. Rafael Luiz Pereira. Início: 2012. Universidade de São Paulo.
21. Tatiana Tais Sibov. Hospital Israelita Albert Einstein. Orientador: Lionel Fernel Gamarra.

Masters

1. Adriane Marangoni. A influência do consumo de castanha de caju na funcionalidade da LDL e da HDL em indivíduos com alto risco cardiovascular. Início: 2011. Universidade de São Paulo.
2. Alexander Hideki Oniwa Wada. Simulações do modelo suscetível infectado. Início: 2013. Instituto de Física da Universidade de São Paulo.
3. Alyne Marem Silva Barbosa. Estudo de especificidade de proteases providas de microorganismos da Unidade de produção de compostos orgânicos da Fundação

- Parque Zoológico de São Paulo. Início: 2011. Universidade Federal de São Paulo.
4. Ana Carolina Bazan de Oliveira. Expressão de resistência a múltiplas drogas em células mesenquimais do cordão umbilical humano. Início: 2011. Universidade de São Paulo.
 5. André Luiz Sehnem. Investigação da influência do tamanho de partícula na termodifusão em colóides magnéticos. Início: 2012. Instituto de Física da USP.
 6. André Luiz Siqueira da Silva. Caracterização de células-tronco tumorais isoladas de linfoma não-Hodgkin. Início: 2011. Universidade de São Paulo.
 7. Andresa Forte. Análise comparativa da capacidade de expansão ex vivo de células-tronco hematopoiéticas do sangue de cordão umbilical em co-cultura com células mesenquimais de diversas origens. Início: 2011. Universidade de São Paulo.
 8. Antonio Augusto Ferreira Carioca. Influência do índice w-3 sobre a oxidabilidade da LDL, inflamação e a composição corporal em mulheres com CA de mama. Início: 2012. Faculdade de Saúde Pública.
 9. Bruno Mattei. Relação estrutura-atividade de análogos da gomesina: interação com modelos de membrana. Início: 2010. Departamento de Biofísica.
 10. Carolina Garcia de Macedo. Estudo das paraoxonases 1, 2 e 3 em pacientes portadores de anemia falciforme. Início: 2009. Universidade de São Paulo.
 11. Célia Bittencourt. Perfil de risco cardiovascular em corredores de elite, efeitos da terapia com estatinas: benefícios, segurança e desempenho físico. Início: 2008. Universidade Federal de São Paulo.
 12. Cristina Gavazzoni. Anomalias termodinâmicas em dímeros. Início: 2011. Instituto de Física da Universidade Federal do Rio Grande do Sul.
 13. Daniela Tegani. Contribuição de Variantes do Gene NPC1L1 na Farmacogenômica e Nutrigenômica de Estratégias Hipolipemiantes. Início: 2008. Universidade Federal de São Paulo.
 14. Delvis Bertrand Jorge de Barros. Condensação de Bose-Einstein em redes livre de escala. Início: 2012. Universidade Federal de Alagoas.
 15. Eduardo Sell Gonçalves. Propriedades ópticas lineares e não-lineares de ferrofluidos: efeito do tamanho das nanopartículas. Início: 2013. Instituto de Física da USP.
 16. Eraldo de Sales. Desenvolvimento de Detetores bidimensionais a gás multifilares para raios X. Início: 2012. Universidade de São Paulo.
 17. Flávia De Conti Cartolano. Efeito do ômega 3 sobre a composição corporal, controle glicêmico e escore de risco de Framingham em indivíduos adultos. Início: 2012. Centro de Apoio à Faculdade de Saúde Pública da Universidade de São Paulo.
 18. Francisco de Melo Rocha. Física-UFPE
 19. Francisco José Garanhani. Estudo de Propriedades Mesoscópicas Multicamadas Magnéticas Heterogêneas. Início: 2013. Instituto de Física.
 20. Gabriel Dias Carvalho. Física-UFPE

21. Gerson de Carli Proença de Almeida Pessotto. Propriedades Magnéticas De Pós Nanoestruturados E Filmes Finos Baseados em FeRh. Início: 2012. Instituto de Física - SP.
22. João Victor de Nogueira Fontana. Física-UFPE
23. Laura Fantazzini Grandisoli. Influencia da abordagem nutricional para perda de peso sobre o perfil cardiometabolico e impacto das adipocitocinas na manutenção e reganho de peso. Início: 2012. Dissertação (Mestrado em Nutrição em Saúde Pública) - Universidade de São Paulo. (Orientador).
24. Lilian Caroline Gonçalves de Oliveira. Caracterização das propriedades hidrolíticas de cisteíno peptidases derivadas de vírus e protozoários. Início: 2009. Departamento de Biofísica.
25. Luciano Monteiro de Camargo. Benefícios do Tratamento da Dislipidemia com Ezetimiba em Monoterapia e da Terapia Combinada com Sinvastatina. Início: 2011. Universidade Federal de São Paulo.
26. Marcelo Salvador. "Processos de relaxação em nanopartículas magnéticas", início, agosto de 2012.
27. Marlene Audin Nuñez. Efeito do ômega-3 sobre biomarcadores cardiometabólicos clássicos e emergentes de indivíduos com alto risco cardiovascular. Início: 2011. Dissertação (Mestrado em Nutrição Humana Aplicada) - Universidade de São Paulo.
28. Mônica Nascimento da Silva. Estudo do efeito da hipercolesterolemia no estadiamento de tumor hepático. Início: 2012. Universidade Federal de São Paulo - Campus Diadema.
29. Oseraldo Vieira Rocha. Desenvolvimento de formulação de um derivado da curcumina para uso oral. Início: 2010. Universidade Bandeirante de São Paulo.
30. Pedro Henrique Amorim dos Anjos. Física-UFPE
31. Pedro Juvencio de Souza Júnior. Propriedades de ópticas não-lineares de cristais líquidos dopados. Início: 2011. Universidade Federal de Alagoas.
32. Pedro Leonidas Oseliero Filho. Estudo estrutural de Sistemas auto organizados: Micelas em solução. Início: 2011. Universidade de São Paulo.
33. Renata Naporano Bicev. Estudo Estrutural de Proteínas em solução. Início: 2011. Universidade de São Paulo.
34. Renato Ferreira de Souza. Início 2012 . Universidade Estadual de Maringá – Orientador: Luiz Roberto Evangelista.
35. Ricardo Almeida de Matos. Síntese Verde de Nanopartículas Metálicas utilizando aminoácidos como agente redutor. Início: 2012. Universidade Federal de São Paulo - Campus Diadema.
36. Rodrigo Garcia da Costa. Modelos estocásticos para tráfego veicular. Início: 2010. Instituto de Física da Universidade de São Paulo.
37. Sandria Carla Randall de Sá. Papel dos receptores Toll-like na diabetes induzida pele estreptozotocina. Início: 2011. Universidade de São Paulo.
38. Simone Cristina Matheus Fischer. Efeitos de Polimorfismos dos Genes que Regulam o Sistema Renina-angiotensina nas Síndromes Coronárias Agudas. Início: 2011. Universidade Federal de São Paulo.

39. Simone Pinto de Melo Barbosa. Como O Tratamento Hipolipemiante Modifica A Expressão E Níveis Da Proteína C Reativa E Possíveis Implicações Clínicas. Início: 2008. Universidade Federal de São Paulo.
40. Tárcius Nascimento Ramos. Fotofísica e Dinâmica de Estados Excitados. Início: 2013. Universidade de São Paulo.
41. Thiago Bertiline. Estudo Bioquímico da calicreína tecidual 7. Início: 2010. Universidade Federal de São Paulo.
42. Valéria Arruda Machado. Hipercolesterolemia Familiar: Efeitos da Suplementação de Fitoesteróis a Terapia Hipolipemiante. Início: 2009. Universidade Federal de São Paulo.
43. Vinícius Wilian Dias Cruzeiro. Estudo Teórico de Pigmentos Fotossintéticos Artificiais. Início: 2012. Universidade de São Paulo.
44. William Kavassaki. Estudo das propriedades ópticas não-lineares de derivados do fenil-azo-beta-naftol. Início: 2012. Universidade Federal de São Paulo, Campus Diadema.

Undergraduate research

1. Andre Bertogna de Toledo. Orientador. Índices de refração de uma fase nemática biaxial liotrópica. Antonio José Palangana.
2. Ariane da Rocha Cerqueira Souza. Expressão da sialoproteína óssea e da osteonectina no reparo de enxertos ósseos autógenos onlay recobertos ou não por membrana colágena reabsorvível em ratos diabéticos. Início: 2012. Faculdade de Odontologia de São José dos Campos - UNESP.
3. Ariane Muniz. Otimização de métodos de extração de beta-glucana. Início: 2012. Universidade Bandeirante de São Paulo.
4. Augusto Antônio Coutinho Silva. Física-UFPE
5. Beatriz Dos Reis Moraes. Hospital Israelita Albert Einstein. Orientador: Lionel Fernel Gamarra.
6. Bottin Piovesan. Estudo de Propriedades Anômalas da Água. Início: 2010. Instituto de Física da Universidade Federal do Rio Grande do Sul.
7. Bruna Trevisani. Polimorfismos da paraoxonase. Início: 2009 - Universidade de São Paulo.
8. Bruno Cardozo Neiva. Preparação e estudo de multicamadas metálicas ferromagnético/supercondutor obtidas por eletrodeposição. Início: 2012. Instituto de Física da Universidade de São Paulo.
9. Camila Lopes Ferreira. Comparação de dois métodos de profilaxia dental: avaliação da pressão arterial e do conforto do paciente. Ensaio clínico controlado e randomizado. Início: 2012. Universidade Estadual Paulista Júlio de Mesquita Filho.
10. Caroline de Oliveira Gallo. Avaliação do consumo de ácidos graxos em indivíduos adultos. Início: 2011. Faculdade de Saúde Pública

11. Daliana Christine Silva. Avaliação do complexo Európio-Clorotetraciclina com marcador fluorescente para a detecção de placas de ateroma. Início: 2012. Universidade Federal de São Paulo - Campus Diadema.
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13. Denis Goncalves Silva. Papel do tecido adiposo e da ho-1 na modulação da resposta inflamatória: estudo num modelo experimental de psoríase. Início: 2011. Universidade de São Paulo.
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16. Eduardo Osório Rizzatti. Modelos para a água em uma dimensão. Início: 2011. Instituto de Física da Universidade Federal do Rio Grande do Sul.
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18. Fernando Cesar Correia de Araujo. O microscópio e o macroscópio na anisotropia dos cristais líquidos nemáticos. Início: 2008. Universidade Estadual de Londrina.
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Patents

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Prizes

1. Professor Eric Roger Wroclawski – “Mamani, J.B.; Miyaki, L.A.; Sibov, T.T.; Pavon, L.F.; Rossan, F.; Amaro Jr, E.; Gamarra, L.F. Intracellular labeling and quantification process by MRI using magnetic nanoparticles of iron oxide into rat glioma cell lines C6. Einstein”, v(10): 216-221 (2012).
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3. Prof. Yan Levin: winner of the CBPF prize of 2012.

Given interviews about his work, media appearances, etc.

1. Francisco Fonseca. Durante o congresso mundial de cardiologia em Dubai. The iQandA Interactive Medical Intelligence for Familial Hypercholesterolemia: Focus on the Scientific, Mechanistic, and Evidence Basis for Using Antisense Oligonucleotides (ASOs) to Manage Challenging High Risk Patients with Hyperlipoproteinemia. 2012.
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(INCT-FCx) Annex II

Teaching, Dissemination and Outreach Programs

VII Summer School INCT of Complex Fluids FSP-USP – 4 to 8 February 2013

The VII Summer School organized by the National Institute of Science and Technology of Complex Fluids (INCT-FCX) was held at the School of Public Health, University of São Paulo, in the period from 4 to 8 February 2013, under the coordination of Prof. Dr. Raquel Teixeira Nágila Damasceno, who is a member of both the new center of research on complex fluids at the IFUSP and the INCT-FCX.

It is noteworthy that this edition of the Summer School was the second event to be held at different locations among the participating institutions of the INCT-FCX.

The central topic of the Seventh Summer School was BLOOD. We list below the final program:

PROGRAM

	04/02	05/02	06/02	07/02	08/02
08:00-08:30	Registration	-	-	-	9:00- 9:30 Stability of the "viscous fingers" in the study of Saffman-Taylor, Arlindo Livério Jr (EACH-USP)
08:30-09:00	Opening Session	-	-	-	9:30 – 10:00 The steric effects on stabilization of lamellar structures, Bárbara B Gerbelli (IFUSP)
09:00-10:00	Blood: definition, characterization and functions Prof. Dr. Maristela Tsujita (FCF-USP)	Transport and stability of nanoparticles in the blood Prof. Dr. Lionel Gamarra (Hosp. A. Einstein)	Lipoprotein metabolism: Structure and functions Prof. Dr. Raul Maranhão (InCor)	Physics of viruses and relative problems in biological and biomimetic matter Prof. Dr. Vladimir Lorman (University Montpellier 2, France)*	10:00-10:30 Networks of hydrogen bonds in mixtures of metanol - water and 1 - propanol - water, Evanildo Lacerda Jr (IFUSP)
10:00-11:30	Physico-chemical equilibrium in the blood Prof. Dr. Ronaldo Araujo (UNIFESP)	Neoplastic changes of leucocytes Prof. Dr. Juliana Pereira (FMUSP)	Dieta mediterranea y sus componentes sobre las lipoproteinas: Enseñanzas de del estudio PREDIMED Prof. Dr. Emilio Ros (Hospital Clinico, UnB, Espanha)	Protein folding and stability I Prof Daniel Otzen, (Aarhus University, Denmark)	10:30 – 11:00 Accumulation of cholesterol in the cornea and aorta: images using the europium fluorescent probe chlortetracycline, Leticia B Sicchieri (UNIFESP)
11:30-13:00	Lunch	Lunch	Lunch	Lunch	10:00 – 11:30 Recording of conventional and photorefractive holograms, Edmilson S Barreto
13:00-15:00	Blood groups, hemoderivatives, and analytic tools Prof. Dr. Luciana Maselli (FMUSP)	Hemoglobin and albumin: structure and functions Prof. Dr. Carlos Bonafé (UNICAMP)	Impact of Leishmaniosis in the blood components Prof. Dr. Ângelo Lindoso (IMT-USP)	Protein aggregation: Functional and pathological features Prof Daniel Otzen, (Aarhus University, Denmark)	
15:00-15:30	Coffee break	Coffee break	Coffee break	Coffee break	

					(UFAL) 11:30 – 12:00 Amphiphathic copolymers: Effect of copolymer structure in biomimetic systems, Iolanda M Cuccovia (IQ-USP) 12:00 -12:30 Main lines of investigation of the group of complex fluids at Maringá, Breno F de Oliveira (UEM)
15:30-16:30	Malnutrition and hemopoese: Changes in the stem cell niche Prof. Dr. Primavera Borelli (FCF-USP)	Applications of NMR to structural studies of proteins Prof. Dr. Roberto Salinas (IQ-USP)	Electrical impedance of essential oils and of vegetable oils from seeds of grapes Denner S Vieira (Depto. Física, UEM)	Anemia: A public health problem Prof. Dr. Naira Hojaij (FMUSP)	Closing Session
16:30-17:00	Estado nutricional, inflamação sistêmica e prognóstico de doentes críticos (Lady F Almeida, EMESCAM) Validação de método de avaliação de ácidos graxos w-3 e seus derivados no plasma humano (Marlene N Aldin, FSP-USP)	Índice glicêmico e carga glicêmica da dieta de mulheres com CA mamária sob tratamento quimioterápico (Elisa Yumi, FSP-USP)	Effects of fatty acids in lipid membranes (Rubim R L Gerbelli, IFUSP)	Deformações periódicas induzidas por termos de superfície em cristais líquidos (Renato F de Souza, UEM)	

* - The talk by Prof. Vladimir Lorman was replaced by a talk by Prof Cristiano Oliveira (IFUSP), since Prof. Lorman was not able to travel due to health problems.

In this edition of the Summer School there 12 national and 2 international speakers, while in 2012 edition there were just 4 speakers. This quantitative difference is due to that in the last year event the same teacher was responsible for several lectures, which was not the case this year. This new format gave to the school a structure close to a symposium, whereas the previous editions had the structure of mini courses.

Besides the participation of the lecturers, we had the presentation of 13 talks referring to ongoing work by students of the INCT-FCX.

Three talks were in other languages than Portuguese: Prof Emilio Ros (UnB) in Spanish, and Prof. Daniel Otzen (Denmark), in English. All other talks were in Portuguese. All the presentations were recorded and are available together with the supplementary material. We hope this will be useful for the participants to review the content of the lectures.

There were 81 registered participants in this Summer School, from 26 institutions. From these participants, 66% were from 5 different schools of the University of São Paulo. Also, there were participants from 10 institutions from outside the state of São Paulo.

Among the participants (students), 40% were dietitians, 22% were physicists, and the remaining 38% were chemists, physicians, pharmacists, physiotherapists, and biophysicists. From the registered students, 51% were graduate students in master and doctoral programs.

The heterogeneity of institutions and training of students is strength of the Summer School. It shows that different areas of knowledge are interested in the general topic of complex fluids. In this edition of the school, the highlight was the students in the health areas. This profile is a direct reflection of the local of this Summer School, at "health quarter" of the University of São Paulo.

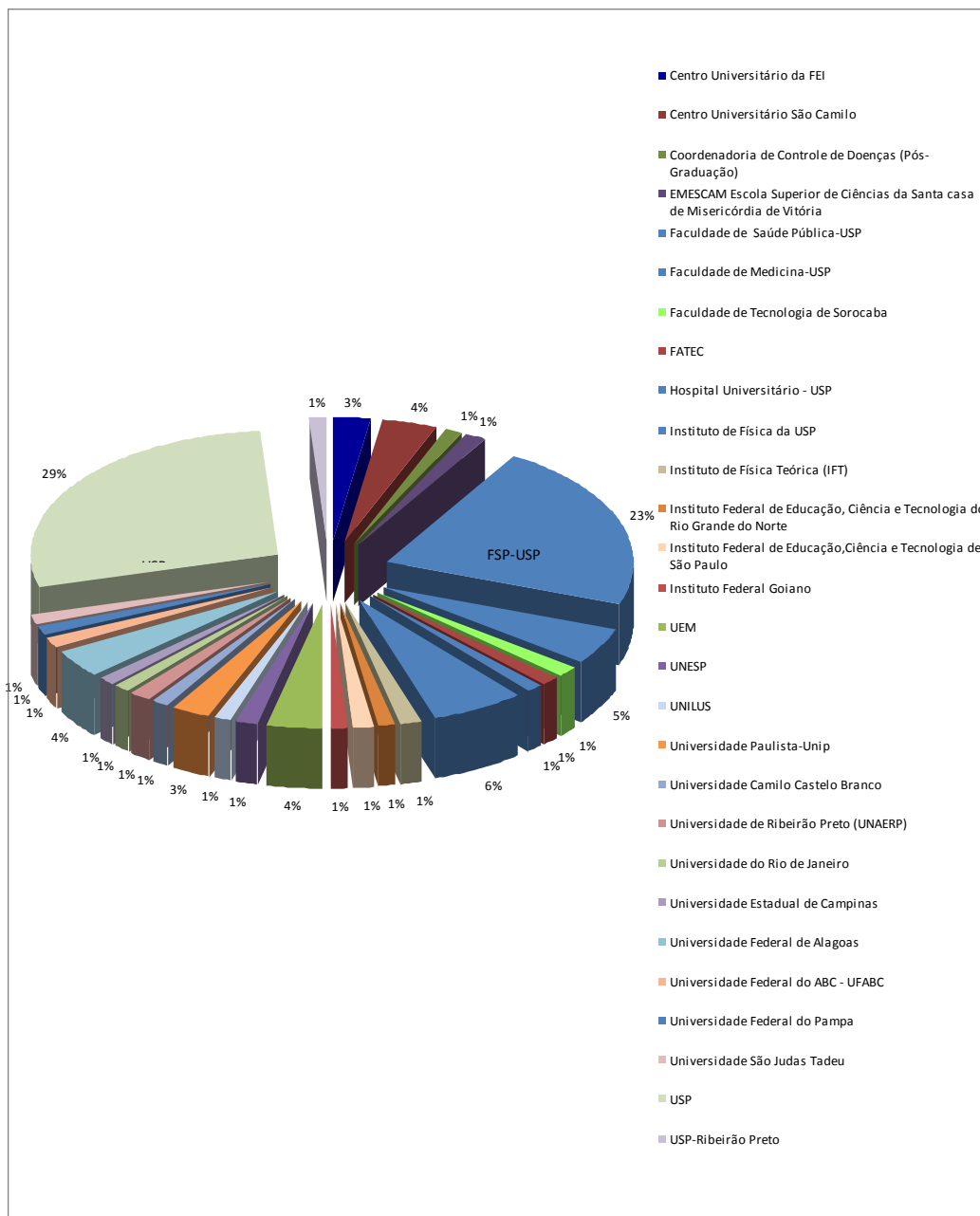


Figura 1 – Distribution of participants of the VII Summer School on Complex Fluids

The students and some of speakers have received some financial aid for the participation. Students from member institutions of the INCT-FCX received travel and per diem paid in full. Students from institutions that are not part of INCT-FCX had some partial relief. The presence of students was controlled in the sessions of the school, and the certificates were conditional to a minimum attendance of 75% of the activities. Foreign participants were fully funded. Of the 81 initially registered students, 60 did attend the school, and 58% had more than 75% of frequency.

An important point for the integration of the students was the oral presentations of all the abstracts presented to the School. These presentations took place every day, after the last talk of the day, and during the morning of February 8. Each student had 15 minutes to the presentation,

followed by a few questions. These presentations had an excellent quality; they have all raised some questions.

During the period of the school, the students were able to have contacts with students from other areas and other institutions, and were able to interact with the speakers who stayed for lunch or during coffee break.

In addition to lectures and student presentations, we invited all members of the INCT-FCX to briefly present their research lines on the last day of school, with the goal of stimulating partnerships and establishing new collaborations between researchers and students.

The concrete results at the VII Summer School can be measured by the assessment made by the participants. This assessment includes organizational, structural and scientific questions, as indicated in Figure 2.

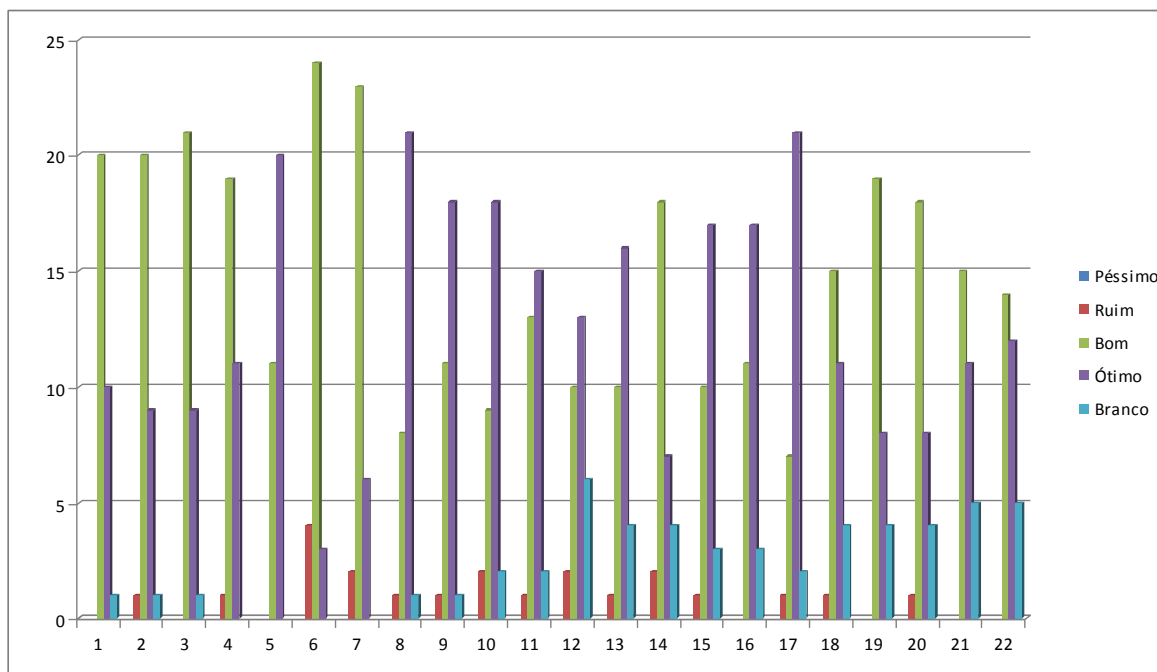


Figura 2 – Results of the evaluation of the courses by the participant students of the VII Summer School of Complex Fluids

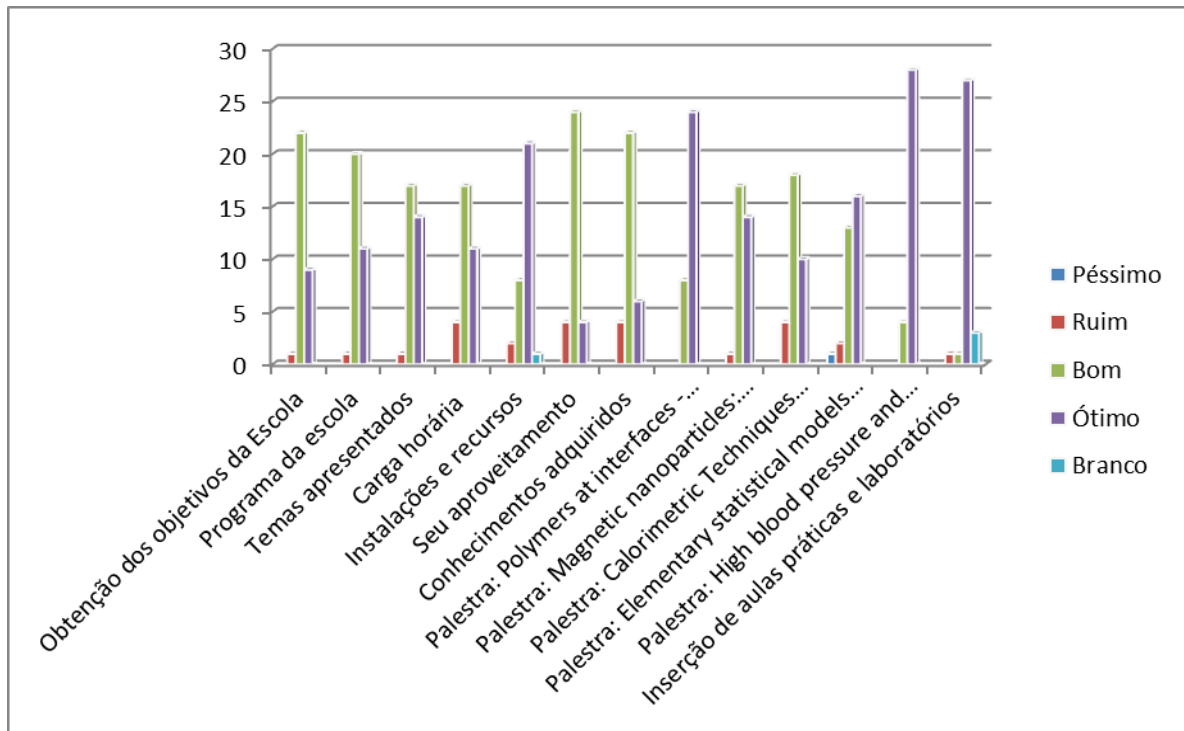


Figura 3 – Results of the evaluation of the courses by the participant students of the VII Summer School of Complex Fluids

The first six items were the following:

1. have the goals been met?
2. program of the School
3. topics of the presentations
4. time load of the School
5. installations and resources
6. what have you learned at this school?

All the participants rated as good or excellent all of these items. This rating profile is better than in the previous edition of the school, and indicates that experience with roaming was valid and should be stimulated.

With respect to the quality of the presentations, it is difficult to compare with the previous schools. Still, it is possible to see that all talks were classified as good or excellent by more than 95% of students. This profile was similar to the 2012 edition.

The VII Summer School was 100% by INCT-FCx. It was announced during about 40 days at various sites the University of São Paulo, and by several emails to all members of the INCT-FCx.

In conclusion, we propose that the organization of future Summer schools should be one of the relevant tasks in the area of complex fluids.

Exhibition - Proteins and Health: The essence of life

Coordination: Vera Bohomoletz Henriques (IFUSP) and Nágila Raquel Teixeira Damasceno (FSP)

Realization: Support: NAP-FCx e INCT-FCx

Support: CINUSP, CCEX-IF, Laboratório de Demonstrações-IFUSP

Abstract

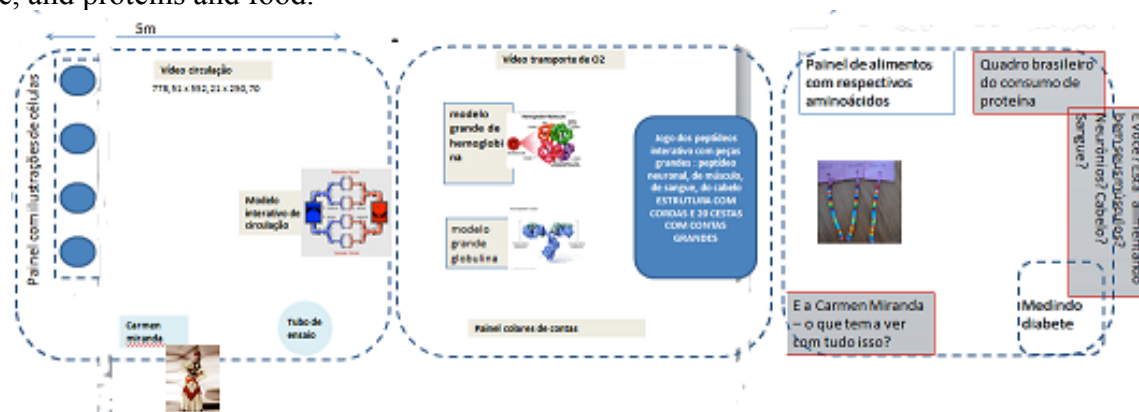
With the goal of bringing science, health and education to the public, we organized the exhibition "Proteins and Health: The essence of life" in the subway station Republica, in São Paulo, during the month of November, with supervised visitations by monitors, from Monday to Sunday, between 11am and 9pm. During this period, the public could interact with micro and macrostructure proteins, arranged in about 100 m² of exhibition space, in addition to playing games with chemical structures of proteins, performing assessment body content of muscles, and visualizing how proteins are part of a balanced diet.

Concept

The central point of this exhibition was the introduction of the idea that there is a microscopic structure which keeps the body in place, and that adequate food is necessary to keep this structure. To introduce this idea, it is necessary to establish connections between the macroscopic structures of our body, in other words, the systems, and their microstructure components, as well as the way these microstructures are "manufactured" every day.

Structure and content of the exhibition

The exhibition was organized according to three modules: cells and functions, proteins and structure, and proteins and food.



In Module I, cells could be visualized under a microscope, the description of the function of red blood cells was described in the video system, the movement could be manipulated in a macroscopic model of the circulatory system, while physical concepts involved in the circulation could be discussed on the basis of a large Heron source model. All of these structures were supplemented by explanatory posters.

PRESENTES EM CADA SISTEMA, CADA ÓRGÃO

CELULAS DOS MÚSCULOS
O principal depósito corporal de proteínas: nossas fibras musculares são constituídas principalmente de dois tipos de proteína, chamadas actina e miosina.

HEMÍCITOS
As células de nosso sangue, ricas na proteína chamada hemoglobina, que transporta oxigênio para todo o corpo.

CELULAS DA PELE
Completam o revestir e protegem o corpo. Um de seus principais componentes é a queratina, presente também em nossas unhas.



FONTE DE HERON
uma bomba sem válvulas

A fonte de Heron, que viveu em Alexandria no primeiro século da nossa era, movimenta a água contra a gravidade usando a energia da própria gravidade!

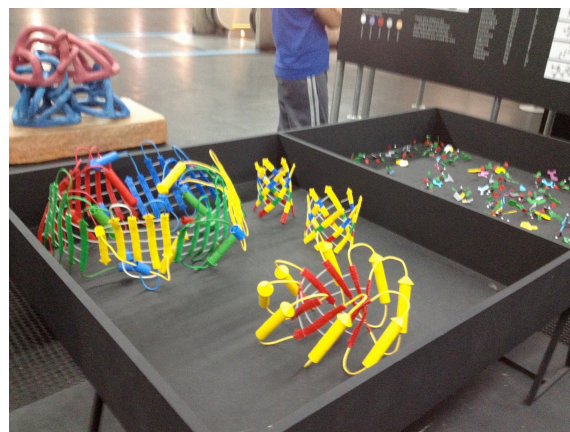
A água que desce no tubo A comprime o ar B, que empurra a água C tubo acima. E uma bomba movida a gravidade.

No fonte de Heron, diferentemente do circuito sanguíneo, o fluxo de água é intercalado com ar, semelhante ao que o músculo cardíaco faz nas cavidades do coração, a água que desce dilata o espaço disponível. O ar, comprimido, empurra a água para fora da fonte.

A SIMILITUDE
O coração bombeia o sangue para que ele vá até os tecidos e volte para casa pelo sistema venoso. É uma bomba sem válvulas.

O ar comprimido (A) empurra a água (B) para cima. A água (B) se expande e empurra o ar (C) para cima. O ar (C) comprime a água (D) e a empurra para fora da fonte.

In Module II, the spatial structure of hemoglobin was illustrated by a sculpture, a model “beads” described the protein structure, and various representations were made of amino acids and peptides. Visitors could build from a set of amino acids, or display protein structures consisting of game pieces. The protein synthesis was described by a video, and an illustrative panel described the digestion of the proteins.



In Module III, a panel reported on the presence of various amino acids in different foods. Another panel reported on Brazilian eating habits and healthy eating, illustrated by an acrylic pyramid with food. A test of bio-impedance was available to assess the muscle content, which is related to the structural protein.



The design of this exhibition was made by the architects Henrique Gabbo Torres e Nadezhda A. Mendes da Rocha, from the Garupa studio.

The exhibition had 15 monitors, who were undergraduate students from the School of Public Health, and who worked about ten hours per day.

Due to a requirement of the subway company, the exhibition was protected during 24 hours per day.

VISITATION

The exhibition received approximately 10,000 people as spontaneous visitors. These people were subway users, with very different educational backgrounds, who took advantage of the explanations at different levels of understanding. Many of them came back with their families and friends. Moreover, we had to schedule some visits for school groups, organized by the Committee for Culture and Outreach of the Institute of Physics, at the headquarters of INCT-FCx and NAP-FCx

Workshop: Amphiphilic aggregates

Coordination: Prof. Dr. Maria Teresa Lamy (IFUSP)

Prof. Dr. Kaline Coutinho (IFUSP)

Realization: NAP-FCx and INCT-FCx

The workshop on "Aggregated Amphiphiles" was organized on 29 June. There were talks by several research members of the NAP e INCT with works in this area. There have been interesting interdisciplinary discussions, with the presence of about 60 people, faculty members and students from IFUSP, FFCLRP, IQUSP, and FM.

Presentations referred to the topics of study of each group, and the methodologies involved, with a view to exchanging ideas among participants, and encouraging collaborations between groups from various areas. As shown in the program below, there were eleven (11) presentations, with discussions, and in the end there was a general discussion with proposals for possible collaborations. As a foreign guest to participate in the discussions, we invited Prof. Bruno Maggio, Professor Emeritus of the University of Cordoba, Argentina, Director of the Center for Investigations of Biological Chemistry at Cordoba, Member of the Board of IUPAB (International Union of Pure and Applied Biophysics) and representative of Argentina in the coordination of CABNN (Argentine-Brazilian Centre for Nanoscience and Nanotechnology).

The interdisciplinary nature of this workshop has been its biggest success, not only due to the discussions between researchers, but also due to the involvement of students, and the interactions between faculty members and students. The main topics of discussion, at the forefront of international research, included lipid emulsions used in gene therapy or drug delivery, lipoproteins, and phase transitions in membranes and micelles. We have also discussed various experimental and theoretical physico-chemical techniques for the investigation of aggregate amphiphiles: calculation of ions on the surface of amphiphilic aggregates, light scattering and small angle X-ray, electron paramagnetic resonance, fluorescence, including modern image techniques, time-resolved fluorescence, Z-Scan, molecular modeling, and statistical models.

8:45	<i>opening</i>
9:00	"Lipidic nanoemulsions as vectors of genic therapy" Sérgio P. Bydlowski (FM-USP)
9:30	"Order-disorder transitions of hydrocarbon chains in micellar systems and vesicles" Lia Q. Amaral (IFUSP)
10:00 -	"The Various Phases of Ceramide Monolayers" Bruno Maggio (Universidad Nacional de Córdoba, Argentina)
10:30	<i>Intervalo</i>
11:00	"Ion binding, aggregate shape and interfacial water in ionic micelles" Hernan Chaimovich (IQUSP)
11:30	"Nonlinear optical properties of human lipoproteins of low density (LDL)" Antônio M. Figueiredo (IFUSP)
12:00	"The laboratory of biological structure of the Department of Biochemistry at IQUSP" Shirley Schreier (IQUSP)
12:30	<i>Almoço</i>
14:00	"Structure of amphiphilic aggregates: the contribution of electronic paramagnetic resonance and light scattering" M. Teresa Lamy (IFUSP)
14:30	"Statistical models for membranes - phase transitions in the presence of charges, hydration and diffusion in the bilayers". Vera Henriques (IFUSP)
15:00	"Structural information on lipid systems from low-angle X-ray scattering measurements" Cristiano L. P. Oliveira (IFUSP)
15:30	<i>Intervalo</i>
16:00	"Modeling lipid bilayers and the interactions with a fluorescent probe" Kaline R. Coutinho (IFUSP)
16:30	"FCS and FLIM: tools for the study of miltefosine on model membranes" Amando S. Ito (FFCLRP-USP)
17:00	<i>General Discussion - Proposals of Work - Closing</i>

Teaching activities

1 – UP-DATING COURSE FOR SCHOOL TEACHERS

Coordinator: Lia Queiroz do Amaral

The previous report included the fourth edition of the up-dating course for teachers "Complex Fluids in Middle School: properties and applications in physics, chemistry and biology", held in July 2011 in São Paulo, in continuity to the Project initiated in 2006 at USP and Secretary of Education of the State of São Paulo. These were 40 hours courses for high-school teachers. According to state laws, the proposal of the course is first analyzed, official authorization is given, and a final report is officially accepted. Teachers of Physics, Chemistry, Biology and Mathematics, especially from public state schools, are the aimed audience.

In July 2012 the fifth edition of the Course was held. As in 2011, it was given within the program of Meeting USP – School, promoted by the Committee of Extension and Culture of IFUSP, in the week July 10 to 14, 2012, from 8 am to 5:30 pm.

The proposal of the course for 2012 needed to be restructured, since some participants from 2011 had other compromises.

TEAM of 2012:

Lia Queiroz do Amaral (coordinator) – IFUSP

Daniel Reinaldo Cornejo – IFUSP

Giancarlo Espósito de Souza Brito - IFUSP

Lionel Fernel Gamarra Contreras - Instituto Israelita de Ensino e Pesquisa Albert Einstein

Karin do Amaral Riske – EPM – UNIFESP

Claudete Valduga - UNIBAN

Paulo Boschcov – EPM - UNIFESP

The program of the course had some changes with respect to 2011, as a result of changes in the team giving the classes. The Laboratory part was replaced by demonstrations and work done in the classroom.

DETAILED ACTIVIDADES (PROGRAM)

July 10 - Morning: Structure of Condensed Matter and Soft Matter (Lia)

Afternoon: Water and Aqueous Systems (Lia)

July 11 – Morning: Thermodynamics, with exercises (Karin)

Afternoon: Biological Membranes (Karin)

July 12 – Morning: Emulsions (Claudete). Blood and Cholesterol (Paulo).

Afternoon: Demonstration of pH (Claudete)

July 13 – Morning: Nanobiothechnology (Gamarra)

Afternoon: Ferrofluids and demonstration of synthesis in the research laboratory (Giancarlo)

July 14 – Morning: Magnetic Properties of Ferrofluids (Daniel)

Afternoon: visit to the research laboratory of magnetic materials (Daniel)

Observation: every day there has been class work for evaluation.

The course raised good interest among students, who had good participation in the classes. Of the 17 registered students in the first day, 16 had good return and have been approved, only one failed since he appeared only in the first 2 days. The class works demonstrated real participation of the students in the classes. The course received good evaluation from the students.

2. Presentation of the Education Project of INCT in an Education Symposium

The Education Project of INCT was presented as an invited talk in the 2nd Symposium of Education of Physics and Mathematics: Relation between Knowledge and Doing - Santa Maria, RGS, Centro Universitário Franciscano (UNIFRA) – 26/27 April 2012:

L. Q. Amaral, “Interdisciplinary Education of Sciences based in properties and applications of Complex Fluids in Physics, Chemistry and Biology”.

The extended abstract of the invited talk was published in the proceedings of the symposium. Further information about this Symposium may be obtained in the site:

<http://www.wix.com/simposiofisicamatema/2012>

Participation in this Symposium was very interesting, allowing a comparison of the situation in São Paulo, in Maringá (Paraná), and now in RGS.

3 – Book(s) on the content of the EDUCATION project

Coordinator: Lia Queiroz do Amaral

In July 2012 a decision to separate the content of the Education Project in two directions was taken.

The Laboratory part of the pilot course given in 2007 in São Paulo consisted of demonstrations in physics designed and given by Alberto Tufaile, who transformed them in a text of demonstrations as chapter XIII of the booklet made in 2008, for the final report on the Milenium Project on Complex Fluids.

Alberto repeated this laboratory part in the course given in 2009 in São Paulo.

In 2011 Alberto and Adriana Tufaile, who were beginning also such activities at EACH-USP East, gave this laboratory part again.

The experience along these courses clearly showed that the simple laboratory demonstrations in physics is of general interest for the school teachers attending the courses, and that the more elaborated conceptual classes in multidisciplinary subjects were of interest to more qualified but less numerous attendants.

While taking decisions on the texts to be included in a book, it became clear that the part on the simple demonstrations in physics could be published immediately, but that the conceptual multidisciplinary texts required still further elaboration.

This possibility was discussed with Alberto and Adriana Tufaile, since the simple demonstrations in physics came from Alberto in the initial Project. Their answer was positive, and it was defined with the Editora Livraria da Física that a first book, with authors Alberto and Adriana Tufaile, was going to be published, with a preface mentioning the INCT support and their participation in the education project. This book is mentioned in the activities of Alberto Tufaile and Adriana P. B. Tufaile, at EACH, USP-Leste.

Afterwards, L. Q. Amaral defined the inclusion of more multidisciplinary material in the book to be made with the more elaborated texts. Besides the new chapters already mentioned in the previous reports, a chapter on Calorimetry (in Membranes) was included, by Karin A. Riske and Kátia Regina Perez. It should contain what was given by Kátia in the 6st. Summer School (February 2012) and by Karin in the course of July 2012. The interest on Calorimetry became clear in view of the importance of thermal measurements on the chapter on Phase Transitions, and the interest demonstrated by the school teachers on results from thermal analysis shown in the classes on Phase Transitions.

The ensemble of 15 chapters became ready on February 2013 and has been already forwarded to the Editora Livraria da Física. Now the details on figures and references are being formatted for the publication, expected along this year of 2013.

The book title will be: “**Between solids and liquids - a contemporary and multidisciplinary vision for the middle school**”. The decision to keep “for the middle school” in the title refers to the possibility of the book entering the program of the Ministry of Education (MEC). It is a book for science divulgation, since at the moment there is not a defined entry for its subject in the present curricula, but the perspective of inclusion in the future exists. The book level is also adapted to undergraduate courses on science teaching.

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Lia Queiroz do Amaral, *IFUSP*

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Hatsumi Mukai and Paulo Ricardo Garcia Fernandes, *DFI/UEM*

III. Condensed Matter

Lia Queiroz do Amaral, *IFUSP*

IV. Thermodynamics

Thomas Haddad and Adriana Tufaile, *EACH – USP/East*

V. Phase Transitions

Lia Queiroz do Amaral, *IFUSP*, Hatsumi Mukai, *DFI/UEM*, and Thomas Haddad, *EACH – USP/East*

VI. Water

Lia Queiroz do Amaral, *IFUSP*

VII. Micellar Systems

Lia Queiroz do Amaral, *IFUSP*

VIII. Liquid Crystals

Paulo Ricardo Garcia Fernandes, *DFI/UEM*

and Antonio M. Figueiredo Neto, *IFUSP*

IX. Measurements in Liquid Crystal Displays

Paulo Ricardo Garcia Fernandes and Hatsumi Mukai, *DFI/UEM*

X. Calorimetry

Karin A. Riske and Katia Regina Perez, *EPM/UNIFESP*

XI. Foams

Alberto Tufaile and Adriana P. Biscaia Tufaile, *EACH – USP/East*

XII. Emulsions

Claudete Valduga, *UNIBAN*

XIII. Ferrofluids

Giancarlo Brito, *IFUSP*

XIV. Water Ionization and pH

Paulo Boschcov, *EPM/UNIFESP* and Claudete Valduga, *UNIBAN*

XV. Biological Fluids

Paulo Boschcov, *EPM/UNIFESP*

The writing of several chapters in co-authorship represented an intense collaboration between INCT members from IFUSP, EACH-USP-East, EPM-UNIFESP and DFI-UEMaringá.

4. Activities at EACH – USP EAST

Adriana Pedrosa Biscaia Tufaile and Alberto Tufaile

Besides participating in the writing of two chapters of the book mentioned in the previous item, we also had the following activities:

A. “Workshops of Science Education in the Brazilian language of signs for deaf-and-dumb people (LIBRAS)”

Coordinator: Profa. Dra. Adriana P. B. Tufaile

Given by Rafael Dias Silva (fellow from the program Learn with Culture and Extension from USP)

Aim: to develop strategies for classes using LIBRAS in practical activities in Physics, Astronomy, Chemistry, Geology and Biology (middle school) and Sciences (elementary school II).

B. Book: “From the Physics of the Pharaohs to the Photon – Perceptions, Experiments and Demonstrations in Physics”, Alberto Tufaile and Adriana P. B. Tufaile. Editora Livraria da Física.

This book includes the experience of the authors in giving the INCT up-dating courses for teachers of Sciences in the elementary and middle school, with several types of practical activities, for teachers of physics,

C. Article accepted for publication: “Guitar as a tool to teach physics”, E. M. Santos, C. Molina, A. P. B. Tufaile, Revista Brasileira de Ensino de Física.

Simple practical activities to study properties of sounds produced by guitars, through harmonic analysis.

D. Work for conclusion of course (TCC):

Rafael Dias Silva, “Demonstration of the Magnetic Field with Ferrofluids (LIBRAS and Portuguese)” 2012, Supervisor: Profa. Dra. Adriana Pedrosa Biscaia Tufaile, Licenciante in Sciences of the Nature, USP.

E. Patent required for the product: “Equipment for demonstration of molecular orbitals”, A. Tufaile and A. P. B. Tufaile, using ferrofluids and super magnets.

Process [12.1.3150.86.4](#), initiated 18 December 2012 through Agency USP Innovation

F. Outreach work: “Chaotic light scattering, applications in several types of illumination”, A. P. B. Tufaile and A. Tufaile, in the Ist Market USP Innovation and Enterprising, 23, 24 e 25 August 2012, EACH-USP.

Collaboration was initiated with engineer Sérgio Corrêa, from firm Inoveled, São Paulo.

G. Outreach work: “Instability of viscous fingers from Saffman-Taylor study”, Arlino Liverio Jr., Adriana P. B. Tufaile, Alberto Tufaile. VII Summer School of Complex Fluids, 04 - 08 February 2013, Faculdade de Saúde Pública, USP.

Demonstration for the journalist team of magazine Pesquisa FAPESP to get images for the article “Tension under control”, from Igor Zolnerkevic, published in this magazine in November 2012, based on the work of José Américo de Miranda, from UFPE/INCT- Complex Fluids:

<http://revistapesquisa.fapesp.br/2012/11/12/tensao-sob-controle/>

5. Activities at the State University of Maringá

Besides the participation of Hatsumi Mukai and Paulo Ricardo Garcia Fernandes in four chapters of the book mentioned in item 3, we had the following activities:

1. Participation of INCT members from Maringá in the Master Program in Professional Teaching of Physics (MNPEF) – SBF, 2013;

2. Participation of INCT members from Maringá in the Graduate Program of Education in Sciences and Mathematics (PCM) – CCE – UEM;

3. Participation of INCT members from Maringá in the Graduate Program in Physics (PFI) – DFI - UEM.

4. Announcements of the activities of NAP-USP Complex Fluids in the pages of the Physics Department of UEM.

5. Work for conclusion of course (TCC):

Marcio Anicete dos Santos, “Reflexes of the educational legislation in teaching physics at public schools, and problems faced by teachers in view of this curricular component”.

Supervisor: Hatsumi Mukai, Co-supervisor: Polônia Altoe Fusinato, Licenciata 2012.

6. Presentation of work at Meetings:

I Regional Meeting on Physics Education

Universidade Estadual de Maringá, 24 - 25 Novembro 2012

“Determination of the Avogadro Number via Langmuir Method: multidisciplinary proposal for the middle school”,
Michel Corci Batista, **Hatsumi Mukai**, **Paulo Ricardo Garcia Fernandes**, Keila Aparecida da Silva, Allan
Gonçalves da Silva

I Regional Meeting on Sciences, Mathematics and Education: Perspectives in History of Physics, 2012:

"Light, More Light!", **Luiz Roberto Evangelista**

I Seminar of technical studies and technology of the Instituto Federal de Educação do Paraná, 2012:

“Technique, Society and Environment”, **Luiz Roberto Evangelista**.