NATIONAL INSTITUTES OF SCIENCE AND TECHNOLOGY – INCT

MONITORING AND EVALUATION

PERIOD: from 2/4/2013 to 2/4/2015

IDENTIFICATION OF THE PROPOSAL

TITLE: INCT of Complex Fluids (INCT-FCx)

Number: 573560/2008-0

Term: from 2/4/2009 to 2/12/2015

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:
As it was reported previously, there is still the problem of a very small number of CAPES fellowships allocated to the INCT. 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 have several mechanisms of interaction:
1. The site of the INCT-FCx (http://inctfcx.vitis.uspnet.usp.br). In this website there are descriptions

of the research works and 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. This meeting has been organized in collaboration with the center for complex fluids at USP (NAP-FCx).
3. We organized regular seminars at USP to discuss many 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 the 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 describe some topics of our research activities. One the main characteristics of our Institute is the multidisciplinary research wok. This text is an attempt to emphasize the interaction between groups, which has been made possible by the organization of the INCT.
We now point out some of the highlights of the reported research work. We mention the main researchers of each group, but in most cases the research work was a collaborative effort involving people from several groups.

At the UFAL group, we analyzed several problems involving complex fluids, with emphasis on heat transport in liquid crystalline systems and light emission of conjugated polymers. In the first case we investigated the effects of the addition of fullerene on the mode of propagation in smectic liquid crystals near the nematic-smectic first-order transition. Results showed that fullerene thermal conductivity of the sample increases, and the thermal diffusivity changes with temperature. Furthermore, it was observed that the introduction of fullerene reduces the temperature of the nematic-smectic A transition, which may affect the development of electro-optical devices based on these systems. With respect to the characterization of emission phenomena in conjugated polymers, we investigated the effects of the temperature and polarity of the solvent on the quantum efficiency and emission spectrum of a compound containing dansyl and pyrrole groups. The obtained results showed that the dansyl-glycinate compound of propyl pyrrole presents an emission process that is highly sensitive to the temperature of the medium, with increasing fluorescence as the temperature rises. We investigated the wave propagation in multilayer media containing liquid crystals. Also, we used ab initio methods to investigate the pharmacological properties of molecules with bactericidal potential. It was observed that the rotation of the polarization of the incident light increases significantly in these systems, which can be used for manufacturing high performance optical insulators. In the study of molecules with bactericidal potential by ab initio calculations, we analyzed the correlation between the efficiency to fight tuberculosis in a group of molecules and the binding energies obtained in the first-principles calculation. The results showed that the use of ab initio calculations is capable of giving information to help identifying which molecules are better suited for use as antibacterial agents, and which can help the development of new drugs.

The group of Prof. Dr. Claudete Valduga investigated the use of nanotechnology in the development of anti-leishmania pharmaceutical formulations. This work indicated a reduction of 70% of the hemolytic potential of miltefosine, which is a drug used in the treatment of visceral leishmaniasis, and which presents as main toxicological effect the hemolysis of the erythrocytes, preventing its intravenous administration. Furthermore, studies in collaboration with Professor Amando Ito (USP-RP) showed that miltefosine, as well as cholesterol, in suitable concentrations, are capable of stabilizing the lipid monolayer of nanoparticles. Therefore, other formulations have been developed

by combining miltefosine with other drugs of anti-leishmania action, which may give rise to new treatments of leishmaniasis, one of the neglected disease that require new treatment options. This work resulted in an article that is still in the submission phase.
Also, we have developed and validated bioanalytical methods for the quantification of short chain fatty acids by gas chromatography, using samples of in a culture medium of probiotic bacteria, plasma, and feces of mice. The results contributed to a publication in the Journal of the American Society of Nephrology (impact factor 9.466), in collaboration with Prof. Niels O. S. Camara.

The group led by Prof. Dr. Rita Ruiz studied aspects related to diarrhea, which is the second cause of infant death and so it is now recognized as an important public health problem. Escherichia coli (EPEC) is, in addition to an important etiologic agent, an interesting model to investigate the interaction with immune cells and the expression of virulence factors. Thus, in this period, there were two important advances in the study of these two points: 1) In the study of the interaction of bacteria with macrophages, we identified a dual mechanism of bacterial evasion. EPEC secretes and antiphagocytic factor that reduces the amount of phagocytosed bacteria, but once phagocytized, EPEC survives in the intracellular environment even in the presence of important proinflammatory cytokines; 2) In the study related to the expression of toxins of the SPATE family (serine protease autotransporters of the Enterobacteriaceae), we described the presence of Pet and Sat toxins, which are important virulence markers. Furthermore, due to its versatility, SPATE family members have enabled the carrying of recombinant proteins or peptides with various functions to the surface of the bacteria. Once exposed on the bacterial surface, the molecule becomes more accessible and more stable compared to the free form. Thus, the system of molecules at the bacterial surface, on the basis of autotransporter molecules, has been used as an important biotechnological tool.

The group led by Prof. Dr. Marcia Barbosa investigated the mechanism of breaking of DNA by the addition of salt. It has been shown that water at an extreme degree of confinement (as in the water channels in our body) undergoes a superflow which is responsible for separating salt from water.

The group led by Prof. Dr. Lionel Gamarra, at the Albert Einstein Hospital, works with magnetic nanoparticles. This group has carried out a number of investigations: the ways of injecting nanoparticles of iron oxide to reach glioblastoma tumors in an animal model, taking into account future therapeutic applications in magnetothermia; the standardization of experimental models of glioma induced by different concentrations of C6 cells; magnetic resonance imaging and histological analyzes of tumor growth at different times after induction; isolation and characterization of the multipotential capacity of stem cells from human bone marrow and the process of internalization of nanoparticles using transfection agents; a pre-clinical study of the cellular and molecular mechanisms involved in tissue and functional repair promoted by the CTM of PCU that were marked with multimodal nanoparticles in the animal model of focal ischemia; study of the density of dopaminergic receptors and dopamine production during natural aging and the correlation with the levels of the same markers in the animal model of Parkinson disease; therapeutic effects of human stem cells marked by fluorescent nanoparticles in tissue and functional repair in the experimental model of Parkinson; cellular and molecular mechanisms involved in brain aging.

The group led by Prof. Dr. Lilia Courrol obtained promising results with the analysis of protoporphyrin IX extracted from blood and animal feces using optical methods for the diagnosis of atherosclerosis. These results indicated that the increase in fluorescence of this metabolic is related to an increased atheroma. This result indicates a non-invasive alternative for the diagnosis of atherosclerosis by examination of blood and feces.

The group led by Prof. Dr. Francisco Fonseca and Dr. Maria Cristina Izar investigated the lipid-lowering strategies, the results of which allowed a better understanding of the effects on various biomarkers of cardiovascular disease, from endothelial progenitor cells and microparticles to the immune response related to oxidized LDL. We determined the absorption of phytosterols and the endogenous synthesis of cholesterol, which led to the establishment of mechanisms associated with the quantifications of cholesterol. We observed the significant role of statins in mediating important mechanisms of cardiovascular protection, along with effective responses mediated by inhibiting cholesterol intestinal absorption and the supplementation of phytosterol. We measured the amount

of phytosterols in a variety of foods consumed by representative samples of individuals in São Paulo, which indicated the low consumption of phytosterols.

B – TRAINING OF HUMAN RESOURCES:

We promoted the training of several undergraduate students in all of the laboratories of the INCT. Some of these students are still working with us. We emphasized the need to learn techniques in different laboratories of the INCT, instead of just working in the laboratory related to the course of origin of the students.

C – TRANSFER OF KNOWLEDGE AND TECHNOLOGY:
The work at the INCT has led to the generation of patents, processes and products.

D – EDUCATION AND DISSEMINATION OF SCIENCE:
1) The INCT-FCx produced a book (see the details in Annex II) with the purpose of producing supplementary material for high-school teachers, and also to disseminate knowledge about the structure of matter, in particular on complex fluids.
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 exhibition was seen by 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) The biggest impact of the actions of the INCT- FCx was undoubtedly the establishment of a solid network of researchers and laboratories with complementary techniques, and with research interactions to treat problems with a multidisciplinary focus. These activities did not come at the expense of developing more specific thematic lines of research, but as a complement to these lines.
2) The significant number of papers published in international journals involving more than one INCT group, 105 papers during the term of this report, clearly shows the achieved progress in the scientific interactions involving not only groups but specialties also.

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:

It is has been submitted, and it is under analysis, an application for the registration of a software to be used for heat mapping in magneto hyperthermia therapy. We have built equipment for directing nanoparticles to a certain target and thus achieving the desired therapy. This equipment has been patented. We developed a new method of analysis of small angle X ray scattering to be used in structural studies of lipoproteins. This method allowed the assessment of slight changes in lipoproteins, which could make them more atherogenic.

D – EDUCATION AND DISSEMINATION OF SCIENCE:
In this aspect, the INCT holds an annual Summer School and teaches at least one updating 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 2013, 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) In 2013 we organized a scientific exhibition at the subway station República in São Paulo. It lasted one month, and dealt with research activities carried out under the INCT. Magnetic fluids, used in many everyday popular devices, as well as in therapies and as contrast agents in nuclear magnetic resonance imaging, were presented in this exhibition.
2) Diarrhea is the second leading cause of infant death and so it is now recognized as an important public health problem. In addition, Escherichia coli (EPEC) is an important etiologic agent, and an interesting model to investigate the interaction with immune cells and the expression of virulence factors. Taking into account that there is growing economic interest in the identification of products secreted by microorganisms, due to the availability and to the low cost of production at the industrial scale, it is possible that progress in the identification, characterization and purification of the antiphagocytic factor secreted by the EPEC can generate, in the future, innovative information for infection control. This research was led by Prof. Dr. Rita Ruiz, at the Butantan Institute.

RESULTS IN NUMBERS

A – INDICATORS OF RESEARCH	
NUMBERS OF THE TECHNICAL, SCIENTIFIC AND ARTISTICAL PRODUCTION IN THE PERIOD (enclose references):	
TYPE	**QUANTITY**
BOOKS	7
CHAPTERS OF BOOKS	44
ARTICLES IN NATIONAL JOURNALS	28
ARTICLES IN INTERNATIONAL JOURNALS	423
ARTICLES WITH AUTHORS FROM SEVERAL GROUPS OF THE INCT	105
PAPERS IN NATIONAL MEETINGS	101
PAPERS IN INTERNATIONAL MEETINGS	79
SOFTWARE	
PATENTS	
PRODUCTS	1
PROCESSES	
ARTISTIC PRODUCTION (SPECIFY): PREFACE IN PHOTO CATALOGUE OF SCIENCE FEMININE NOUN	1
OTHER (INVITED TALKS)	20

B – INDICATORS ABOUT THE FORMATION OF HUMAN RESOURCES	
NUMBERS ON THE FORMATION OF HUMAN RESOURCES IN THE PERIOD	
TYPE	**QUANTITY**
COMPLETED:	
SCIENTIFIC INITIATION	20
MASTER	38
DOCTOR	31
POST-DOCTOR	16
OTHER (SPECIFY):	
ONGOING:	
SCIENTIFIC INITIATION	26
MASTER	41
DOCTOR	79
POST-DOCTOR	30
OTHER (SPECIFY):	

C – INDICATORS OF KNOWLEDGE AND TECHNOLOGY TRANSFER	
NUMBERS OF THE PRODUCTION IN THE PERIOD (Specify and enclose references):	
TYPE	**QUANTITY**

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
Videos in English	2

ADDITIONAL INFORMATION

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

1) Results obtained by the INCT-FCX are available at 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 updating 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:

There were no additional funds for the acquisition of new equipment during the term of this report.

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

1) UFAL Group: Research activities for the study of wave propagation in non-linear media. Contributor: Prof. Antonio Sergio Shadow - UFC; INCT Photonics for Optical Communications. Research activities for the study of biocompatible polymers and luminescent polymers. Contributor: Adriana Santos Ribeiro - IQB / UFAL; INCT for Integrated Nanotechnology Bookmarks.
2) Dr. Claudette Valduga of Uniban: Development of research in collaboration with researchers of the INCT of Pharmaceutical Innovation.
3) Dr. A. M. Figueiredo Neto: We have strong interactions with researchers from INCT-Redoxoma INCT, with Prof. Dr. Sayuri Miyamoto (IQUSP).
4) Dr. Sarah Alves: Collaboration with researcher Dr. Luiz S. Long Jr, INCT in Pharmaceutical Innovation, for the study of optical properties of metal nanoparticles and organic compounds, and with Dr. Virginia B. Campos Junqueira, INCT- Pharmaceutical Innovation, in the study of the optical nonlinearity of analytes related to metabolic disorders in several pathologies, and of circulating plasma DNA in cancer studies.
5) Dr. Rita Ruiz: Collaboration with the INCT-Toxins in the study of (i) action of mesoporous silica SBA-15 in professional phagocytes; ii) assessment of cytotoxicity induced by autotransported proteins.
6) IQUSP Group with INCT-Redoxona.
7) Lipid Group at UNIFESP: There was a close relationship with the INCT-Immunology, with Prof. Magnus Gidlund, as well as collaborations with this INCT involving nanoparticles, with Prof. Raul Cavalcante Maranhão.

FINAL CONSIDERATIONS

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. Funds have been used in a quick and efficient way to make possible the collaboration between researchers and to take care of emergency replacement of equipment and consumer items. It has been possible to used these funds for 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 report of activities, 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 term of this report, we published 423 articles in journals with international circulation, and 105 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.

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, 2015.

Signature:

National Institute of Science and Technology of Complex Fluids

(Partial Report of Activities - Year 5)

Introduction

We now describe the main research results obtained by members of the INCT-FCX during the fifth year of activities.

There are two annexes:

Annex 1 - scientific publications, invited presentations in scientific meetings, participation in scientific meetings, supervision of students (finished programs), supervision of students (ongoing programs), chapters of books, and prizes.

Annex II – teaching, dissemination and outreaching activities. An organized School and an exhibition for the general public in a subway station in São Paulo.

The Steering Committe

Composition

Prof. Dr. Antônio Martins Figueiredo Neto (Coordinator)
Prof. Dr. Luis Juliano Neto (Vice-Coordinator)
Prof. Dr. Francisco Antonio Helfenstein Fonseca
Profa. Dra. Iolanda Midea Cuccovia
Profa. Dra. Lia Queiroz do Amaral
Prof. Dr. Luiz Roberto Evangelista
Prof. Dr. Niels Olsen Saraiva Camara
Prof. Dr. Sylvio Roberto Accioly Canuto

Members of the Steering Committee were in contact by electronic media with a periodicity depending on the needs of the administration of the INCT.

Main results of the research activities

Initial considerations:

In this fifth term of activity of the INCT-FCx, it has been possible to see the consolidation of the team that was formed during these 5 years. In this period, we published a record number of **423** scientific articles. There were **105** published articles in international journals, with the participation of more than one member of the team of the INCT.

In the following sections we describe the main research results, with emphasis on the development of effective collaborations between groups of the INCT. The text of this report is dived into different research subjects, with an eye on interdisciplinary activities.

Research topic: Lipoproteins

Effects of w-3, w-6 (omega-3, omega-6) on the cardiometabolic parameters, with emphasis in the glycidic profile and the corporal composition. Lipids and biological interactions.

In this study, we included 86 subjects (w-6 group) and 88 subjects (w-3 group), who received 3.0 g/day of the respective fatty acid. The effect of the intervention was monitored at the beginning of the study and after 8 weeks. Adults and elderly subjects were included, of both sexes, without previous cardiovascular events. The results showed that both groups had a similar profile in terms of age, sex, race, smoking, current illnesses, use of medication and family history. At the beginning, the groups had similar levels of physical activity and diet. The adhesion to the intervention was greater than 90%, which gives increased confidence in the results. There was a significant difference in the lipid profile after the intervention, although this was similar to that observed in the w-6 group. Similar profiles were also observed for glucose, insulin and HOMA-IR.

Taking into account these results, we checked whether there was any difference between the groups according to the stratification score of Framinham risk (ERF). This score estimates the individual's risk in a cardiovascular event in a 10-year interval. After the stratification of the w-3 and w-6 groups, according to low, intermediate, and high ERF, we observed that insulin values (18 x 15 mg/dl) and HOMA-IR (5 x 3.8) were reduced in individuals with intermediate ERF. This profile did not change when w-3 and w-6 groups were compared (Fig. 1).

When evaluating the impact of interventions on body composition, we observed a slight increase in BMI.

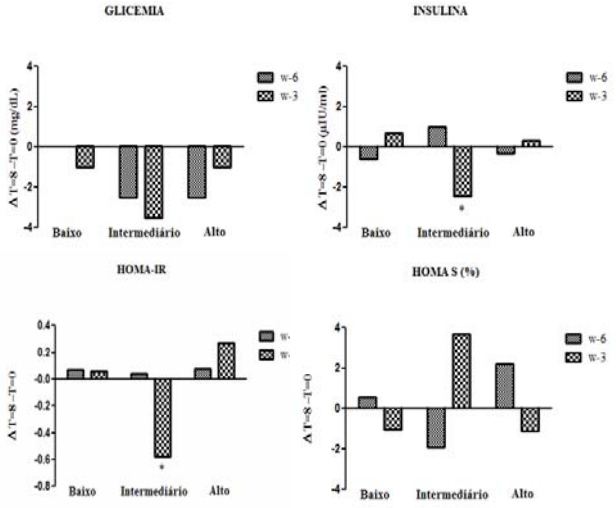


Figure 1 – Variation of glicemic values, insulin, HOMA-IR and HOMA 2-%S according to the type of intervention and score of risk of Framingham

However, the percent distribution of body fat was lower in the group of women who received w-3 (Fig. 2).

This variation was significantly larger in group w-3 as compared with group w-6. When the sample was stratified in terms of ERF, the groups displayed similar profiles.

This study was based on main hypothesis that the increase in fatty acid intake of omega-3 (w-3), specifically EPA and DHA, results in weight loss or change in body composition, leading also to the improvement of the variables related to glucose homeostasis in a population above 30 years of age with different levels of cardiovascular risk.

Studies with fish oil, glucose homeostasis, and insulin resistance in humans and animals, are inconsistent. While promising data have been described from experimental studies, not only with EPA and DHA, but also with the alpha-linolenic acid, clinical studies suggest that these fatty acids are not able to improve insulin sensitivity.

In obese and hypertensive individuals, the consumption of fish in the diet (3.65g of w-3/day) showed no independent effects on insulin or glucose, and also no changes were observed in blood glucose and fasting insulin with 30ml supplementation of fish oil a day, containing 3.8g of EPA and 2.5 g of DHA, in obese subjects with impaired glucose tolerance. In subjects with mild obesity, 15 ml/day of fish oil (3.1g of w-3/day) did not alter the metabolic clearance rate of glucose in the hyperinsulinemic euglycemic clamp. In healthy elderly patients, adjusting the ratio w-6: w-3 by replacing w-6 by alpha-linolenic acid, EPA, DHA, or by a mixture EPA + DHA mixture (keeping fixed the dietary consumption of saturated

and unsaturated fatty acids, to provide about 6% of the energy by means of polyunsaturated fatty acids) produced no differences in blood glucose and fasting insulin or HOMA-IR. In healthy individuals, it was

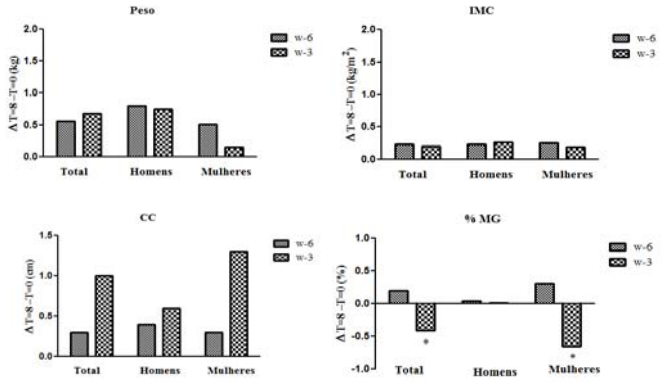


Figure 2 – Variation of the weight, index of body mass, waist circumference, and percentage of body fat, according to gender and intervention.

observed that the consumption of fish oil (3.6 g of w-3 by day) had minimal effects on insulin sensitivity, on the rapid insulin release (first phase), and on the glucose tolerance. However, this study showed that after the stratification of the population by the Framingham Risk Score (FRS), that is, according to the cardiovascular risk of individuals (low, intermediate or high), the added supplements of 1.11g of EPA + 0.69 g of DHA was able to produce significant changes in fasting insulin and HOMA-IR in the population that had intermediate risk, in spite of no observed changes in insulin sensitivity and fasting glucose of these individuals. These results may be related to improvements in the inflammatory profile of these individuals, with the EPA and DHA acting directly on cytokines and inflammatory markers, reducing the inflammatory process and contributing to the reduction of insulin resistance. However, in our study it was not possible to evaluate any variable related to inflammation.

In the present study, despite the increase in the percentage of EPA + DHA in plasma observed in the group supplemented with w-3, the body weight of this population has not decreased. However, there was significant reduction in fat mass percentage, especially among female subjects. These results are in agreement with previously described studies, which also indicated beneficial effects on the body fat with the supplementation with these fatty acids, but not in the weight of 5 women and 1 healthy man with the substitution of 6 g of a diet lipids by 6g of fish oil (1.1 g/d of EPA + 0.7 g/d of DHA) during 3 weeks, and in diabetic women, with a supplement of 1.08 g/d of EPA + 0.72 g/d of DHA during 8 weeks.

Studies that have the same design and objectives as the intervention carried out by our group are scarce, making it difficult to compare with other results in the literature, in which fish oil has been used as an adjunct in the treatment of weight loss. In these studies, EPA and DHA were able to produce a greater reduction in body weight in individuals practicing physical activities who have received during 3 weeks a quantity of 2.8 g of EPA + DHA, as compared to those who did only physical and activity, and

also in those who received nutritional counseling and a supplementation of 180mg EPA + 120mg DHA for 6 months, as compared with those who had only the orientation. Conversely, when using supplementation with w-3 (3g EPA + DHA) in conjunction with a set of aerobic exercises and a dietary counseling program, there was no beneficial reduction of weight, as compared to the group supplemented with soybean and corn oil at 1: 1 ratio.

Therefore, results obtained so far indicate a protecting response of w-3 in glucose homeostasis and in the distribution of fat mass.

In addition to the results presented above, the intervention with w-3 proved to be able to modify classical cardiometabolic (lipid) and emergent (size lipoprotein subfractions) parameters (Table 1). We also observed a significant reduction of the electronegative fraction of LDL during the intervention.

Table 1 – Effects of w-3 on the lipid profile, sizes of lipoproteic fractions, and generation of LDL(-).

		w-3		
Markers	**T=0S**	**T=4S**	**T=8S**	***p***
TG (mg/dL)	143 (81)	106 (54)*	108 (54)*;	**<0,001**
CT (mg/dL)	204 (37)	186 (39)*	187 (38)*;	**0,002**
LDL (mg/dL)	138 (36)	120 (36)*	124 (36)*	**0,003**
HDL (mg/dL)	38 (11)	45 (11)*	41 (11)	**0,003**
TG/HDL	4,4 (3,5)	2,7 (1,9)*	2,9 (2,1) *	**<0,001**
CT/HDL	5,8 (1,9)	4,4 (1,3)*	4,7 (1,4) *;**	**<0,001**
LDL/HDL	4,0 (1,5)	2,9 (1,1)*	3,2 (1,2) *;**	**<0,001**
CT-HDL (mg/dL)	167 (37)	141 (38)*	146 (37)*	**<0,001**
NEFA(mEq/L)	0,69 (0,32)	0,62 (0,31)	0,63 (0,31)	0,362
APO AI (mmol/L)	131,2(26,1)	137,5 (27,0)	139,0 (28,1)	0,109
APO B (mmol/L)	103,9 (22,3)	110,3 (27,5)	109,7 (25,8)	0,157
HDL-C/APOAI	0,29 (0,07)	0,32 (0,07)*	0,31 (0,06)	**<0,001**
LDL-C/APOB	1,4 (0,3)	1,1 (0,2)*	1,2 (0,3)*	**<0,001**

APOB/APOAI	0,81 (0,22)	0,82 (0,21)	0,82(0,24)	0,861
LDL_{LARGE}(mg/dL)	54,2 (16,6)	53,3 (15,8)	53,3 (16,3)	0,829
LDL_{SMALL} (mg/dL)	5,9 (9,9)	4,8 (5,3)*	6,4 (9,0) **	0,731
Size of LDL (nm)	26,9 (0,6)	27,0 (0,4)	26,9 (0,5)	0,308
Phenotype A (n/%)	20 (26)	21 (27)	26 (34)	0,630
Phenotype B (n/%)	57 (74)	56 (73)	51 (66)	0,828
HDL_{LARGE} (mg/dL)	11,5 (5,5)	15,6 (7,2)*	14,8 (6,7) *	**<0,001**
$HDL_{INTERMEDIATE}$(mg/dL)	18,5 (4,6)	21,2 (4,2)*	19,8 (4,5) *,**	**<0,001**
HDL_{SMALL} (mg/dL)	7,5 (3,3)	8,1 (2,9)	6,9 (2,2) **	**0,011**
LDL(-) (U/L)	6,6 (7,88)	5,0 (6,06)*	5,1 (4,97) *	**<0,001**

Association of the cardiometabolic risk with the parameters of Z-scan

From the samples used in the Cardionutri study, we carried out a cross-sectional analysis to identify possible associations between cardiometabolic markers and parameters obtained in the analysis of Z-scan. In this respect we tested two statistics strategies.

On the basis of the Kmeans method of multivariate groupings, the variables APO.A1_0 , APO.B_0 , cHDL1_T0 , cInt_HDL_T0 , cLDLgran_0 , cLDLpeq_0 , cLg_HDL_T0, cSmall_HDL_T0 , CT0 , ctotal_HDL_T0 , GLI0 , HDL0 , LDL0 , LDL_size_T0 , LDLm_0 , pInt_HDL_T0 , pLDLgrand_0 , pLDLpeq_0 , pLg_HDL_T0 , pSmall_HDL_T0 , TG0 and TG_HDL_0, led to the formation of two groups. These groups, which were called 1 (with less cardiometabolic risk) and 2 (larger cardiometabolic risk), have shown that Z-scan peak measurements are negatively associated with group of larger cardiometabolic risk (group 1 = $8,56 \times 10^4$ and group 2 = $3,8 \times 10^4$, p = 0,021).

The second statistical method used was the Principal Component Analysis (PCA). In this method we included the same 22 variables as before. We then selected 6 components, which were able to explain 85% of the variability of the parameters included in the method (Table 2). Looking at the possible association of these components with the Z-scan, we observed that the component 1 explained 29% of the variability and was negatively associated with the Z-scan (r = -0.34, p = 0.007). In the first component, we noted that the reduction in cHDL1 (31%), int_HDL (32%), lg_HDL (37%), total_HDL (32%) and HDL (35%) (antiatherogenic particles), followed by increasing of the ratio TG_HDL (31%), has led to the characterization of an increased cardiovascular risk, indicating that for a larger component there is a smaller sign of the Z-scan, as pointed out by the negative association between these parameters.

When evaluating component 4, we have seen a reduction of HDL1 (30%) and lg_HDL (30%) GLI (38%) and

TG (28%), followed by an increase in LDLpeq (26%) and LDL size (24%). This component was positively associated with the Z-scan, although a pro or anti-atherogenic profile has not been identified by component (r = 0.29, p = 0.02).

Table 2 – Analysis of the main components of the cardiometabolic variables.

	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5
APO.A1_0	-0.207084627	0.21886472	0.17191470	-0.07911914	0.118444632
APO.B_0	0.072259253	0.39161505	-0.12688656	-0.10527961	-0.204820731
cHDL1_T0	**-0.312081027**	-0.03458009	-0.04518676	**-0.29551855**	-0.002650091
cInt_HDL_T0	**-0.317769725**	0.09850599	0.07610901	0.08568822	-0.101887271
cLDLgran_0	0.020157482	0.13899172	-0.47270007	0.22705723	-0.063562359
cLDLpeq_0	-0.053498028	0.18942080	-0.16135896	**0.26282413**	0.530820247
cLg_HDL_T0	**-0.367084263**	-0.02461393	-0.07574374	-0.18399957	0.058485419
cSmall_HDL_T0	-0.086354054	0.30586802	0.35241774	0.24655193	-0.041195063
CT0	0.011307225	0.40036055	-0.12152409	-0.19742387	-0.158623333
ctotal_HDL_T0	**-0.322260448**	0.20733627	0.07908509	-0.10481537	0.006554933
GLI0	0.064056447	0.06773466	-0.03639117	**-0.37762079**	0.248900105
HDL0	**-0.357998406**	0.12721978	0.10539578	0.01829405	-0.025382926
LDL0	0.013902517	0.34230531	-0.18663442	-0.12735765	-0.241220392
LDL_size_T0	-0.245936347	-0.21060226	0.02125386	**0.24184843**	-0.054297918
LDLm_0	-0.129623444	0.15736137	-0.15005279	0.16015947	-0.270573846
pInt_HDL_T0	0.217848663	-0.13970211	-0.13255953	0.10683502	-0.152821168
pLDLgrand_0	0.005715802	0.10440633	-0.49543809	0.19325004	-0.039472688
pLDLpeq_0	-0.085666344	0.15622496	-0.15376947	0.21658196	0.571689615
pLg_HDL_T0	**-0.259282719**	-0.18267403	-0.25266314	**-0.29575785**	0.092364492
pSmall_HDL_T0	0.129694501	0.28049295	0.34730866	0.24300042	-0.002001639
TG0	0.239218265	0.21749677	0.06594213	**-0.27704555**	0.189774189
TG_HDL_0	**0.313396246**	0.11816730	0.01875736	-0.24598378	0.155778413

This work is in the final phase of analysis and the results show that Z-scan provides a parameter directly connected to the patient risk of developing cardiovascular disease, which is an advantageous replacement of other indicators.

Topic of research: Liquid Crystals

The INCT-FCx develops frontier research in this area since the beginning of its existence. The network of researchers and laboratories has led to significant advances in this area, in particular due to the interactions brought about by the INCT. Some highlights are described in the following paragraphs.

a) Study of the cholesteric-cholesteric phase transition in lyotropic liquid crystals.

We have investigated the lyotropic mixture of potassium laurate (KL)/K_2SO_4/1-undecanol (UnDeOH)/water/brucine (B). The phase diagram, determined by techniques of optical microscopy of polarized light, and measurements of optical birefringence, is shown in Fig. 3. We have identified three cholesteric phases, discotic cholesteric (Ch_D), calamitic cholesteric (Ch_C) and biaxial cholesteric (Ch_B).

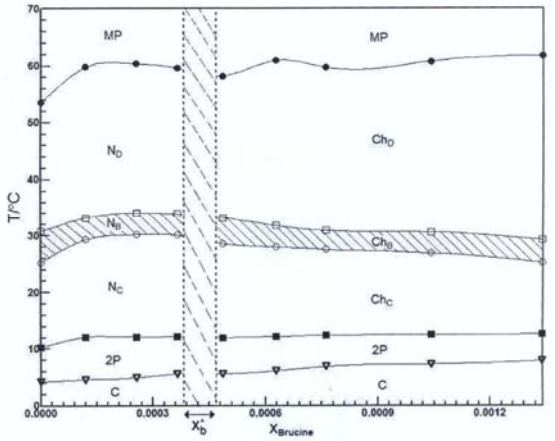


Figure 3: Surface of the phase diagram of the KL/K_2SO_4/UnDeOH/water/B mixture. X represents the molar fraction of BS; 2P, MP e C represent regions of phase coexistence of two and multiple phases, and the crystalline phase.

In this diagram, we have not observed the coexistence between discotic and calamitic cholesteric phases, just the crossover between the discotic and cholesteric biaxial phases. The measurement of the pitch of the micellar cholesteric structure indicated a behavior of the type $P^{-1} \propto X_B$ (Fig. 4).

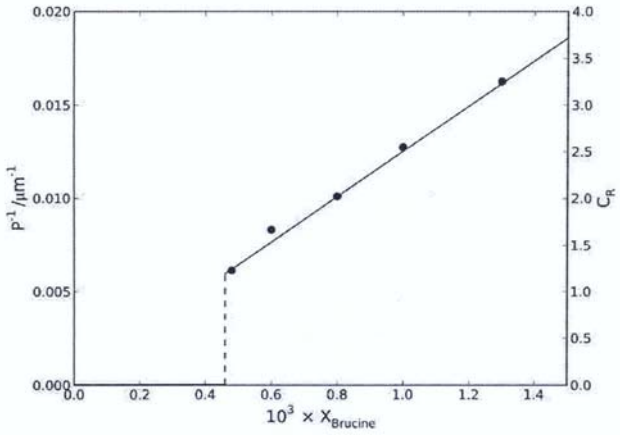


Figure 4: Inverse of the pitch and ratio of the confinement versus the concentration of brucine.

We define the ratio of confinement $\left(C_R = d/P\right)$ as the width of the sample divided by the pitch of the cholesteric structure. We checked that there is a value of C_R above which there appears a cholesteric structure (Fig. 5).

b) Dynamic light scattering in lyotropic liquid crystals

We investigated the rate of damping of the thermal fluctuations of the nematic director in lyotropic discotic nematic samples, with and without the addition of salt. Our experimental arrangement allows taking data with several geometries and polarizations of the laser beam with respect to the nematic director (Fig. 5).

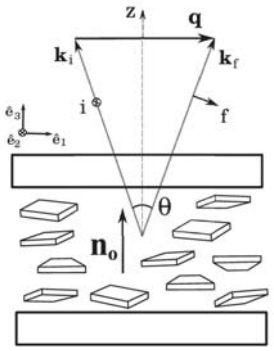


Figure 5 – Geometry of the experiment with DLS, showing the scattering vector $\vec{q}$ and the director $\vec{n}_0$.

We obtained the orientational diffusivities associated with the pure deformations of splay and twist types. In Fig. 6(a), we show typical signals of autocorrelation of splay (polarized) and twist (depolarized), and in Fig. 6(b) we show the corresponding relaxation rates as a function of q^2.

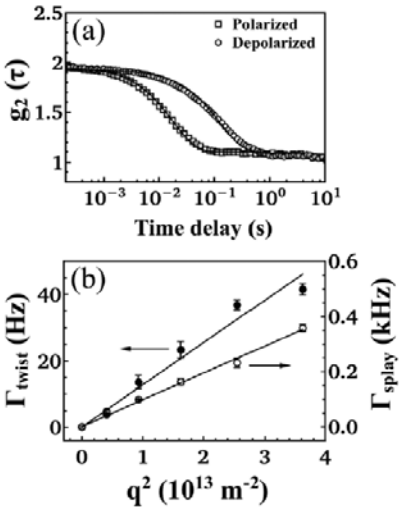


Figure 6 – (a) Typical signals of autocorrelation of splay (polarized) and twist (depolarized), and (b) corresponding relaxation rates as a function of q^2.

c) Study of the phase transitions involving the nematic biaxial phase (N_b) and coexistence of the two nematic uniaxial phases (N_d and N_c) in lyotropic liquid crystals

There has been a continuous collaboration between the groups of UEM and IFUSP, with some Ph. D. programs of students from Maringá. The behavior of the system SDS (sodium dodecyl sulphate) / decanol / water, was investigated with several experimental techniques existent in Maringá: measurements of the refractive indexes, polarized optical microscopy (textures), conoscopy (biaxiality) and digital processing of images, (quantitative analysis of textures). The relevance of this study comes from the fact that SDS is the detergent most used in industry, and also because it has a behavior very different from KL, much studied academically. The understanding of such differences has both academic importance and practical interest. Samples with different molar ratios water / SDS (M_w = 32, 36 and 42), with a fixed molar ratio decanol / SDS (M_d = 0.324) were investigated. The literature had previously defined (NMR studies) sequences of phase transitions with temperature increase, starting at 20ºC:
M_w = 32 – N_d – (coexistence N_d + N_c) – N_c – other phases – isotropic
M_w = 36 – biaxial phase N_b (emerging from solid) - (coexistence N_d + N_c) – N_c – other phases - Isotropic
M_w = 42 - N_c – other phases – Isotropic
Measurements of refractive indexes M_w = 36, seen in figure 7, display an anomalous behavior in the transitions N_b - coexistence (N_d + N_c) – N_c.

In the sequence, conoscopy measurements confirmed existence of a biaxial island, and also the region of coexistence of the two uniaxial phases, with an important detail: the biaxial phase is stable, but in the coexistence region there is spinodal decay along time, and drops of the uniaxial N_d phase grow in a matrix of the uniaxial N_c phase. Further investigation, with a resolution of 0.01°C, was performed, in a sample with M_w = 32, searching for a biaxial phase between N_d and the coexistence region (N_d + N_c). A new biaxial phase was indeed discovered in the range 30.0°C to 32.5 °C. Therefore, the transition N_b -

coexistence (N_d + N_c) is typical of the SDS system. Finally, with the additional technique of digital processing of images it was possible to follow the transition along an intensity curve. Stability of the biaxial phase was again observed, together with spinodal decay in the coexistence region above 32.5 °C. This very reproducible behavior has been explained by changes in the proportions of a mixture of discs and cylinders, according to recent theories proposed by members of INCT from IFUSP.

d) **Study of the rheology of lyotropic liquid crystals**

The group from Paraná State (UEM-Maringá e UEL-Londrina), by means of collaborations with researches from Brasília and São Paulo (IFUSP), has carried out investigations focusing the rheology of lyotropic liquid crystals. The results indicated that the ternary mixture (i.e., without salt) exhibiting the discotic (N_D) nematic phase showed only a slight pseudo-plastic (or shear-thinning) behavior. In contrast, a pronounced pseudo-plastic effect was observed in the N_D phase of the quaternary samples. On the other hand, all the N_C samples (salted or unsalted) showed a quasi-Newtonian behaviour. These studies dealing with rheological properties of lyotropic liquid crystals – materials that belong to one of the main lines of investigation of the INCT – have been facilitated by the financial support and by the favourable scientific atmosphere of the Institute.

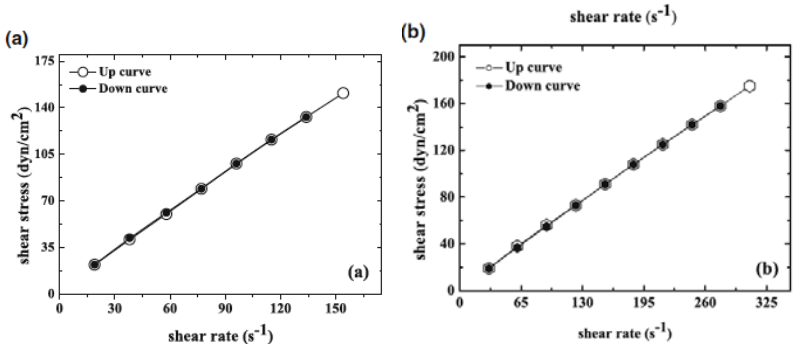


Figure 7: a) Example of a rheogram of the phase N_D for the ternary mixture Nd3, and (b) rheogram of the phase N_C for a quaternary mixture Nc4c.

e) Fundamental properties of thermotropic liquid crystals (with or without addition of nanoparticles)

The group of photo thermal phenomena in complex fluids, from State University of Paraná (UEPG), in Ponta Grossa, Paraná, developed very fruitful scientific collaboration with researchers from other INCTs. The first one, with the INCT-INDI, was dedicated to the preparation of nanoparticles by laser ablation in order to investigate the photo thermal properties of liquid crystals doped with

nanoparticles; the second one, with **INCT-INEO**, with focus on the thermal properties of thermotropic liquid crystals in the nematic-isotropic transition. The financial support from INCT-FCx has been decisive to the construction of the experimental facilities used by the Group. This support, combined with other sources of funding, allowed the acquisition of the equipment necessary to produce and characterize the samples by means of experimental techniques of linear and non-linear optics.

The researchers of INCT based on the Federal University of Alagoas (UFAL), in collaboration with researches from IFUSP and UNIFESP, have investigated several problems involving the heat transport in liquid-crystalline systems and the phenomenon of light emission in conjugated polymers. In the first class of problems, the focus was investigation of the effects of the addition of fullerene on the propagation modes in smectic liquid crystals in the vicinity of the first order nematic - smectic A transition. It was shown that the presence of fullerene leads to an increasing in the thermal conductivity of the samples and changes the behaviour of the thermal conductivity with the temperature. In addition, it was shown that the introduction of fullerene is responsible for a lowering in the nematic - smectic A transition temperature. This behaviour may have some practical consequences on the development of electro-optical devices based on these kinds of liquid-crystalline systems.

The main impact of the support of INCT-FCX in the formation of human resources may be appreciated if one observes that experimental Ph.D. theses and M.Sc. dissertations can now be entirely developed in the physics institute of the University, which was not possible some years ago (before the actions of INCT). Indeed, this was possible because INCT has provided the major part of the financial support necessary to build the laboratories and experimental facilities. As a consequence, the major part of the graduate students of the Group of Anisotropic Liquids and Polymers from the Physics Institute of UFAL, which was created by the members of the INCT, develop experimental works dealing with physicochemical properties of complex fluids.

f) Electric response in liquid crystals and electrolytes (analytical models and computer simulations)

Impedance spectroscopy (IS) investigations have been carried out by the group of University of Maringá (UEM), in collaboration with researchers from other INCTs. These studies led to the proposal of a complete analytical model for the analysis of IS data in confined systems as liquid-crystalline materials and electrolytes in general. This proposal is an extension of the classical model of Poisson-Nersnt-Planck, based on the usual diffusion, for cases involving phenomena of anomalous diffusion.

A comparison between the theoretical predictions with a set of preliminary experimental data (as shown in figure 8) indicate that the formalism can be used to describe, with good agreement, the response of the electric impedance in typical situations of confined samples, as in liquid crystal experiments. In particular, in the low frequency limit, the model correctly predicts that the electric response is truly affected by the choice of the reaction term governing the bulk behavior of the mobile charges, and that

these surface effects may be adequately taken into account by boundary conditions formulated in terms of integral equations as it has been proposed in this work.

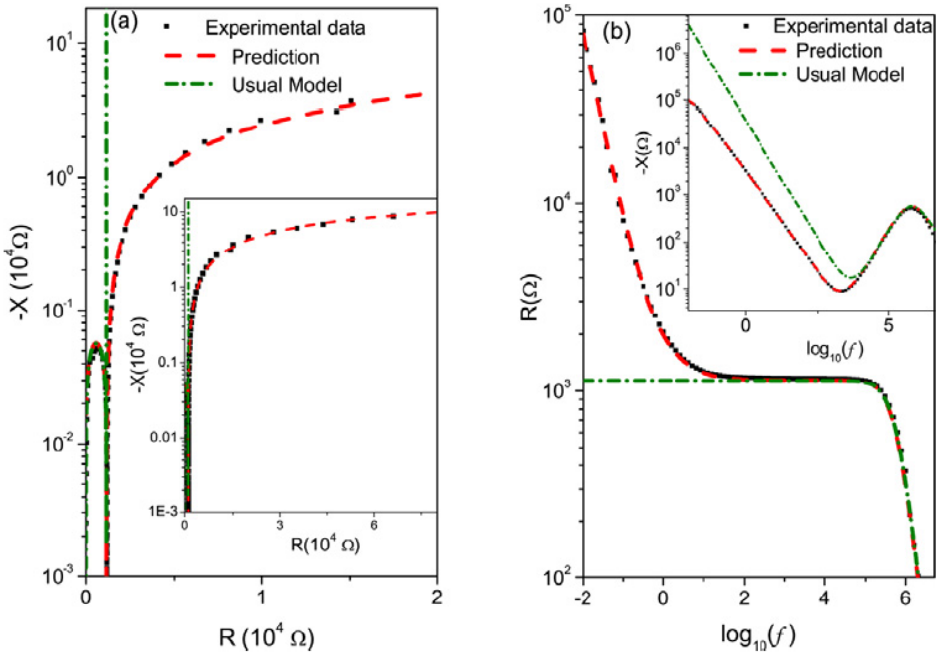


Figure 8: Anomalous effects of surface on the behavior of the electric impedance of an ionic solution of Milli-Q water with a given quantity of $CdCl_2H_2$ 0. The different curves correspond to experimental data, to the usual diffusive model, and to the new model including anomalous diffusion (PNPA).

The investigation of electrolytes has also been the object of interest of other groups in the INCT. The work *Ion specificity and micellization of ionic surfactants: A Monte Carlo study* is a result of a collaboration started in the framework of the INCT involving researchers from Federal University of Santa Catarina (UFSC) and Federal University of Rio Grande do Sul (UFRGS). In the work, they developed a simulation method that allows the calculation of critical micelle concentrations (CMCs) for ionic surfactants in the presence of different salts. These results give rise to the exploration of the process of micellization of ionic surfactants in the presence of various Hofmeister electrolytes (Fig. 9).

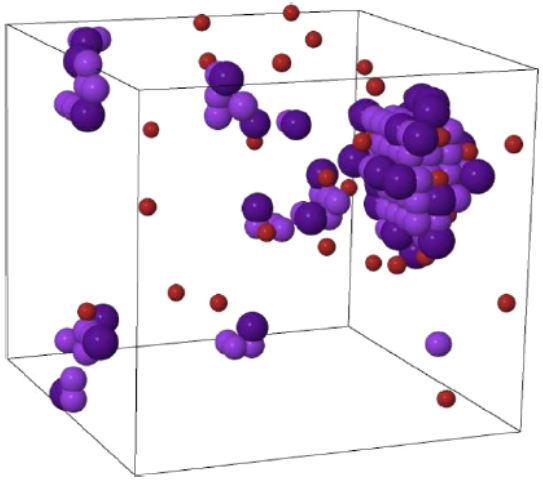


Figure 9 : Snapshot of a typical equilibrium salt-free configuration.

Results from simulations are in good agreement with available experimental data for cationic surfactants.

g) Conceptual advances in the study of complex fluids and their applications

Researchers from the INCT, in the Federal University of Rio Grande do Sul (UFRGS), have proposed a new theoretical treatment in the context of the nonequilibrium statistical mechanics of systems with long-range (LR) interactions. The predictions of this treatment were compared with explicit simulations involving an N-body problem and turned out to be very efficient to determine distributions of position and velocity of self-gravitating clusters, magnetically confined plasmas, and kinetic models of spins, without the need of using adjustable parameters.

In the paper *Principles of thermal design with nematic liquid crystals*, by F. Moraes, from the Federal University of Paraíba, and collaborators, it was published a proposal to build a simple device based on liquid crystal materials, which takes into account an analogy with gravitational models. The idea is that a mechanism of heat concentration and dispersion may be established if we reproduce the topology of a disclination within a hollow cylinder, which may produce a curvature in a conducting line of flux. Results of this work deserved a highlight in *Liquid Crystals Today*, vol. 23, n. 2, p. 47 (2014).

Topic of research: Magnetic colloids

a) Optical and non linear properties of nanoparticles

We used the Z-scan technique with femtosecond pulses in time scale to investigate the nonlinear optical response of magnetic nanoparticles in magnetic colloids (ferrofluids). In Table 3 we give the different

samples of magnetite, with various coatings, the diameters measured by X-ray diffraction and electron microscopy, as well as the size dispersions.

Table 3: Samples used in the study. The first column indicates the coating, the second indicates the diameter measured by X-ray difraction, the third gives the diameter measured by electron microscopy, and the fourth column gives the the width of the log-normal distributions obtained by electron microscopy.

Sample label	D_{XRD} (nm)	D_{TEM} (nm)	σ_{TEM} (nm)
DXS	7.6 ± 0.6	8.2	0.3
DX	8.3 ± 0.7	9.5	0.3
UCA	8.6 ± 0.7	8.5	0.4
Lipid	10.3 ± 0.8	9.6	0.3
CT	10.9 ± 0.9	11.2	0.3
Amine	11.6 ± 0.9	10.2	0.4
Chitosan	15.7 ± 1.3	10.6	0.3
OS	16.1 ± 1.3	10.7	0.3

Typical results of the optical response are presented in Fig. 10, with the normalized transmittance in the geometries with the iris in front of the detector (Fig. 10a) and without the iris (Fig.10b).

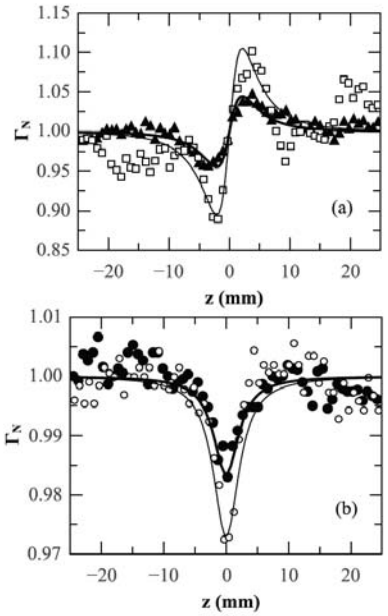


Figura 10 – Normalized transmittance of two samples of nanoparticles as a function of the position z: (a) geometry with the iris; (b) geometry without the iris.

From these measurements we have been able to determine the non-linear refraction index (n_2) and the absorption coefficient of two photons (β). The coatings of the nanoparticles turned out to be irrelevant with respect to the two parameters. In Fig. 11 we show these parameters as a function of the diameter of the nanoparticles.

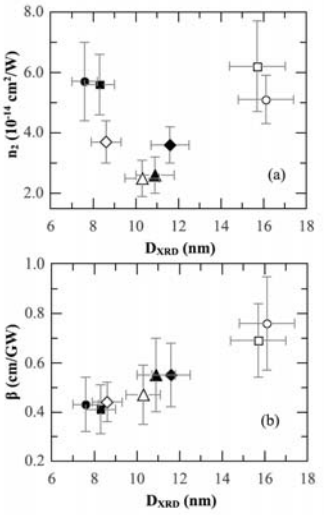


Figure 11 – (a) non-linear refraction index; and (b) two-photon absorption as a function of the diameter of the nanoparticles. Different symbols refer to different coatings of the nanoparticles.

The gaps calculated from the curves of linear absorption as a function of the energy of the incident photon are 3.1 eV (for direct transitions) and 1.9 eV (for indirect transitions). In Fig. 12 we show the structure of bands of Fe in magnetite, and the transitions that are observed in the experiment.

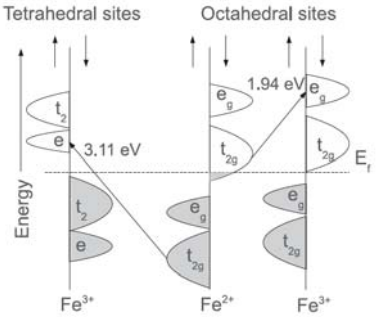


Figure 12 – Structure of bands of the ions of Fe in the magnetite, with the identification of the transitions observed in the experiment.

Results obtained for the absorption of two photons in terms of the diameter of the nanoparticles indicated that there is an increase of β with D_{XRD}. Modifications in the structure of bands of Fig. 12, so that for smaller particles there is a larger difference between the energy of the orbitals t_{2g} and e and e_g, may explain the obtained results.

Topic of research: Membranes

a) Study of the gel - liquid crystal phase transition in the lyotropic biomembrane DMPG

In collaboration with Dr. Francesco Spinozzi, from the Università Politecnica delle Marche, in Ancona, Italy, we developed a model to interpret SAXS results obtained in the LNLS synchrotron, in Campinas, focusing on a DPMG (anionic phospholip) sample, of 150 mM concentration, with anomalous behavior in the temperature range from 20 °C to 35 °C, and with a new Lp lamellar phase with pores. A global fitting of 37 SAXS curves has been made in this region, with an iterative regularization procedure. The model reproduces the momentum transfer region (q), in which there appears a large band due to the structure of the lipid bilayer. Information obtained directly from interfering peaks that occur in the SAXS curve, for smaller values of q, are then used in this model. The proposed membrane model has 4 fractions of surface: flat regions with chains in the ordered (gel) and disordered (fluids, LC) configurations, and two kinds of pores (large and small). Small pores exist in the lamellar phase (above 23 °C) and large pores characterize the intermediate IP phase (between 20 °C and 23 °C, and in a larger temperature range and for concentrations less than 70 mM). The fitting allowed the calculation of the average size of the large pores (140 ± 40) Å in the IP phase, and smaller pores (27 ± 2) Å in the new lamellar phase. The origin of these pores involves theoretical studies in progress. The relevance of this study comes from the fact that biological membranes have a composition with anionic phospholipid chains that are larger than chains in DPMG.

b) Structure of micelles; interaction of phospholipid vesicles with peptides; studies of the activity of enzymes.

Studies of cationic micellar structures with triflate ions indicated that the counter ion controls the properties of the micelles. In addition to the experimental part, this work involved a study by molecular dynamics of the interaction triflate with micelles of N,N,N, trimetildodecyalmmonium.

Vesicles were studied looking at the interaction of a synthetic, antimicrobial peptide, BP100, with negatively charged vesicles. We have shown that the BP100 secondary structure is modified when it interacts with vesicles containing negatively charged phospholipids. We also studied the role of macrophages as a key mediator in renal injury induced by adenine. Another focus of our work was the activity of enzymes, among them the paraoxonase, trying to obtain its purification and expression. Another enzyme that we have studied is the Superoxide dismutase 1. We have shown that that the oxidation of tryptophan 32 of the human superoxide dismutase 1, caused by the peroxidase activity-dependent bicarbonate, triggers a non-amyloid protein aggregation.

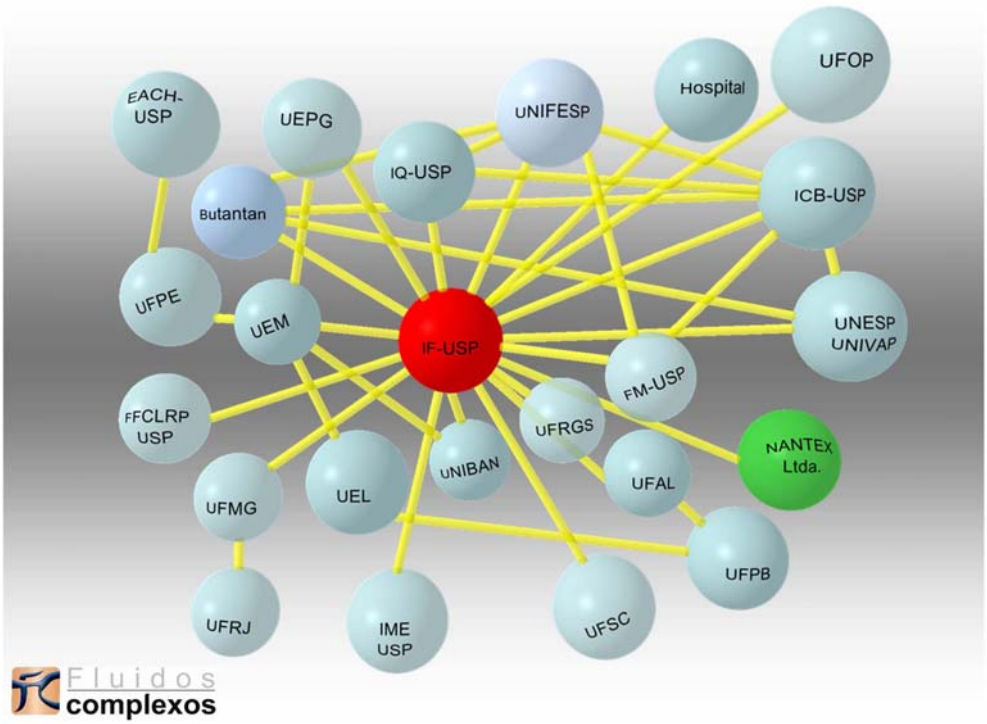
Researches involving the theoretical group of simulations:

We have used quantum calculations and computer simulations with stochastic (Monte Carlo) and dynamic (Molecular Dynamics) methods to model the interactions between molecules of interest and

between the molecules and their embedding environment (solvent, mixtures with ions, liposome, etc). We used these systems to develop, and test, methodologies and a molecular approach to help understanding the experimental measurements of the optical processes of absorption and emission of one photon and of the absorption of two photons. It should be pointed out that the collaboration with experimental groups has already given rise to two important works: (i) the determination of pKa by the spectroscopy titration curve and the description of theoretical methodologies that accurately determine that magnitude; (ii) the use of experimental data and theoretical calculations for proposing a new interpretation of the unusual double fluorescence in biological sensors, PRODAN and LAURDAN, which are used in the identification of phases (gel-fluid) of model membranes.

Matrix of current collaborations

In the following we represent a diagram of connections of collaborations between the various institutions of the INCT-FCx. In red, we represent the main institution, and in green a company that was incorporated in the project in 2010. This matrix is already a few years old.



(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 105)

1. A.P. Dos Santos And Y. Levin, Polarizable Surfaces: Weak And Strong Coupling Regimes, In Electrostatics Of Soft And Disordered Matter (Pan Stanford, 2014).
2. A. Pikovsky, S. Gupta, T. N. Teles, F. P. C. Benetti, R. Pakter, Y. Levin, And S. Ruffo, Ensemble Inequivalence In A Mean-Field Xy Model With Ferromagnetic And Nematic Couplings, Phys. Rev. E 90, 062141 (2014).
3. A.Tufaile ; Freire, M. V. . Some Aspects Of Image Processing Using Foams. Physics Letters. A (Print), V. 378, P. 3111-3117, 2014.
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423. 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 talks at scientific meetings

1. 13th International Conference on Magnetic Fluid. 2013. Antônio Martins Figueiredo Neto
2. 2013 Photonics West SPIE. New lyotropic mixtures presenting the biaxial nematic liquid crystalline phase. 2013. Antônio Martins Figueiredo Neto
3. 3rd International Workshop on Complex Physical Phenomena in Materials.Nonlinear optical properties of magnetic colloids investigated with the z-scan technique. 2014. Antônio Martins Figueiredo Neto.

4. 7th FAPERJ School: The dynamics and assembly of soft structures.Structure and Nonlinear Optical Properties of Complex Fluids: Liquid Crystals, Ferrofluids and Fluids of Biological Interest. 2014. Antônio Martins Figueiredo Neto
5. 9th Ibero-American Workshop on Complex Fluids and 2nd Italian-Brazilian Workshop on Liquid Crystals. Investigation of Electro-Optical Behavior of Grape Seed Oils. 2013. Paulo R.G. Fernandes.
6. 9th Ibero-American Workshop on Complex Fluids and 2nd Italian-Brazilian Workshop on Liquid Crystals. New lyotropic nematic and cholesteric biaxial mesophases. 2013. Antônio Martins Figueiredo Neto
7. Collaborative Conference on Materials Research (CCMR) 2014. Influence of nanoparticle size on the nonlinear optical properties of magnetic ferrofluids. 2014. Antônio Martins Figueiredo Neto
8. Congresso brasileiro de hematologia e hemoterapia. Tratamento do linfoma difuso de grandes células b do idoso. 2013 Juliana Pereira.
9. Encontro Anual de Iniciação Científica. Cristais líquidos, óleos vegetais e óleos essenciais: uma investigação experimental. 2014. Paulo R.G. Fernandes.
10. Encontro Anual de Iniciação Científica. Introdução ao estudo de tópicos de cosmologia e cristais líquidos ano I. 2014. Paulo R.G. Fernandes.
11. I Encontro Nacional do Programa LIFE. 2014. Paulo R.G. Fernandes.
12. I simpósio do ciclo de simpósios sobre saúde pública. 2014. Juliana Pereira.
13. I Simposio Internacional de Cardio-Oncologia Brasil - Estados Unidos. Relacionamento entre oncologistas e cardiologistas - desafios para cardio-oncologia. 2014. Juliana Pereira.
14. I Worshop Norte Paranaense de Fluidos Complexos. 2013. Paulo R.G. Fernandes.
15. Optics of Liquid Crystals (OLC 2013). Cholesterization of Uniaxial and Biaxial Nematic Lyotropic Phases. 2013. Antônio Martins Figueiredo Neto.
16. Simpósio Paulista de Oncologia. Diagnóstico inicial e tratamento do linfoma difuso de grandes células B. 2014. Juliana Pereira.
17. VII Escola de Verão de Fluidos Complexos. Impedância Elétrica de Óleos Essenciais e do Óleo Vegetal de Semente de Uva. 2013. Paulo R.G. Fernandes.
18. X Latin American Workshop on Magnetism and Magnetic Materials and their Applications. Ac susceptibility and dc magnetization of thin film-based Nb/Ni/Nb proximity structures. 2013. Daniel R. Cornejo.
19. XIII Meeting on Recent Advances in Physics of Fluids and its Applications.Nonlinear optical properties of magnetic nano particles. 2014. Antônio Martins Figueiredo Neto.
20. XXXVII Encontro Nacional de Física da Matéria Condensada (ENFMC). Multidisciplinar research on the National Institute of Science and Technology on Complex Fluids: human LDL and HDL. 2014. Antônio Martins Figueiredo Neto.

Participation in scientific meetings

1. 12th European Conference on Liquid Crystals, ECLC-2013, September 22-27, 2013, Rhodes, Greece. Lia Queiroz do Amaral.
2. 12th European Conference on Liquid Crystals. On the possibility of achieving thermal cloaking/concentration in nematics. 2013. Fernando Moraes.
3. 13 Escola de Modelos de Regressão.O critério GAIC e as estratégias de seleção de modelos mistos com distribuição beta. 2013. Viviana Giampaoli.
4. 16th International Biotechnology Symposium & Exhibition- IBS-2014, 2014, Fortaleza.
5. 21o Simpósio Internacional de Iniciação Científica.Behavior of atypical enteropathogenic Escherichia coli (EPECa) in the interaction with macrophages: Study of different serotypes. 2013. Rita de Cássia Ruiz.
6. 21o. Simposio Nacional de Probabilidade e Estatistica. Índice glicêmico e carga glicêmica da dieta de mulheres portadoras de neoplasia mamária sob tratamento quimioterápico. 2014. Elisete C.Q. Aubin.
7. 248th ACS National Meeting. Determination of biochemical parameter in children with leukemia and solid tumors supplemented with selenium by Z-Scan technique. 2014. Sarah Alves.
8. 24th International Symposium on Pharmaceutical and Biomedical Analysis (PBA 2013), Bologna, Italy. Claudete Valduga
9. 24th International Symposium on Pharmaceutical and Biomedical Analysis (PBA 2013), Bologna, Italy. Claudete Valduga.
10. 24th International Symposium on Pharmaceutical and Biomedical Analysis (PBA 2013), Bologna, Italy. Caludete Valduga.
11. 25th International Liquid Crystal Conference. Anomalous behavior in the crossover between the negative and positive biaxial nematic mesophases in a lyotropic liquid crystal. 2014. Antônio Martins Figueiredo Neto e Lia Amaral.
12. 27o Congresso Brasileiro de Microbiologia. Anti-phagocytosis induced by atypical enteropathogenic Escherichia coli(aEPEC): Secretion of the active component in defined media. 2013. Rita de Cássia Ruiz.
13. 28th International Workshop on Statistical Modeling. Nearest Neighbors Prediction Method for mixed logistic regression. 2013. Viviana Giampaoli.
14. 31ª Reunião Anual da SBPqO 03 a 06 de setembro de 2014. Águas de Lindóia - São Paulo
15. 36ª Reunião anual da Sociedade Brasileira de Química, 2013, Águas de Lindóia. cd-36rasbq/resumos, 2013. Claudete Valduga.
16. 3º Simposio Argentino de Nanomedicina. 2013. Claudete Valduga
17. 41th Congress of The international Society of Oncology and Biomarkers and XIV International Symposium on Biology and Clinical Usefullness of TUmor Markers. Expression of genes related to metabolism of selenium supplementation in children with leukemias and solid tumor.. 2014. Sarah Alves.
18. 4th International Advances in Applied Physics & Materials Science Congress & Exhibition. Substrate induced superlattice minibands in graphene. 2014. Fernando Moraes
19. 58th Annual Meeting of the Biophysical Society. Solubilization of giant vesicles composed of erythrocyte lipid extracts and of ternary lipid mixtures by Triton X-100. 2014. Karin do Amaral Riske.
20. 59th World Statistics Congress of the International Statistical Institute. Regression with Autocorrelated Errors Using Design-adapted Haar Wavelets. 2013. Elisete C.Q. Aubin.
21. 6º Encontro USP-Escola.Ferrofluidos em Cristais Líquidos. 2013. Sérgio Leonardo Gomez.
22. 9th European Biophysics Congress. Interaction of the antimicrobial peptide gomesin with model membranes. 2013. Karin do Amaral Riske.
23. 9th Ibero-American Workshop on Complex Fluids and 2nd Italian-Brazilian Workshop on Liquid Crystals. 2013. Sérgio Leonardo Gomez, Lia Amaral e Sarah Alves.

24. 9th Liquid Matter Conference. Ions at hydrophobic interfaces. 2014. Yan Levin.
25. Advances in Nonequilibrium Statistical Mechanics:.Advances in Nonequilibrium Statistical Mechanics. 2014. Yan Levin.
26. Comparison of Smokers' Palatal Wound Healing After Low Laser Application N. C. dos Santos1, M. A. Fonseca1, S. F. Botti-Dias1, I. F. Mathias2, A. B. Jurema1, M. Jardini1, M. P. Santamaria1 UNESP, Sao Jose dos Campos, Sao Paulo, BRAZIL
27. EMBO - Structural and biophysical methods for biological macromolecules in solution (gl. Solubilization of giant vesicles composed of erythrocyte lipid extracts and of ternary lipid mixtures by Triton X-100. 2014. Karin do Amaral Riske.
28. From Soft Matter to Bio-Systems. Electroporation dynamics of charged GUVs: effect of gel encapsulation and salt concentration. 2013. Karin do Amaral Riske.
29. I Enfisul. Nonlinear Optical Properties Of The E7 Thermotropic Liquid Crystal At The N-I Phase Transition. 2013. Sérgio Leonardo Gomez.
30. I Simpósio Iberoamericano de Investigação em Câncer, 2013, Campinas. I Simpósio Iberoamericano de Investigação em Câncer - Anais, 2013.
31. II Workshop Paranaenese de Fluidos Complexs.Enhanced thermal lens effect in gold nanoparticle-doped lyotropic liquid crystal. 2015. Sérgio Leonardo Gomez.
32. III Symposium on Drug Design and Development for Neglected Diseases. 2013. Caludete Valduga
33. INCTFcx and NAPFCx summer school 2014: Structural and biophysical methods for biological macromolecules in solution, 2014, São Paulo. Programa - INCTFcx and NAPFCx summer school 2014, 2014. Claudete Valduga.
34. International Soft Matter Conference 2013. International Soft Matter Conference 2013. 2013. Yan Levin.
35. Optics on Liquid Crystal 2013. Nonlinear Optics of Triton X-100/C10H21OH/H2O Lamellar Liquid Crystal. 2013. Sarah Alves.
36. Quo Vadis, Quantum Physics?. Palestra convidada: Recent developments in Casimir physics. 2013. Paulo Américo Maia Neto.
37. StatPhys25. Ions at Interfaces. 2013. Yan Levin.
38. Treatment of Gingival Recession Associated With Low-level Laser in Smokers. M. Santamaria1, M. A. Fonseca1, S. Fernandes-Dias1, A. C. de Marco1, W. D. Kerbauy1, M. Jardini1 FOSJC-UNESP, São José dos Campos, SP, BRAZIL
39. Uniaxial and biaxial nematic phases in sodium dodecyl sulphate - decanol — D2O mixtures. An optical conoscopy study. O.R.Santos, W.S.Braga, A.J. Palangana and L.Q.Amaral
40. Wetting and Capillarity in Complex Systems. Ions at interfaces: Surface tensions and surface potentials of electrolyte solutions. 2013. Yan Levin.
41. Workshop on Biologycal and Biomimetic Systems. 2013. Claudete Valduga
42. XIII Encontro da SBPMat.Enhancement of the thermal nonlinear optical properties of Au nanoparticles doped lyotropic liquid crystals. 2014. Sérgio Leonardo Gomez.
43. XIII Escola Jorge André Swieca de Ótica Quântica e Não Linear.Interações dispersivas e a ótica quântica. 2014. Paulo Américo Maia Neto.
44. XIX Congresso Brasileiro de Física Médica. Goiânia, 2014. Marina B. Barioni e Amando S. Ito.
45. XIX Congresso Brasileiro de Física Médica. Goiânia, 2014. Wallance M. Pazin, Amando S. Ito.
46. XV Reunião Científica Anual do Instituto Butantan.Behavior of atypical enteropathogenic Escherichia coli (aEPEC) from different serotypes in the interaction with macrophages. 2013. Rita de Cássia Ruiz.
47. XVII Congresso Paulista de Nefrologia. Aplicabilidade de células-tronco para doenças renais. 2013. Niels Câmara.

48. XXIII International Materials Research Congress. Probing the Casimir force with optical tweezers. 2014. Paulo Américo Maia Neto.
49. XXIX Annul Meeting of SBPZ XL Annual Meeting on Basic Research in Chagas' Disease. São Paulo: SBPz, 2013. v. 1. p. 90-90.
50. XXVI Encontro Nacional de Física da Matéria Condensada.Stabilization of lamellar phases-the role of steric interactions. 2013. Elisabeth Andreoli de Oliveira
51. XXXVII Encontro Nacional de Física da Matéria Condensada, Costa do Sauípe, Brasil, 2014. Amando S. Ito
52. XXXVII Encontro Nacional de Física da Matéria Condensada, Costa do Sauípe, Brasil, 2014. Marina B. Barioni, Amando S. Ito, Ivan Haralampiev, Thomas Korte, Andreas Herrmann.
53. XXXVII Encontro Nacional de Física da Matéria Condensada, Costa do Sauípe, Brasil, 2014. Wallance Moreira Pazin, Marina B. Barioni e Amando S. Ito. Strctural and dynamic properties of lipid emulsions containing miltefosine.
54. XXXVIII Congress of the Brazilian Society of Immunology and 11st World Congress on Inflammation. 2013. Niels Câmara.

Training of personnel (work already completed)

Post-doctors

1. Alexandre Pereira dos Santos. 2013. Universidade Federal de Santa Catarina, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Wagner Figueiredo.
2. Andrea Cecília Dorion Rodas. 2013. Universidade Federal de São Paulo. Niels Olsen Saraiva Câmara.
3. Andréa M. Monteiro. Início: 2010. Instituto de Física da USP. Supervidor: Antônio Martins Figueiredo Neto.
4. Andrea Moro Caricilli. 2014. Universidade de São Paulo, Fundação de Amparo à Pesquisa do Estado de São Paulo. Niels Olsen Saraiva Câmara.
5. Bruno Marcos. 2014. Universidade Federal do Rio Grande do Sul, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Yan Levin.
6. Cíntia C. Vequi-Suplicy. 2013. Universidade de São Paulo, Fundação de Amparo à Pesquisa do Estado de São Paulo. Kaline Rabelo Coutinho.
7. Claudio Ccapa Ttira. 2014. Universidade Federal do Rio de Janeiro, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Paulo Americo Maia Neto.
8. Daniel Luiz da Silva. 2013. Universidade de São Paulo, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Sylvio Roberto Accioly Canuto.
9. Debora Tavares. 2014. Universidade de São Paulo, Fundação de Amparo à Pesquisa do Estado de São Paulo. Niels Olsen Saraiva Câmara.
10. Evanildo Gomes Lacerda Júnior. 2014. Universidade de São Paulo, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Kaline Rabelo Coutinho.
11. Felipe Alves Morais. 2014. Faculdade de Medicina da Universidade de São Paulo, Financiadora de Estudos e Projetos. Sergio Paulo Bydlowski.
12. Joel da Cunha. 2014. Faculdade de Medicina da Universidade de São Paulo, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Sergio Paulo Bydlowski.
13. Marcia Martins Szortika. 2013. Universidade Federal de Santa Catarina, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Wagner Figueiredo.
14. Matheus Correa Costa. 2014. Instituto de Ciências Biomédicas (USP), Fundação de Amparo à Pesquisa do Estado de São Paulo. Niels Olsen Saraiva Câmara.

15. Milton Rocha Moraes. 2014. Universidade de São Paulo, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Niels Olsen Saraiva Câmara.
16. Welbert Pereira. 2014. Universidade de São Paulo, . Niels Olsen Saraiva Câmara.

Doctors

1. Alejandra Andrea Tapia Silva. Influência local em modelos lineares generalizadps mistos com variável resposta discreta. 2014. Tese (Doutorado em Doutorado em Estatística) - Instituto de Matemática e Estatística-USP. Orientador: Viviana Giampaoli.
2. Alze Pereira dos Santos Tavares. Impacto de modificações de LDL nos desfechos da doença renal crônica em pacientes em tratamento conservador. 2015. Universidade Federal de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
3. Andressa Antonini Bertolazzo. Anomalias Dinâmicas e Termodinâmicas em um Modelo Puramente Repulsivo de Gás de Rede. 2014. Tese (Doutorado em Física) - Universidade Federal do Rio Grande do Sul. Orientador: Marcia Cristina Bernardes Barbosa.
4. Antonio Rodrigues da Cunha. Estudos Teórico e Experimental de Propriedades Estruturais e Eletrônicas da Molécula Emodina em Solvente e em Bicamada Lipídica. 2014. Tese (Doutorado em Física) - Universidade de São Paulo. Orientador: Kaline Rabelo Coutinho.
5. Bertúlio de Lima Bernardo. Uma visão moderna de alguns conceitos da teoria quântica. 2013. Tese (Doutorado em Fisica) - Universidade Federal da Paraíba. Orientador: Fernando Jorge Sampaio Moraes.
6. Cassiano Donizetti De Oliveira. Estudos dos mecanismos renoprotetores das células-tronco derivadas do tecido adiposo em modelos experimentais de doença renal crônica. 2014. Universidade Federal de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
7. Clarice Silvia Taemi Origassa. Modulação da transição endotélio mesenquimal pela heme oxigenase 1: relevância para o estudo da progressão da doença renal. 2013. Universidade Federal de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
8. Danilo Candido de Almeida. Mecanismos de reparo tecidual e celular induzidos por células-tronco mesenquimais e por microvesículas derivadas de células-tronco mesenquimais em modelos de lesão renal aguda. 2013. Universidade Federal de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
9. Evanildo Gomes Lacerda Júnior. Estudos Teóricos de Misturas Álcool-Água e Seus Efeitos em Propriedades Eletrônicas em um Derivado de Quinolina. 2013. Tese (Doutorado em doutorado em física IFUSP) - Universidade de São Paulo. Orientador: Kaline Rabelo Coutinho.
10. Fabiana Rodrigues Arantes. Sistemas de nanopartículas magnéticas: estudos experimentais e simulações Monte Carlo. 2014. Instituto de Física da Universidade de São Paulo. Orientador: Daniel Reinaldo Cornejo.
11. Flávio Tocci Moreira. Efeitos de dois tratamentos hipolipemiantes na resposta imune em pacientes com hipercolesterolemia. 2014. Tese (Doutorado em Medicina (Cardiologia)) - Universidade Federal de São Paulo. Coorientador: Maria Cristina de Oliveira Izar.

12. Freddy Hernadez Barajas. Modelos multiníveis Weibull com efeitos aleatórios. 2013. Tese (Doutorado em Doutorado em Estatística) - Instituto de Matemática e Estatística-USP. Orientador: Viviana Giampaoli.
13. Henrique Andrade Rodrigues da Fonseca. Resposta humoral à LDL oxidada e ao peptídeo APOB-D como biomarcador na doença hipertensiva. 2013. Tese (Doutorado em Medicina (Cardiologia)) - Universidade Federal de São Paulo. Orientador: Maria Cristina de Oliveira Izar.
14. Jonas Romero Fonseca de Lima. Propriedades eletrônicas da matéria topológica. 2014. Tese (Doutorado em Fisica) - Universidade Federal da Paraíba. Orientador: Fernando Jorge Sampaio Moraes.
15. José Rafael Bordin. Estudos computacionais sobre a dinâmica e 1455 estruturação de fluidos complexos confinados em nanoporos. 2013. Tese (Doutorado em Programa de Pós Graduação em Física) - Universidade Federal do Rio Grande do Sul. Orientador: Marcia Cristina Bernardes Barbosa.
16. Lidiane Maria Omena da Silva. Efeitos da adição de fulereno nas propriedades térmicas, ópticas e eletrônicas de cristais líquidos esméticos. 2014. Tese (Doutorado em Física da Matéria Condensada) - Universidade Federal de Alagoas. Orientador: Italo Marcos Nunes de Oliveira.
17. Lucas Modesto Costa. Um tratamento Multiescala (QM/MM) das Propriedades Espectroscópicas da Tetraciclina e seus Complexos com Mg e Eu em àgua. 2014. Tese (Doutorado em fisica) - Instituto de Física da USP. Orientador: Sylvio Roberto Accioly Canuto.
18. Marcelo Hidalgo Cardenuto. Propriedades Eletrônicas de Átomos e Moléculas em Fluidos Supercríticos. 2013. Tese (Doutorado em fisica) - Instituto de Física da USP. Orientador: Sylvio Roberto Accioly Canuto.
19. Marcus Vinicius Araujo Damasceno. Efeitos de Solventes em Espectros de Absorção Eletrônica da Merocianina e Derivados. 2015. Tese (Doutorado em Física) - Universidade de São Paulo. Orientador: Kaline Rabelo Coutinho.
20. Marina Berardi Barioni. Propriedades estruturais de membranas modelo em interação com o composto anti-Leishmania miltefosina. Doutorado em Física Aplicada a Medicina e Biologia - FFCLRP. Orientador: Amando Ito.
21. Marta Natividade Crizol Martins. Estudos comparativos do mecanismo de ação de peptídeos antimicrobianos. 2013. Universidade Federal de São Paulo. Coorientador: Karin do Amaral Riske.
22. Matheus Correa Costa. Envolvimento da heme oxigenase 1 nos mecanismos celulares de resposta ao estresse em um modelo de lesao renal aguda. 2013. Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
23. Natalia Mastantuono Nascimento. Fator de von Willebrand, ligação com fator VIII e estudo da atividade da ADAMTS-13 em pacientes com síndrome antifosfolípide primária. 2014. Tese (Doutorado em Ciências Médicas) - Universidade de São Paulo. Orientador: Sergio Paulo Bydlowski.
24. Olga Cecilia Usuga Manco. Modelos de regressão beta com efeitos aleatórios normais e não normais para dados longitudinais. 2013. Tese (Doutorado em Doutorado em Estatística) - Instituto de Matemática e Estatística-USP. Orientador: Viviana Giampaoli.

25. Priscila Ribeiro dos Santos. Características ópticas não lineares de lipoproteínas humanas. 2013. Instituto de Física da USP. Orientador: Antônio Martins Figueiredo Neto.
26. Sara Maria Moreira Lima-Verde. Papel da obesidade nos marcadores de oxidação e adipocitocinas em mulheres com cancerde mama: estudo caso controle. 2014. Tese (Doutorado em Saude Publica em Nutrição) - Faculdade de Saúde Pública. Orientador: Nágila Raquel Teixeira Damasceno.
27. Tabata de Mello Tera. Imunolocalização dos marcadores de angiogênese e reabsorção óssea em regeneração óssea guiada em ratos com diabetes mellitus induzida.. 2013. Tese (Doutorado em Programa de Pós-Graduação em Biopatologia Bucal) - Faculdade de Odontologia do Campus de São José dos Campos – UNESP. Orientador: Maria Aparecida Neves Jardini.
28. Tárcio Teodoro Braga. Papel das moleculas TLR2, TLR4, MyD8 e do inflamassoma NLPR3 na fibrose renal. 2014. Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
29. Tatiana Moreira Domingues. Estudos de síntese, conformação e atividade biológica da gomesina e análogos através de diferentes metodologias. 2013. Universidade Federal de São Paulo. Coorientador: Karin do Amaral Riske.
30. Vinicius de Andrade Oliveira. Ácidos graxos de cadeia curta, produtos do metabolismo da microbiota intestinal, protegem da lesão renal aguda. 2014. Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
31. Vinicius Mariani Lenart. Estudo das propriedades ópticas e de transporte térmico de ouro coloidal em cristais líquidos liotrópicos. 2015. Universidade Estadual de Ponta Grossa. Orientador: Sergio Leonardo Gómez.

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. 2013. Dissertação (Mestrado em Nutrição em Saúde Pública) - Universidade de São Paulo. Orientador: Nágila Raquel Teixeira Damasceno.
2. Alexander Hideki Oniwa Wada. Simulações numéricas da percolação dinâmica. 2015. Dissertação (Mestrado em Fisica) - Instituto de Física da Universidade de São Paulo. Orientador: Mário Jose de Oliveira.
3. Alexandre Penteado Furlan. Comportamento de um modelo para a água em sistemas porosos. 2013. Dissertação (Mestrado em Física) - Universidade Federal do Rio Grande do Sul. Orientador: Marcia Cristina Bernardes Barbosa.
4. Ana Carolina Bazan de Carvalho. Expressão de resistência a múltiplas drogas em células mesenquimais do cordão umbilical humano. 2013. Dissertação (Mestrado em Ciências Médicas) - Universidade de São Paulo. Orientador: Sergio Paulo Bydlowski.
5. Ana Paula Zerbeto. Melhor preditor empírico aplicado aos modelos beta mistos. 2014. Dissertação (Mestrado em Estatística) - Instituto de Matemática e Estatística-USP. Orientador: Viviana Giampaoli.

6. André Luiz Sehnem. Investigação da influência do tamanho de partículas na termodifusão de colóides positivamente carregados. 2014. Instituto de Física da USP. Orientador: Antônio Martins Figueiredo Neto.
7. André Luiz Siqueira da Silva. Pesquisa de células-tronco tumorais em pacientes com linfoma não-Hodgkin. 2014. Dissertação (Mestrado em Ciências Médicas) - Universidade de São Paulo. Orientador: Sergio Paulo Bydlowski.
8. Andresa Forte. Expansão ex vivo das células-tronco hematopoiéticas do sangue do cordão umblilical: análise comparativa da proliferação celular em cocultura de células-tronco mesequimais provenientes do endotélio vascular do cordão umbilical e do tecido adiposo. 2014. Dissertação (Mestrado em Ciências Médicas) - Universidade de São Paulo. Orientador: Sergio Paulo Bydlowski.
9. Antonio Augusto Ferreira Carioca. Influencia do indice w-3 sobre a oxidabilidade da LDL, inflamação e a composição corporal em mulheres com CA de mama. 2014. Dissertação (Mestrado em Nutrição em Saúde Pública) - Faculdade de Saúde Pública. Orientador: Nágila Raquel Teixeira Damasceno.
10. Carolina Garcia de Macedo. Estudo das paraoxonases 1,2 e 3 em pacientes portadores de anemia falciforme. 2013. Dissertação (Mestrado em Ciências Médicas) - Universidade de São Paulo. Orientador: Sergio Paulo Bydlowski.
11. Cristina Gavazzoni. Anomalias Dinâmicas e Termodinâmicas em um Modelo de Dímeros. 2013. Dissertação (Mestrado em Programa de Pós-Graduacão em Física) - Instituto de Fisica da Universidade Federal do Rio Grande do Sul. Orientador: Marcia Cristina Bernardes Barbosa.
12. Daniela Melo Tegani. Contribuição de Variantes do Gene NPC1L1 na Farmacogenômica e Nutrigenômica de Estratégias Hipolipemiantes. 2014. Dissertação (Mestrado em Ciências) - Universidade Federal de São Paulo. Orientador: Maria Cristina de Oliveira Izar.
13. Delvis Bertrand Jorge de Barros. Condensação de Bose-Einstein em Cadeias com Acoplamentos de Longo-Alcance. 2014. Dissertação (Mestrado em Física da Matéria Condensada) - Universidade Federal de Alagoas. Orientador: Marcelo Leite Lyra.
14. Dennys Reis. Efeito do comprimento da cadeia do alcóol nas transições de fase colestérica-colestérica em cristais líquidos liotrópicos. 2013. Instituto de Física da USP. Orientador: Antônio Martins Figueiredo Neto.
15. Felipe Azevedo Gomes. Dinâmica quântica de uma partícula livre na superfície de um cone duplo. 2014. Dissertação (Mestrado em Física) - Universidade Federal da Paraíba. Orientador: Fernando Jorge Sampaio Moraes.
16. Felipe Grabarz. Papel das celulas NKT e dos macrófagos M2 na lesao pulmonar crônica. 2014. Dissertação (Mestrado em Imunologia Básica e Aplicada) - Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
17. Flávia De Conti Cartolano. Efeito do ômega 3 sobre a composição corporal, controle glicêmico e escore de risco de Framingham em indivíduos adultos. 2014. Dissertação (Mestrado em Nutrição em Saúde Pública) - Centro de Apoio à Faculdade de Saúde Pública da Universidade de São Paulo. Orientador: Nágila Raquel Teixeira Damasceno.
18. Flávia Dias Xavier. Padrão de Expressão e significado prognóstico dos Genes BCL2, BCL6, CCND2, FN1, LMO2 E SCYA3 pela técnica de PCR em tempo real em linfoma difuso de

grandes células B tratados com Rituximabe. 2013. Tese (Doutorado em Ciências Médicas) - Faculdade de Medicina da Universidade de São Paulo. Orientador: Juliana Pereira.

19. Gerson de Carli Proença de Almeida Pessotto. Propriedades magnéticas de filmes nanoestruturados de FeRh e FeRh/Fe. 2014. Orientador: Daniel Reinaldo Cornejo.
20. Isabela Moreira Silva. Aspectos biofísicos da interação do peptídeo antimicrobiano Esculentina 1B (1-18), Esc 1B (1-18), com modelos de membranas. 2014. Universidade Federal de São Paulo. Coorientador: Karin do Amaral Riske.
21. Isabela Moreira Silva. Interação do peptídeo antimicrobiano esculentina 1B (1-18) com modelos miméticos de membrana. 2014. Universidade Federal de São Paulo. Orientador: Katia Regina Perez.
22. Julio Eloisio Brandão da Silva. Níveis de Landau-Coriolis. 2013. Dissertação (Mestrado em Física) - Universidade Federal da Paraíba. Orientador: Fernando Jorge Sampaio Moraes.
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. 2014. Dissertação (Mestrado em Nutrição em Saúde Pública) - Universidade de São Paulo. Orientador: Nágila Raquel Teixeira Damasceno.
24. Lívia Campos do Amaral de Oliveira Lins. Níveis de células progenitoras endoteliais e micropartículas circulantes em pacientes de alto risco recebendo tratamento hipolipemiante. 2014. Universidade Federal de São Paulo. Orientador: Maria Cristina de Oliveira Izar.
25. Marcelo Salvador. Distribuição de Barreiras de Energia de Nanopartículas Magnéticas em Campo Externo. 2014. Dissertação (Mestrado em Física) - Universidade Federal de Santa Catarina. Orientador: Wagner Figueiredo.
26. Marcio de Moura Cunha. Influência de campo magnético e rotação em nanotubos de carbono. 2013. Universidade Federal da Paraíba. Orientador: Fernando Jorge Sampaio Moraes.
27. Marlene Audin Nuñez. Efeito do ômega-3 sobre biomarcadores cardiometabólicos clássicos e emergentes de indivíduos com alto risco cardiovascular. 2014. Dissertação (Mestrado em Nutrição Humana Aplicada) - Universidade de São Paulo. Orientador: Nágila Raquel Teixeira Damasceno.
28. Matheus Girotto. Vortices and Yukawa particles in a confining potential. 2014. Dissertação (Mestrado em Física) - Universidade Federal do Rio Grande do Sul. Orientador: Yan Levin.
29. Patricia de Azevedo Lima. Oxidação e tamanho de particulas de lipoproteínas em crianças com epilepsia refrataria. 2014. Dissertação (Mestrado em PRONUT) - Faculdade de Ciências Farmacêuticas. Orientador: Nágila Raquel Teixeira Damasceno.
30. Patrick dos Santos Simonário. Método pseudomolecular para a obtenção das constantes elásticas para um potencial de modelo de rede.. 2014. Dissertação (Mestrado em Física) - Universidade Estadual de Maringá. Orientador: Luiz Roberto Evangelista.
31. Pedro Juvencio de Souza Júnior. Propriedades de ópticas não-lineares de cristais líquidos dopados com azocorantes nas proximidades da transição nemática-esmética-A de priimeira ordem. 2013. Dissertação (Mestrado em Física da Matéria Condensada) - Universidade Federal de Alagoas. Orientador: Italo Marcos Nunes de Oliveira.
32. Priscilla Barbosa Costa. Papel do IFNg na ativação das células-tronco mesenquimais: análise em um modelo de lesão renal aguda. 2014. Universidade Federal de São Paulo. Orientador: Niels Olsen Saraiva Câmara.

33. Sandria Carla Randall de Sá. Papel dos receptores Toll-like na diabetes induzida pele estreptozotocina. 2013. Dissertação (Mestrado em Imunologia) - Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
34. Simone Pinto de Melo Barbosa. Como o tratamento hipolipemiante modifica a expressáo e níveis da proteína c reativa e possiveis implicações clínicas. 2013. Dissertação (Mestrado em Ciências) - Universidade Federal de São Paulo. Orientador: Maria Cristina de Oliveira Izar.
35. Thiago Marques de Andrade. Dispositivo eletro-óptico utilizando fase nemática. 2013. Dissertação (Mestrado em Curso de Mestrado Em Física) - Universidade Estadual de Maringá. Orientador: Antonio José Palangana.
36. Thiago Petrucci. Medidas de Impedância Elétrica em Água Milli-Q e Difusão Anômala. 2013. Dissertação (Mestrado em Física) - Universidade Estadual de Maringá, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Coorientador: Paulo Ricardo Garcia Fernandes.
37. Valéria Arruda Machado. Efeitos da suplementação de fitosteróis à terapia hipolipemiante na hipercolesterolemia familiar. 2014. Dissertação (Mestrado em Medicina (Cardiologia)) - Universidade Federal de São Paulo. Orientador: Maria Cristina de Oliveira Izar.
38. Vinícius Wilian Dias Cruzeiro. Estudos Teóricos do Espectro de Absorção de Porfirinas e Ftalocianinas. 2014. Dissertação (Mestrado em Física) - Universidade de São Paulo. Orientador: Kaline Rabelo Coutinho.

Undergraduate students

1. Andre Bertonha de Toledo. Estudo de fases nemáticas liotrópicas em função da concentração de DPH. Início: 2011. Iniciação científica (Graduando em Física) - Universidade Estadual de Maringá. Orientador: Antônio J. Palangana.
2. Arlino Camargo Liverio Jr. Projeto: “Dinâmica de orbitais moleculares usando ferrofluido sob a ação de campo magnético variável”. 2013-2014. Escola de Artes, Ciências e Humanidades - Universidade de São Paulo. Orientadora: Adriana Pedrosa Biscaia Tufaile.
3. Camila Lopes Ferreira. Comparação de dois métodos de profilaxia dental: avaliação da pressão arterial e do conforto do paciente. Ensaio clínico e randomizado. 2013. Iniciação Científica. (Graduando em Odontologia São José dos Campos) - Universidade Estadual Paulista. Orientador: Maria Aparecida Neves Jardini.
4. Caroline de Oliveira Gallo. Avaliação do consumo de ácidos graxos em indivíduos adultos. 2013. Iniciação Científica. (Graduando em Nutrição) - Faculdade de Saúde Pública. Orientador: Nágila Raquel Teixeira Damasceno.
5. Daniella Vicensotto Bernardo. Expressão da osteocalcina no reparo de enxertos ósseos autógenos onlay recobertos ou não por membrana colágena reabsorvível em ratos diabéticos.. 2013. Iniciação Científica. (Graduando em Odontologia São José dos Campos) - Universidade Estadual Paulista. Orientador: Maria Aparecida Neves Jardini.
6. Danilo Martini Rosolia. Eletroporação de vesículas lipídicas gigantes negativamente carregadas em presença de detergentes. 2014. Iniciação Científica. (Graduando em Ciências Biológicas) - Universidade Federal de São Paulo. Orientador: Karin do Amaral Riske.

7. Denis Goncalves Silva. Papel do tecido adiposo e da ho-1 na modulação da resposta inflamatória: estudo num modelo experimental de psoríase. 2014. Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
8. Denise Roberta Neiva Sonego. Estudo de peroxidação lipidica em crianças portadoras de tumores sólidos e leucemia através da ótica não linear. 2013. Iniciação Científica. (Graduando em Química) - Universidade Federal de São Paulo - Campus Diadema. Orientador: Sarah Isabel Pinto Monteiro do Nascimento Alves.
9. Denner Serafim Vieira. Cristais líquidos, Óleos vegetais e Óleos essenciais: Uma Investigação Experimental. 2013. Iniciação Científica. (Graduando em Abi - Física) - Universidade Estadual de Maringá. Orientador: Paulo Ricardo Garcia Fernandes.
10. Elisa Yumi Royama da Silva. Avaliação do índice e da carga glicêmica da dieta de mulheres com câncer de mama sob tratamento quimioterápico. 2013. Iniciação Científica. (Graduando em Nutrição) - Faculdade de Saúde Pública. Orientador: Nágila Raquel Teixeira Damasceno.
11. Gabriel Antonio F. Siqueira. Introdução ao Estudo de Tópicos de Cosmologia e Cristais Líquidos ? Ano I. 2013. Iniciação Científica. (Graduando em Física) - Universidade Estadual de Maringá. Orientador: Hatsumi Mukai.
12. Guilherme Bottura. Papel do PARF na lesao renal induzida pela sepse. 2014. Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
13. Guilherme Bottura. Papel do PARF na lesao renal induzida pela sepse. 2014. Iniciação Científica. (Graduando em Imunologia) - Universidade de São Paulo. Orientador: Niels Olsen Saraiva Câmara.
14. Karina Amancio Fudimura. Estudo de Termodifusão de Fluidos Magnéticos pela Técnica de Z-Scan. 2013. Iniciação Científica. (Graduando em Química) - Universidade Federal de São Paulo - Campus Diadema. Orientador: Sarah Isabel Pinto Monteiro do Nascimento Alves.
15. Kelly Lidiane Santos de Barros. Fricção Quântica. 2013. Iniciação Científica. (Graduando em Física) - Universidade Federal do Rio de Janeiro. Orientador: Paulo Americo Maia Neto.
16. Luciana da Mata Mônaco. Atividade antioxidante de própolis de abelhas brasileiras.. 2013. Iniciação Científica. Faculdade de Filosofia Ciências e Letras de Ribeirão Preto USP. Orientador: Amando Siuiti Ito.
17. Michely Patricia Rosseto. Estudos Introdutórios de Teoria Elástica Contínua de Fluidos Complexos. 2013. Iniciação Científica. (Graduando em Física) - Universidade Estadual de Maringá. Orientador: Luiz Roberto Evangelista.
18. Patricia Vieira Guimarães. Cristais Liquidos, Óleos Vegetais e Óleos Essenciais: Uma Investigação Experimental - Co-orientação. 2014. Iniciação Científica. (Graduando em Física) - Universidade Estadual de Maringá. Orientador: Hatsumi Mukai.
19. Rafaela Gesing. Estudos e Aplicações da Dinâmica Molecular. 2013. Iniciação Científica. (Graduando em Física) - Universidade Federal de Santa Catarina. Orientador: Wagner Figueiredo.
20. Yasmin Brandão. Necessidade de tratamento periodontal em pacientes diabéticos e não diabeticos. Caso controle. 2014. Iniciação Científica. (Graduando em Odontologia) - Faculdade de Odontologia do Campus de São José dos Campos - UNESP. Orientador: Maria Aparecida Neves Jardini.

Training of personnel (work in progress)

Doctors

1. Alexander Hideki Oniwa Wada. Simulações de modelos para percolação dinâmica. Início: 2015. Tese (Doutorado em Fisica) - Instituto de Física da Universidade de São Paulo. Orientador: Mário José de Oliveira.
2. Alexandre Penteado Furlan. Estudo de Sistemas em Matriz Confinante. Início: 2013. Tese (Doutorado em Pós-Graduação em Física da UFRGS) - Instituto de Fisica da Universidade Federal do Rio Grande do Sul. Orientador: Márcia C. Barbosa.
3. Alexsander 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. Orientador: Antônio Martins Figueiredo Neto.
4. Aline Ignacio Silvestre da Silva. Influência da microbiota intestinal residente sob a ativação de subpopulações de células dendríticas no modelo de colite ulcerativa aguda experimental. Início: 2014. Instituto de Ciências Biomédicas USP. Orientador: Niels Câmara
5. Ana Carolina Bassi Stern. RNAi anti MDR em linfomas. Início: 2011. Tese (Doutorado em Ciências Médicas) - Universidade de São Paulo. Orientador: Sérgio Paulo Bydlowski.
6. Ana Paula Alves. Vasculogênese no embrião de galinha. Início: 2010. Tese (Doutorado em Física) - Universidade Federal de Minas Gerais, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Orientador: Ubirajara A. Batista.
7. Ana Paula Perdigão Praxedes. Propriedades ópicas e termodinâmicas de filmes poliméricos biocompatíveis. Início: 2011. Tese (Doutorado em Física da Matéria Condensada) - Universidade Federal de Alagoas. Orientador: Italo M.N. Oliveira.
8. Ana Paula Zerbeto. Predição em Modelos Mistos. Início: 2014. Tese (Doutorado em Doutorado em Estatística) - Instituto de Matemática e Estatística-USP. Orientador: Viviana Giampaoli.
9. Anderson Alves de Lima. Efeito Hall quântico, defeitos topológicos e rotação. Início: 2013. Universidade Federal da Paraíba. Orientador: Fernando Moraes.
10. André Luiz Sehnem. Termodifusão em colóides magnéticos: influência da temperatura e do campo magnético. Início: 2014. Instituto de Física da USP. Orientador: Antônio Martins Figueiredo Neto.
11. Bárbara Bianca Gerbelli. O papel de mecanismos entrópicos na formação de complexos lamelares de lipídios não catiônicos e DNA. Início: 2013. Universidade de São Paulo. Orientador: Elisabeth Andreoli de Oliveira.
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. Tese (Doutorado em Biologia Celular) - Universidade Federal de Minas Gerais. Coorientador: Ubirajara A. Batista.
13. Bruno Mattei. Solubilização de membranas modelo de diferentes composições pelo detergente Triton X-100. Início: 2013. Tese (Doutorado em Ciências Biológicas (Biologia Molecular)) - Universidade Federal de São Paulo. Orientador: Karin do Amaral Riske.

14. Carlos Eduardo Bistafa da Silva. Dinamica do estado excitado de bases nitrogenadas em meios solventes. Início: 2011. Tese (Doutorado em fisica) - Instituto de Física da USP. Orientador: Sylvio Canuto.
15. Carlos Gentil Oro Lemos. Relações Termodinâmicas em Processos Fora do Equilibrio. Início: 2014. Tese (Doutorado em Curso de Pós-Graduação em Física - UFSC) - Universidade Federal de Santa Catarina. Orientador: Wagner Figueiredo.
16. Caroline Papianni. Papel dos acidos graxos omega 3, 6 e 9 sobre o risco cardiometabólico de indivíduos adultos. Início: 2013. Tese (Doutorado em Saude Publica em Nutrição) - Faculdade de Saúde Pública. Orientador: Nágila R. Damasceno.
17. 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. Orientador: Cristiano L.P. Oliveira.
18. 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. Orientador: Antônio Martins Figueiredo Neto.
19. Cleusa Pavan. O Acesso Aberto à informação científica e a publicação de artigos e de revistas científicas: em questão o financiamento público no Brasil. Início: 2014. Tese (Doutorado em Programa de Pós-Graduação em Educação em Ciências) - Universidade Federal do Rio Grande do Sul. Orientador: Márcia C. Barbosa.
20. Cristiane Naffah de Souza. Sinalização via mTOR em neutrófilos em modelo experimental de inflamação associada à obesidade. Início: 2014. Instituto de Ciências Biomédicas (USP). Orientador: Niels Câmara.
21. Cristiano Santos Lopes. Caracterização por Z-scan das propriedades fototérmicas de nanofluidos. Início: 2013. Universidade Estadual de Ponta Grossa. Orientador: Ségio Leonardo Gomez.
22. Cristina Gavazzoni. Fases sólidas em dímeros. Início: 2013. Tese (Doutorado em Pós-Graduação em Física da UFRGS) - Instituto de Fisica da Universidade Federal do Rio Grande do Sul. Orientador: Márcia C. Barbosa.
23. Daniel Humberto Garcia Espinosa. Propriedades ópticas não-lineares de fluidos complexos na escala de tempo de femtosegundos. Início: 2011. Instituto de Física da USP. Orientador: Antônio Martins Figueiredo Neto.
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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. Yan Levin.
2. Antonio Rodrigues da Cunha. Início: 2015. Universidade de São Paulo, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Supervisor: Kaline Coutinho.
3. Clarice Silvia Taemi Origassa. Início: 2013. Instituto de Ciências Biomédicas (USP). Supervisor: Niels Olsen Saraiva Câmara.
4. Diney Ether. Início: 2013. Universidade Federal do Rio de Janeiro, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Supervisor: Paulo Américo Maia Neto.
5. Eduardo Roberto de Lascio. Início: 2012. Instituto de Física da Universidade de São Paulo, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Supervisor: Daniel R. Cornejo.

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13. Karin Ayumi Tamura. Início: 2014. Instituto de Matemática e Estatística-USP. Supervisora: Viviana Giampaoli.
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20. Paula Andreia Jaramillo Garcia. Início: 2013. Instituto de Física da USP. Supervisor: Sylvio Canuto.
21. Paula Fernanda Bienzobas. Início: 2012. Instituto de Fisica da USP, Fundação de Amparo à Pesquisa do Estado de São Paulo. Supervisor: Mário José de Oliveira.
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23. Raùl Fuentes. Início: 2015. Instituto de Física - UFRGS, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Supervisor: Márcia C. Barbosa.
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Masters

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Given interviews about his work, media appearances, etc.

International scientific dissemination video

1* Parhelic-like Circle from light scattering in Plateau borders
https://youtu.be/twCcierkyp4

2* The Parlaseric Circle, Halos, Laser Pillars and Laser Dogs.
https://youtu.be/Q34IMPHOydg

(INCT-FCx) Annex II
Teaching, dissemination and extension activities

EMBO Global Exchange Lecture Course on Structural and Biophysical Methods for Biological Macromolecules in Solution
2014 / São Paulo – Brazil
Organized by CT-FCx and NAP-FCx

Chairman: Prof. Dr. Cristiano Luis Pinto de Oliveira

Local Institution: Instituto de Física, Universidade de São Paulo

1. Summary of the activities during the School

In this report we describe the activities at a summer school that was held at the Institute of Physics of the University of São Paulo, in São Paulo. This school was organized by Professors L. P. Cristiano Oliveira and Antonio Martins Figueiredo Neto, from the Institute of Physics of the University of São Paulo in partnership with Dr. Dmitri Svergun and his group, from the European Molecular Biology Laboratory (EMBL) in Hamburg, Germany. As it is detailed below, the focus of this school was the presentation of methods for structural characterization of biological macromolecules in solution. The same proposal of courses is already in use by Dr. Svergun group at EMBL, in Hamburg, as well as in several other countries. Internationally renowned researchers in the various topics covered in the school taught classes and fully attended the event, which led to an intense interaction with students. The school had the participation of 49 students at M.Sc., Ph.D., and post-doctoral levels, and 10 senior participants, who were faculty members and researchers at university and research institutions. The official language of the course was English. Students were encouraged to bring biological samples to collect small angle X ray scattering (SAXS) data during the course. Altogether, 23 samples were subjected to experiments in the SAXS equipment available at IFUSP, allowing the collection of a great amount of data. Satisfaction indicators collected through anonymous questionnaires indicated the response and impressions of the participants.

2. Announcemente of the School

The School was announced by several means, at the national and international levels. The School had a website, http://events.embo.org/14-macromolecule/, which was designed and kept by the *European Molecular Biology Organization* (EMBO). The poster of the School, which can be retrieved at the site, is reproduced in **Erro! Fonte de referência não encontrada.**:

Figure 1 – Poster of the announcement of the School.

3. Program of the school

The schedule of the School, given to the participants, together with the list of participant and email addresses is shown in the following.

VIII ESCOLA DE VERÃO
INCT DE FLUIDOS COMPLEXOS
IFUSP – 19 - 26 JANUARY 2014

Structural and biophysical methods for biological macromolecules in solution

PROGRAM

Transfer from the hotel Howard Johnson to USP: 08:00 in front of the hotel
Transfer from USP to the hotel Howard Johnson: 18:30 (Lecturers)
(in front of Students Restaurant) 19:30 (Students)

The students shall have lunch and dinner at the students Restaurant of the Institute of Physics.
Tickets will be distributed at the event site.

Sunday 19 January 2014

Basics of SAXS and SANS
09:00 - 09:30: Introduction - D. Svergun, C.Oliveira
09:30 - 10:30: Lecture 1: Basics of X-ray scattering by solutions - D.Svergun
10:30 - 11:00: Coffee Break
11:00 - 12:00: Lecture 2: SAXS in Brazil - Selected applications - I. Torriani
12:00 - 13:00: Lecture 3: Neutron scattering - J.Trewhella
13:00 - 14:00: Lunch
14:00 - 15:30: Visit of the USP facilities (IFUSP - IQUSP)
15:30 - 16:00: Coffee Break
16:00 - 17:00: Lecture 4: Biological research at USP - C.Oliveira
17:00 - 19:00: Poster session
19:00 : Welcome dinner (sandwiches and beverages at IFUSP)

Monday 20 January 2014

SAXS/SANS data analysis
09:00 - 09:45: Lecture 5: SAXS and SANS facilities and experimental practice - C. Blanchet
09:45 - 10:30: Live Demonstration: Remote Data Collection at SAXS beamline P12,Hamburg, Germany - C. Blanchet, D. Franke
10:30 - 11:00: Lecture 6: SAXS/SANS data processing and overall parameters - D. Franke
11:00 - 11:30: Coffee Break
11:30 - 13:00: Lecture 7: Ab initio methods: how do they work - D. Svergun
13:00 - 14:00: Lunch
14:00 - 15:30: Lecture 8: Atomic structure based modelling - M. Petoukhov
15:30 - 16:00: Coffee Break
16:00 - 18:00: Tutorial 1: Hands-on practical on SAXS/SANS data analysis - M.Petoukhov, D.Franke
18:00 : Dinner

Tuesday 21 January 2014

Biophysical techniques, multidisciplinary approaches part I
09:00 - 10:00: Lecture 9: Sample preparation and characterization - M.Vanoni
10:00 - 11:00: Lecture 10: Static and dynamic light scattering - L.Arleth
11:00 - 11:30: Coffee Break
11:30 - 13:00: Lecture 11: Calorimetry: ITC and DSC - P. Westh
13:00 - 14:00: Lunch
14:00 - 15:30: Lecture 12: Analytical ultracentrifugation - O. Byron
15:30 - 16:00: Coffee Break
16:00 - 18:00: Tutorial 2: Practical SAXS measurements and SAXS Quest
18:00 : Dinner

Wednesday 22 January 2014

Biomolecular NMR
09:00 -11:00 : Lecture 13: Introduction to basic NMR - A. Bonvin
11:00 -11:30 : Coffee Break
11:30 -13:00: Lecture 14: Spectral Assignment and Structure Calculation - L. Banci
13:00 -14:00 : Lunch
14:00 -15:30 : Lecture 15: Recent Advances in Biomolecular NMR (part 1)- R. Salinas
15:30 -16:00 : Coffee Break
16:00 -17:00 : Lecture 16: Recent Advances in Biomolecular NMR (part 2)- L. Banci
17:00 -18:00 : Tutorial 3: WeNMR project and demonstration - A. Bonvin
18:00 : Dinner

Thursday 23 January 2014

Practical session and excursion

09:00 - 11:00: Tutorial 4: Practical SAXS measurements and SAXS Quest
11:00 - 11:30: Coffee Break
11:30 - 13:00: Tutorial 5: Practical SAXS measurements and SAXS Quest
13:00 - 14:00: Lunch
14:00 : Free time: Sao Paulo Tour (Transfer from USP to the hotel Howard Johnson)

Friday 24 January 2014

Biophysical techniques, multidisciplinary approaches part II

09:00 - 11:00: Lecture 17: NMR, docking and bioinformatics - A.Bonvin
11:00 - 11:30: Coffee Break
11:30 - 13:00: Lecture 18: Combination of scattering and biophysical methods - O. Byron
13:00 - 14:00: Lunch
14:00 - 15:30: Lecture 19: Spectroscopic methods - M.Vanoni
15:30 - 16:00: Coffee Break
16:00 - 17:00: Lecture 20: Joint use of SAXS and SANS - J.Trewhella
18:00 : Dinner

Saturday 25 January 2014

Mixtures, processes, interactions

09:00 - 10:00: Lecture 21: Time-resolved X-ray and neutron scattering - C. Blanchet
10:00 - 11:00: Lecture 22: Membrane proteins - L.Arleth
11:00 - 11:30: Coffee Break
11:30 - 13:00: Lecture 23: Protein hydration - P. Westh
13:00 - 14:00: Lunch
14:00 - 15:30: Lecture 24: Mixtures, assemblies, flexible systems - M. Petoukhov
15:30 - 16:00: Coffee Break
16:00 - 18:00: Tutorial: Hands-on practical on mixtures - D. Franke, M.Petoukhov
19:30 : Course Dinner at Churrascaria Rincão Gaúcho (Transfer from USP to the Restaurant and from the Restaurant to the hotel Howard Johnson)

Sunday 26 January 2014

Workshop

09:00 - 09:40: Questions and Answers session
09:40 - 10:00: Selected student presentation #1 - Cassio Alves
10:00 - 10:40: Danillo Bittar - Bruker solutions for SAXS and WAXS - The New N8 Horizon
10:40 - 11:10: Coffee Break
11:10 - 11:30: Selected student presentation #2 - Everton Barbosa
11:30 - 12:10: Sergio Rodrigues - SAXS studies of protein solutions using high brilliance clean beam and low background camera
12:10 - 12:30: Selected student presentation #3 - Ivani Pauli
12:30 - 13:30: Lunch
13:30 - 13:50: Selected student presentation #4 - Guilherme de Oliveira
13:50 - 14:30: Mateus Cardoso - SAXS at LNLS: UVX and Sirius
15:10 : Concluding Session
(Transfer from USP to the hotel Howard Johnson)

Local Contacts:

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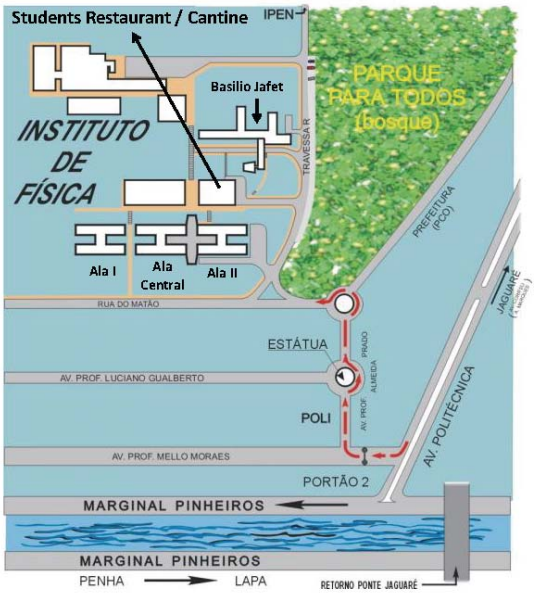
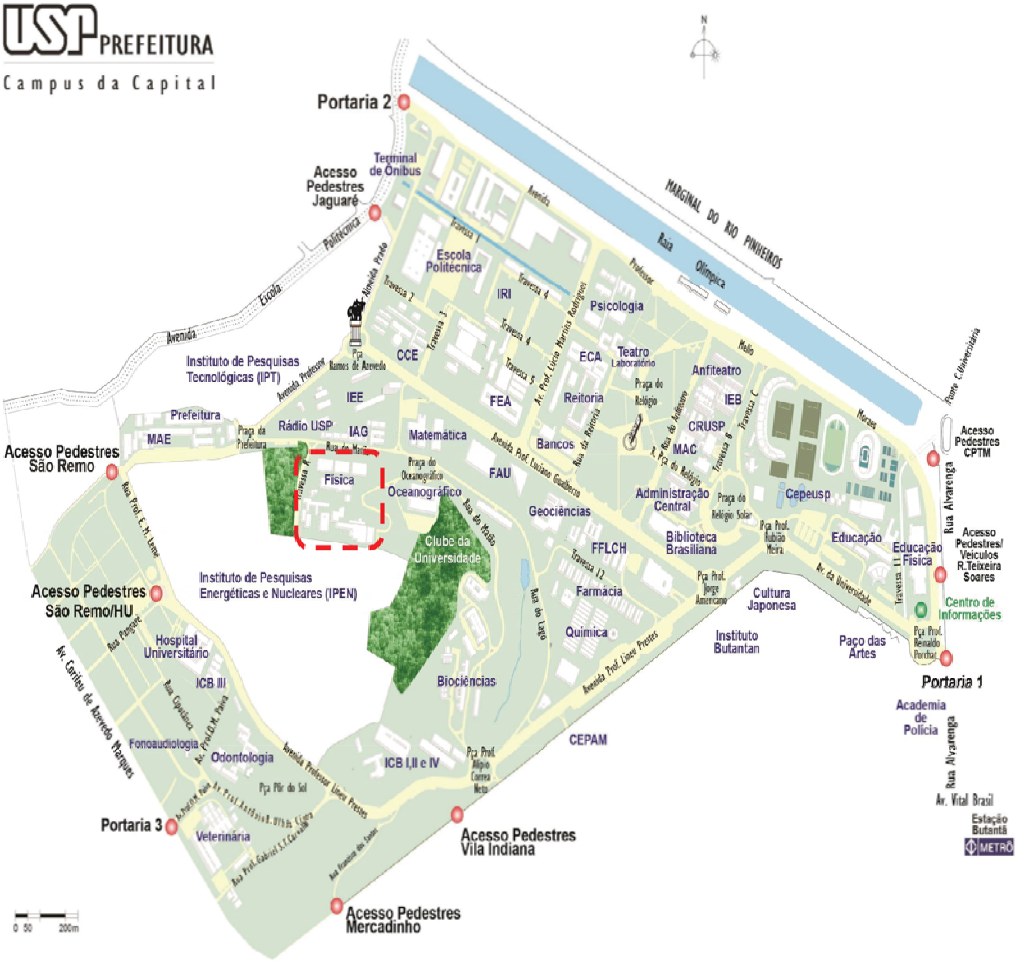
EVENT SITE – Institute of Physics

Lectures /Tutorials:	Auditório Norte (Ala central)
Posters:	Room 204, Ala 2
Stands / Coffee Brakes:	Room 206, Ala 2
SAXS Instruments:	Basilio Jafet room 116 / Lab. Crystallography





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48	Wael Awad	wael.awad@biochemistry.lu.se
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12	Maxim Petoukhov	m.petoukhov@embl-hamburg.de
13	Olwyn Byron	Olwyn.Byron@glasgow.ac.uk
14	Peter Westh	pwesth@ruc.dk
15	Roberto Salinas	rsalinas@usp.br

4. Application for the School and selection of participants

It was possible to use the website to enter an application to attend the School. We had a total of 120 applicants from several countries. Participants were selected on the basis of well-defined selection criteria, according to an original proposal presented to FAPESP. The students were charged a fee of 50 Euros (150 Reais) in order to avoid "no shows" and to help funding the School. There were 49 selected students. We covered housing expenses of the students from outside of São Paulo. All students were able to eat free meals at the University Restaurant at the Institute of Physics. Ten senior researchers were able to participate by paying the same fees of 150 Reais, but without additional support.

5. List of speakers and participants of the School

The full list of participants and speakers is given in the following tables. The students were asked to present their research results in the poster sections. We also show the titles of the presented works. Some of the senior participants were also asked to present their research work.

Table 1 – List of participants of the School, with institutions and email addresses

	Nome	Instituição	e-mail
1	Alexandre M.J.J. Bonvin	Professor at Faculty of Science, Utrecht University, the Netherlands	a.m.j.j.bonvin@chem.uu.nl
2	Clement Blanchet	Staff Scientist (Svergun Group) at EMBL-Hamburg	c.blanchet@embl-hamburg.de
3	Cristiano L. P. Oliveira	Professor at Institute of Physics, University of São Paulo	crislpo@if.usp.br
4	Daniel Franke	Senior Computational Scientist at EMBL Hamburg	d.franke@embl-hamburg.de
5	Dmitri Svergun	Group Leader and Senior Scientist at EMBL-Hamburg	svergun@embl-hamburg.de
6	Fabiano Yokaichiya	Researcher - IPEN	fabiano.yokaichiya@gmail.com
7	Iris Torriani	Professor at Institute of Physics, University of Campinas, Brazil	torriani@ifi.unicamp.br
8	Jill Trewhella	Professor at University of Sydney	jill.trewhella@sydney.edu.au
9	Lise Arleth	Professor at Faculty of Life Sciences, University of Copenhagen	mvp640@ku.dk
10	Lucia Banci	Professor at Centro Risonanze Magnetiche, University of Florence	banci@cerm.unifi.it
11	Maria Vanoni	Professor at Department of Biomolecular Sciences and Biotechnology, University of Milano, Italy	maria.vanoni@unimi.it
12	Maxim Petoukhov	Staff Scientist (Svergun Group) at EMBL-Hamburg	m.petoukhov@embl-hamburg.de
13	Olwyn Byron	Professor at College of Medical, Veterinary and Life Sciences, Glasgow University	Olwyn.Byron@glasgow.ac.uk
14	Peter Westh	Professor at Research Unit for Functional Biomaterials, Roskilde University, Denmark	pwesth@ruc.dk
15	Roberto Salinas	Professor at Institute of Chemistry, University of São Paulo, Brazil	rsalinas@usp.br

Table 2 – List of students that were selected to participate in the School, with institutions and email addresses

	Nome	Instituição	e-mail	Titulo do Pôster apresentado
1	Adam Campos-Acevedo	Biotechnology Institute, UNAM	adam@ibt.unam.mx	Crystallographic and biochemical studies evidencing the dimeric formation in solution of thioredoxin 1 from white leg shrimp Litopenaeus vannamei.
2	Aline Sampaio Pinto	Brazilian National Laboratory of Biosciences(LNBio)	linsampaio@gmail.com	Structural and biophysical investigations of the Putrescine ATP-Binding Cassete transporter from Xanthomonas axonopodis pv. citri
3	Ana Paula Alves	UFMG	anafisic@gmail.com	Vasculogenesis Study using Fractal Analysis in Chicken Embryo.

4	André Luis Sehnem	Instituto de Física da USP	alsehnem@if.usp.br	Influence of the particle size and ion concentration in ferrofluid thermodiffusion.
5	Angela Maria Fala	National Bioscience Laboratory	angela.fala@lnbio.cnpem.br	Heterologous expression and purification of the hypoxia-induced factor HIF-1 human aiming structural and biochemical studies
6	Ariel Mechaly	Instituto Pasteur de Montevideo	aemechaly@pasteur.edu.uy	Gaining insights into the Escherichia coli Cpx signaling system through a hybrid structural biology approach
7	Ashish Gupta	Louisiana State University	agupt11@tigers.lsu.edu	Structural insights into the transcriptional regulator MftR from Burkholderia thailandensis, which participates in oxidative stress responses
8	Barbara Bianca Gerbelli	Instituto de Física da USP	barbarabgerbelli@gmail.com	Steric-induced effects on stabilizing a lamellar structure
9	Bruna Campos Ramos	LNBio - National Laboratory of Biosciences	bruna.campos@lnbio.cnpem.br	A Redox 2-Cys Mechanism Regulates the Catalytic Activity of Divergent Cyclophilins
10	Bruno Mattei	UNIFESP	b-mattei@hotmail.com	Solubilization of membranes of different compositions by Triton X-100
11	Cassio Alves	UNIVERSITY OF SAO PAULO	alves.cassio@gmail.com	Modeling atomisticof DNA Nanocages and SAX simulation
12	Celso Luiz Sigoli Risi	Instituto de Física-IFUSP	celsorisi@usp.br	Dynamic light scattering in lyotropic liquid crystals
13	Daniel Espinosa	Instituto de Física da USP	espinosa@if.usp.br	Nonlinear optical properties of magnetite ferrofluids and their dependence on the particle's size
14	Danilo Olivier	Departamento de Física - Faculdade de Filosofia Ciências e Letras de Ribeirão Preto - USP	doliviercg@gmail.com	Interaction of fusion peptide with model membrane
15	Denize Favaro	Chemistry Institute/University of Sao Paulo	favarodenize@gmail.com	
16	Dennys Reis	Instituto de Física da USP	dreis@if.usp.br	Effect of Alkyl Chain Length of Alcohols on the Cholesteric to Cholesteric Phase Transitions in Lyotropic Liquid Crystals
17	Diana Estevez	FSP/USP	dgestevez@gmail.com	
18	Diorge Souza	University of Sao Paulo	diorge@iq.usp.br	Structural and functional characterization of a peptidoglycan hydrolase inhibitor associated with the Xanthomonas Type IV Secretion System
19	Eduardo Gonçalves	Instituto de Física da USP	eduardo.sell.goncalves@usp.br	Nonlinear optical properties of ferrofluids: Nanoparticle's size effects
20	Emerson Rodrigo da Silva	UFABC - Universidade Federal do ABC	ersilva@ufabc.edu.br	
21	Éverton Barbosa	Universidade Federal de Viçosa	verton.tecladista@gmail.com	Solution structural studies of the splicing regulator kinase SRPK2 (Serine/Arginine-rich Protein-specific Kinase 2).
22	Gabriel Oka	Universidade de São Paulo (USP) - Instituto de Quimica (IQ)	gabriel.oka@usp.br	Structural and interaction studies between protein domains of the Xanthomonas Type IV Secretion System
23	Guilherme A. P. de Oliveira	Federal University of Rio de Janeiro	mrguiba@superig.com.br	Intramolecular Dynamics within the N-Cap-SH3-SH2 Regulatory Unit of the c-Abl Tyrosine Kinase Reveal Targeting to the Cellular Membrane
24	Gustavo	UFRJ	ventura@biof.ufrj.br	pH acidification promotes structural

	Ventura			changes that stimulate DNA binding and enzymatic activities of the HCV NS3 helicase
25	Hugo Serrano-Posada	Faculty of Chemistry-UNAM	hugojavier81@hotmail.com	Glycine betaine biosynthesis in plants: Structural and kinetic studies of choline monooxygenase from Spinacia oleracea.
26	Ignacio Fernandez	Fundación Instituto Leloir	ifernandez@leloir.org.ar	Understanding a redox-activated two component system from Brucella abortus using a biophysical approach
27	Igor Ferreira	Brazilian Biosciences National Laboratory	igormonteze@gmail.com	Structure and enzymatic kinect of the enzyme liver-type glutaminase (LGA/GLS2)
28	Ivani Pauli	Instituto de Física da USP	ivanipauli@gmail.com	Discovery of new cruzain inhibitors with non-competitive mechanism using in silico and in vitro medicinal chemistry strategies
29	Jose Wilson Carvalho	Instituto de Química de São Carlos, Universidade de São Paulo	jwilsonfamilia@gmail.com	NaCl effect on the thermal stability of extracellular hemoglobin of Rhinodrilus alatus (HbRa) monitored by small angle X-ray scattering (SAXS)
30	Juliana Fattori	Brazilian Biosciences National Laboratory (LNBio/CNPEM)	juliana.fattori@lnbio.cnpem.br	Nuclear receptors interactions with coregulators, ligands and DNA
31	Laureana Stelmastchuk	USP	laure.stelmastchuk@gmail.com	Identification of Mn/FeSODs structural determinants necessary to metal specificity
32	Luis Daniel Rueda Raez	Universidad Peruana Cayetano Heredia	ldrueda.raez@gmail.com	Homo-multimeric complexes of nicotinamidase/pyrazinamidase in Mycobacterium tuberculosis
33	Luís Fernando Saraiva Macedo Timmers	Pontifícia Universidade Católica do Rio Grande do Sul	luisfernandosaraiva@gmail.com	Novel Inhibitors of the Mycobacterium tuberculosis InhA Enzyme.
34	Marcelo Rodrigues	Institute of Zoology, University of Innsbruck	marcelo.rodrigues@uibk.ac.at	Bioadhesion of a freshwater polyp
35	Pedro Leonidas Oseliero Filho	Instituto de Física da USP	pedroleonidasoseliero@hotmail.com	Development of a methodology for the structural and thermodynamic studies of micelles systems
36	Rafael Borges	IBB/UNESP	rjborges@ibb.unesp.br	Structural Studies of BthTX-I complexed with the inhibitor 12-Methoxy-4-methylvoachalotine from Tabernaemontana catharinensis
37	Rafael Caceres	Pontifícia Universidade Católica do Rio Grande do Sul - PUCRS	caceres.bioinformatics@gmail.com	Structural studies and design of new selective inhibitors of purine nucleoside phosphorylase (EC 2.4.2.1) from Mycobacterium tuberculosis
38	Rafael Leite Rubim	Instituto de Física da USP	rubim@if.usp.br	Effects of ethoxylated fatty acids on structure and interactions between lipid bilayers
39	Renata Bicev	Instituto de Física da USP	renatabicev@gmail.com	20S Proteasome: Structural Study
40	Sun Yang	Instituto de Física da USP	sunyang@if.usp.br	Development of a methodology for the structural and thermodynamic studies of micelles systems
41	Tatiana M. Domingues	UNIFESP	tmdomingues@unifesp.br	The Binding of the Antimicrobial Peptide Gomesin to Large Unilamellar Vesicles
42	Tatiana Prieto	UFABC - Universidade Federal do ABC	tati_prieto@yahoo.com.br	Peroxidase Activity of Cytoglobin: an EPR Study
43	Tatiane P. Sudbrack	UNIFESP	tati.sud@gmail.com	Interaction of mimetic peptides of the motif of the Falcipain-2 with Hemoglobin
44	Vanessa C. Rescia	UNIBAN/ANHANGUERA EDUCACIONAL	vanessarescia@uol.com.br	A new and soft method for extraction of (1,3)-Bet-D-Glucan from

				saccharomyces cerevisiae
45	Vitor Hugo Serrão	IFSC/USP	vitor.serrao@usp.br	The macromolecular complex in Selenocysteine pathway from Escherichia coli.
46	Viviam Moura	UFABC - Universidade Federal do ABC	vivianms89@gmail.com	Modular hyperthermostable bacterial endo-β-1,4-mannanase: molecular shape, flexibility and new structural insights
47	Viviane de Paula	Universidade Federal do Rio de Janeiro	vpaula@cnrmn.bioqmed.ufrj.br	Structural Basis of CCR2 Sulfotyrosine Recognition by the human beta-defensin 6
48	Wael Awad	Biochemistry & structural biology department, Lund University	wael.awad@biochemistry.lu.se	Structural Study of N-glycosylated Human Glypican-1 Core Protein
49	Wallance Pazin	FFCLRP-USP	wallancepazin@usp.br	Effects of miltefosine interactions with nanoemulsions: na advanced fluorescence study

Table 3 – List of the senior participants of the School, with the institution and contact email

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4	Gisele Amorim	Federal University of Rio de Janeiro	gamorim@cnrmn.bioqmed.ufrj.br	
5	Jorge Lulek	Universidade Estadual de Ponta Grossa	iulek@uepg.br	Structure of an Odorant-Binding Protein from the Mosquito Aedes aegypti Suggests a Binding Pocket Covered by a pH-Sensitive ''Lid''
6	Karin A. Riske	UNIFESP	kariske@unifesp.br	
7	Katia Regina Perez	Department of Biophysics/EPM/UNIFESP	kdaghastanli@unifesp.br	
8	Roberto Morato Fernandez	Instituto de Biociências - UNESP/Botucatu	rmorato@ibb.unesp.br	
9	Viviane Paula Martini	Federal Institute of Paraná	viviane.martini@ifpr.edu.br	Structure of Geobacillus stearothermophilus 6-Phosphogluconate Dehydrogenase Complexed with 6-Phosphogluconate
10	Mario de Oliveira Neto	UNESP	mario.neto@ibb.unesp.br	

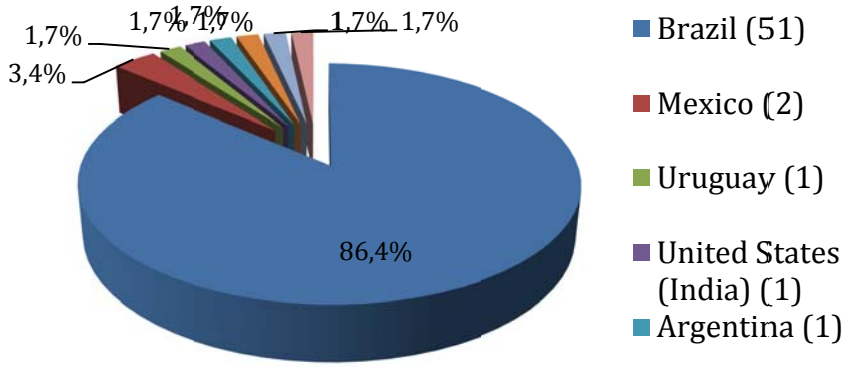

Figure 1 - Distribution of the participants by country of origin.

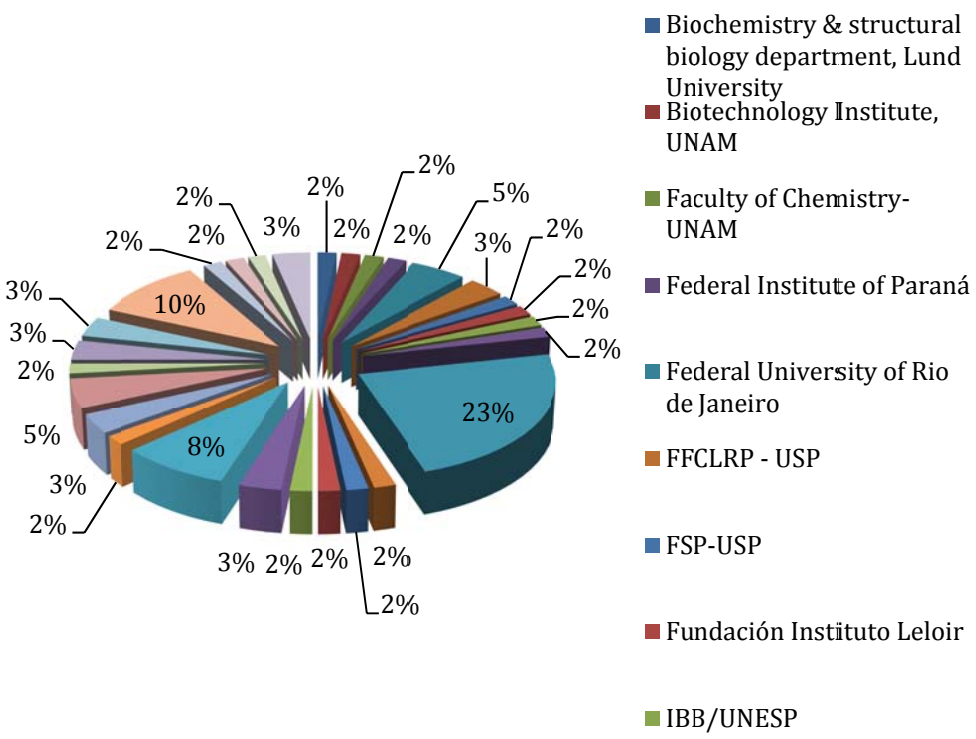

Figure 2 – Distribution of the participants by institution of origin.

In Figure 2 we draw a graph that shows the distribution of the participants by country of origin (not necessarily the nationality), and in Figure 3 we show the institution of origin. The graphs indicate that the majority of participants came from Brazil, although there was an important participation of people from other countries. Also, we had a quite heterogeneous distribution of the institutions of origin of the participants.

6. Considerations about the activities at the School

As described in the school program, the students presented their research activities in the form of posters, which were accessible throughout the period of the event. During the school, besides the more conventional lectures, there were also some tutorials, in which specific tasks were given to students in the form of "Quests" to be performed at group work. These activities were quite attractive because they allowed the students to discuss problems with each other and with the creators of the programs, which is indeed a quite rare opportunity. At the end, groups were classified according to the number of points, and the first three groups received an award. In the last day there was a workshop where representatives from the sponsoring companies were able to present seminars on their products. Also, selected students in the poster sessions were able to present their work in oral form, and researchers at the National Light Laboratory presented new perspectives for research in the future. The most active student in the workshop was given a book donated by the group of Dr. Dmitri Svergun.

7. Collection of data of SAXS

One of the main topics of the School was the use of the SAXS technique to analyze the structure of macromolecules in solution. At IFUSP there are two laboratory equipments of SAXS, a Bruker-NANOSTAR and a Xenocs-XEUSS, both of them under the responsibility of Prof. Cristiano Luis Pinto de Oliveira. These 2 equipment have been recently bought and upgraded by means of funds of FAPESP. The detector of the NANOSTAR has been changed (FAPESP # 2010/19074-6), and the o

XEUSS was bought with funds from a thematic proposal (FAPESP # 2011/13616-4). The sutends were then stimulated to bring their own samples to be analyzed in the available equipment at IFUSP. The list of the samples in given in Table 4.

Table 4 - Samples that were measured in the equipment of IFUSP during the 2014 School.

Nome	Amostra medida	Buffer	Equipamento	Número de Amostras
CAMPOS ACEVEDO, Adam Andres (UNAM)	Protein Thioredoxin (12 kDa, 10 mg/ml)	Tris (10 mM, pH 7.5)	Xeuss	2
FERREIRA, Igor Monteze (LNBio)	Liver-type Glutaminase, (15.8 kDa/monomer, 6 mg/ml)	30 mM HEPES (pH 7.5), 500 mM NaCl, 0.5 mM TCEP	Xeuss	1
GUPTA, Ashish (Luisiana State University, USA)	Protein MFTR 3 (5 mg/ml, ~19 kDa)	Sodium phosphate (pH 7), 300 mM NaCl, glycerol 10%	Xeuss	1
MECHALY, Ariel (Institut Pasteur, Montevideo)	Protein FCP1 (~4 mg/ml, 30 kDa)	Tris-HCl (25 mM), NaCl (300 mM)	Xeuss	1
OKA, Gabriel Umaji (IQ-USP)	Protein 09CT (3.1 mg/ml, 13 kDa)	Tris (pH 8.0, 20 mM), NaCl (50 mM)	Xeuss	1
PAULA, Viviane de (UFRJ)	Protein HBD 6 (5 kDa) + Polissacharide, 13 kDa (whole), 2 mg/ml	Sodium Phosphate (pH 4.8)	Xeuss	1
PINTO, Aline Sampaio (LNBio)	NIT (red protein), 8 mg/ml, 33.76 kDa, 313 aminoacids	Sodium phosphate (50 mM, pH 7.4), 150 mM NaCl, 5% Glycerol	Xeuss	1
PRIETO, Tatiana (UFABC)	GH3 (8 mg/ml, 83 kDa)	ABF 50 mM, pH 4	Xeuss	1
SILVA, Viviam Mauro da (UFABC)	Beta-mananase (4 mg/ml, 73 kDa)	ABF 50 mM, pH 6.5	Xeuss	1
STELMASTCHUK, Laureana (USP)	Tb Protein (dimeric, 25 kDa/monomer)	SOD w/ Iron in PBS (5 mg/ml, pH 7.4)	Xeuss	1
TIMMERS, Luis Fernando Saraiva M. (PUCRS)	HNS1 (3 mg/ml, 13.823 kDa, 134 AA)	50 mM, NaCl 100 mM, pH 7.9	Xeuss	1
FATTORI, Juliana (LNBio)	Nuclear Receptor COUP-TFII (3.4 mg/ml), DNA binding domain	Tris Hcl (50mM, pH7.5), NaCl 300mM, glycerol 10%	NanoStar	2
FERNÁNDEZ, Ignacio (Fund. Inst. Leloir, Argentina)	Protein Ntrx, purified by IMAC and SEC	Tris (20mM), NaCl (200mM), protease inhibitors	NanoStar	2
POSADA, Hugo Javier Serrano (UNAM)	Trimer in solution w/ MW (~130 kDa)	50mM HEPES-KOH (pH 7.5), 10% Glycerol, 2mM DTT, 100 mM Kcl	NanoStar	2
RAEZ, Luis Daniel Rueda (Univ. Peruana Cayetano Heredia)	Ribosomal Protein of M. Tuberculosis in E. Coli (1.9 mg/ml, 61.2 kDa)	Citrato (60mM, pH 6.5)	NanoStar	2
RISKE, Karin (UNIFESP)	LUVs (POPC + cholesterol w/ and wo/ Triton X-100), 20mM, 100nm	Hepes (50mM, pH7.5)	NanoStar	3
			Total:	**23**

It has been possible to collect data of excellent quality. The students were able to immediately begin the analysis of data according to the methods learned during the School. The obtained experimental graphs are shown in Figure 4.

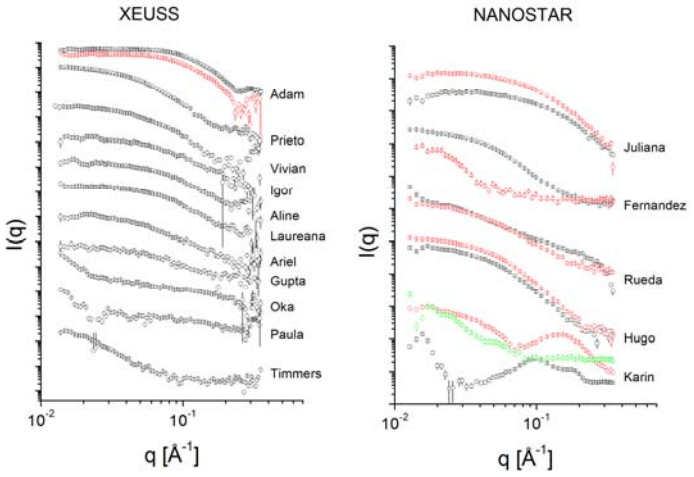

Figura 3 – SAXS graphs obtained during the School. Samples were brought by students and submitted to SAXS measurements in the two available equipments at IFUSP.

8. Answers of the evaluation by the students of the School

In the last day of School, students received the following questionnaire of evaluation, to assess their opinion about the School.

Figure 4 – Graph of bars to represent the evaluation of the School by the students.

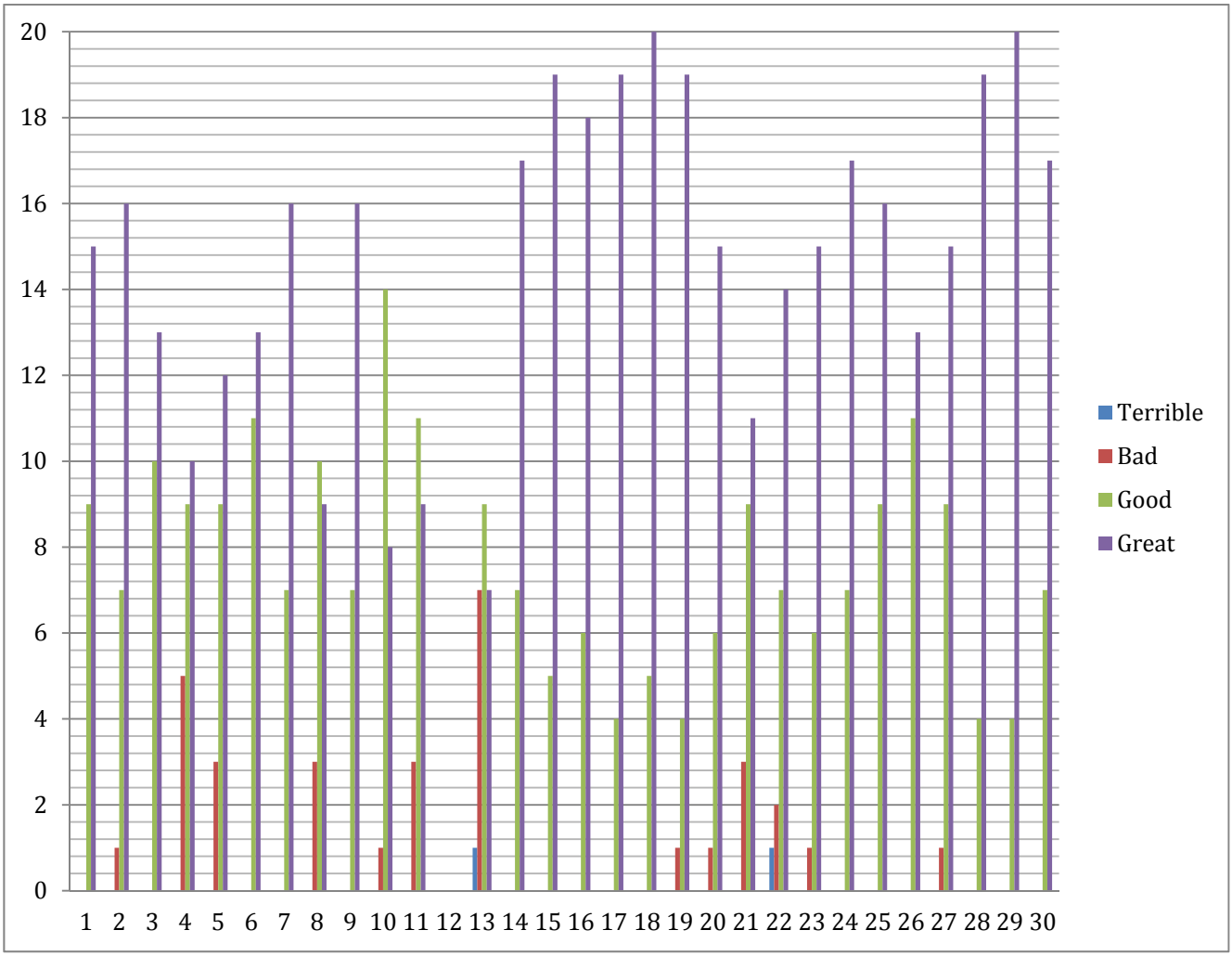

Table 5 - Questionnaire of evaluation of the courses and tabulation of results. Made at the IFUSP.

VIII ESCOLA DE VERÃO
INCT DE FLUIDOS COMPLEXO
19 a 26 de Janeiro de 2014

For the items below, please make an **X** in the most appropriate answer to each question:

Items	Answers			
	Terrible	Bad	Good	Great
Achieving the objectives of the School			9	15
School program		1	7	16
Papers presented			10	13
Working hours????		5	9	10
Facilities and resources		3	9	12
Acquired knowledge			11	13
Lecture 1: Basics of X-ray scattering by solutions - D.Svergun			7	16
Lecture 2: SAXS in Brazil - Selected applications – I. Torriani		3	10	9
Lecture 3: Neutron scattering - J.Trewhella			7	16
Lecture 4: Biological research at USP - C.Oliveira		1	14	8
Lecture 5: SAXS and SANS facilities and experimental practice - C. Blanchet		3	11	9
Lecture 6: SAXS/SANS data processing and overall parameters - D. Franke	1	7	9	7
Lecture 7: Ab initio methods: how do they work - D. Svergun			7	17
Lecture 8: Atomic structure based modelling - M. Petoukhov			5	19
Lecture 9: Sample preparation and characterization - M.Vanoni			6	18
Lecture 10: Static and dynamic light scattering - L.Arleth			4	19
Lecture 11: Calorimetry: ITC and DSC - P. Westh			5	20
Lecture 12: Analytical ultracentrifugation - O. Byron		1	4	19
Lecture 13: Introduction to basic NMR - A. Bonvin		1	6	15
Lecture 14: Spectral Assignment and Structure Calculation - L. Banci		3	9	11
Lecture 15 and 16: Recent Advances in Biomolecular NMR - L. Banci	1	2	7	14
Lecture 17: NMR, docking and bioinformatics - A.Bonvin		1	6	15
Lecture 18: Combination of scattering and biophysical methods - O. Byron			7	17
Lecture 19: Spectroscopic methods - M.Vanoni			9	16
Lecture 20: Joint use of SAXS and SANS - J.Trewhella			11	13
Lecture 21: Time-resolved X-ray and neutron scattering - C. Blanchet		1	9	15
Lecture 22: Membrane proteins - L.Arleth			4	19
Lecture 23: Protein hydration - P. Westh			4	20
Lecture 24: Mixtures, assemblies, flexible systems - M. Petoukhov			7	17

From these data, we conclude that 95% of the answers have been “good” e “fine”, and that only 5% were either “bad” or "very bad", in all items of this questionnaire. This high percentage of acceptance of the School is a sure indication of the degree of satisfaction of the participants with respect to the program, the infrastructure and the planning of the School.

Tabela 6 - Questionnaire of evaluation of the courses and tabulation of results. This questionnaire was made by EMBO via the website.

glc14-01		
Were you an invited speaker/lecturer or participant?	Count	%
participant	14	26.92
participant (selected for oral presentation)	5	9.62
participant (selected for poster presentation)	33	63.46
Select which most accurately describes your position	Count	%
Senior Academic (Group Leader / Professor)	7	13.46
Postdoctoral Fellow	11	21.15
PhD Student	28	53.85
Undergraduate / Master's student	6	11.54
Where would you prefer to continue the next stage of your career?	Count	%
Not given	1	1.92
Europe	29	55.77
North America	5	9.62
South America	17	32.69
Was the topic adequately covered?	Count	%
yes	51	98.08
no	1	1.92
Did this meeting alter/change your viewpoint?	Count	%
Not given	1	1.92
yes	43	82.69
no	8	15.38
Was there a poster session?	Count	%
yes	50	96.15
no	2	3.85
Did you acquire useful career contacts/collaborations?	Count	%
Yes	23	44.23
Partly	25	48.08
No	4	7.69
Did you have the opportunity to suggest organizers for future meetings?	Count	%
Not given	2	3.85
yes	10	19.23
no	40	76.92
The number of participants at the meeting was:	Count	%

just right	48	92.31
too many	4	7.69
The duration of the meeting was:	Count	%
Not given	1	1.92
too short	2	3.85
just right	33	63.46
too long	16	30.77
Was there sufficient time for discussion and to meet other participants/speakers?	Count	%
yes	48	92.31
no	4	7.69
Was the location satisfactory?	Count	%
yes	52	100.00
Was the accommodation satisfactory	Count	%
Not given	6	11.54
yes	46	88.46
Did the meeting live up to your expectations?	Count	%
yes	41	78.85
partly	11	21.15
The meeting programme was:	Count	%
Excellent	16	30.77
Very good	24	46.15
Good	9	17.31
Adequate	2	3.85
Unsatisfactory	1	1.92
The quality of the scientific talks at the meeting were:	Count	%
Excellent	35	67.31
Very good	13	25.00
Good	4	7.69
The overall proportion of novel/unpublished results was:	Count	%
Not given	1	1.92
Excellent	8	15.38
Very good	16	30.77
Good	17	32.69
Adequate	10	19.23
The organizational aspects of the meeting were:	Count	%
Excellent	13	25.00
Very good	27	51.92
Good	7	13.46
Adequate	4	7.69
Poor	1	1.92

Overall evaluation of the meeting:	Count	%
Excellent	21	40.38
Very good	22	42.31
Good	7	13.46
Adequate	2	3.85
Would you recommend colleagues to attend EMBO-funded meetings?	Count	%
yes	51	98.08
no	1	1.92
If you have attended other similar meetings, how did this compare?	Count	%
Not given	10	19.23
Better	10	19.23
Equally good	28	53.85
Not as good	4	7.69
Do you grant permission for us to use any of your comments/feedback for possible promotional use on our websites/advertising literature?	Count	%
yes	43	82.69
no	9	17.31

In analogy with other questionnaire, this EMBO survey also conforms the high rate of approval of the course by the students.

9. Material made available by the School

All the talks of the invited speakers were made available at a server of the Group of Complex Fluids of IFUSP. This page can reached by the link

http://axpfep1.if.usp.br/~gfcxhp/embo2014/

In order to have access to the data, it is necessary to use the following username and password:

user: embo14
password: ProteiN

In this site, there are also some photos and videos taken during the School.

10. Final remarks

In this report we have described the "*EMBO Global Exchange Lecture Course on Structural and Biophysical Methods for Biological Macromolecules in Solution*" organized at IFUSP, between 19 and 26 February, 2014. It has been possible to organize a school of high level, with an active participation of students. Results indicate a good evaluation of the students and a high degree of satisfaction. We believe that this school has reached the proposed goals, and will lead to a meaningful advance it the use of the presented techniques in the future research work of the participants.

Exhibition “Magnetic Liquids: in science, technology and arts”

Coordination: Vera Bohomoletz Henriques and Daniel Reinaldo Cornejo (IFUSP)

Support: INCT-FCx, CINUSP, CCEx-IF, Laboratório de Demonstrações-IF, secretaria NAP-FCx

Abstract

With the aim of bringing science and education to the population, the exhibition "Magnetic Liquids: science, technology and art." was held at the subway station Republic of São Paulo, from 4 to 30 October 2013. The visits to this exhibition were guided by twenty-one monitors, from Monday to Sunday, from 10 am to 8 pm. The visitors had the opportunity to interact with ferrofluids, observe their behavior under the action of magnetic fields and learn about their properties and applications. The exhibition was set in an area of approximately 100 m^2, and consisted of explanatory panels, videos projected on LCD TVs, and microscopes displaying amazing images of these materials. There were about 10,000 people visiting the exhibition.

Introduction

Nowadays, ferrofluids are one of the results of nanotechnology with greater presence in our daily life. They can be found in pharmaceuticals, paints, cosmetics, sound equipment, cars, etc. In addition to these important technological applications, ferrofluids have very interesting features. As they are liquids with magnetic properties, they offer a unique possibility to be used as objects for presentation to a diverse audience of various physical phenomena in an aesthetic way, pleasant, and without losing scientific rigor.

One goal of the INCT and the NAP on Complex Fluids is to organize university outreach events that offer the people the opportunity to come into contact with the objects of study and the results of our research field, showing how science and its "products" are part of our daily life. This was the basic idea for designing the exhibition "Magnetic Liquids: science, technology and art," which aims at using these features and applications of ferrofluids as a vehicle to trigger curiosity and interest for science in a large and diverse audience.

Members of the team

The team responsible for the exhibition was integrated by faculty members at IFUSP, Daniel Reinaldo Cornejo, Giancarlo Esposito de Souza Brito, Suhaila Maluf Shibli, and Vera Bohomoletz Henriques, and by Dr. Lionel Fernel Gamarra Contreras, a researcher at the institute of research and education of the Albert Einstein Hospital.

Structure and content of the exhibition

The exhibition was displayed in an area of about 100 m^2 in the Republic subway station of São Paulo, and was divided into three modules.
In the first module, there were panels with an overall presentation of the characteristics of ferrofluids, explaining what they are made of and how they can be prepared. Also, there was an explanation of the general concepts of magnetic fields, focusing on the intensities of fields that we have in our everyday life (the magnetic field of the Earth, the refrigerator magnets, the magnetic fields used in medicine for image diagnostic, and the magnetic fields in nuclear magnetic resonance devices and scanners). A desk with experiments using magnets and magnetic fields, open to interactions with the visitors, completed this module.
The second module was oriented to show the applications of ferrofluids in medicine. In addition to the explanatory panels, there were three microscopes where visitors could observe healthy cells and cells with tumors, showing how the use of ferrofluids improves the image in the tumor region, which facilitates the diagnosis. There were also panels to illustrate the drug delivery technique using ferrofluids and the treatment of cancer therapy known as hyperthermia. In one video produced for display it was explained how ferrofluids are used in marking stem cells to follow the path of these cells within the human body.

In the third module , using explanatory panels, there were illustrations of applications of ferrofluids in industry, which includes the automotive industry, the paint and the cosmetics industries. In this module, there was also a table-top demonstration, and in particular an interactive experiment, so that people were able to control the intensity of an electromagnet and observe how the generated magnetic field creates peculiar structures in a ferrofluid. In another the experimental arrangement, people could see how a ferrofluid reacts to an applied magnetic field produced by a loudspeaker. This module was completed with a video where it was shown some recent work of contemporary artists who have used ferrofluids as material to create art.

The exhibition design was in charge of the architects Henry Gabbo Torres and Nadezhda A. Mendes da Rocha, from the Garupa studio.

Results

The public who visited the exhibition, estimated at about 10,000 people, were mostly subway users, that is, people with a diverse level of education. It was remarkable the enthusiasm and fascination that this topic generated in most visitors, in particular due to the possibility of interacting with the instruments of the experimental setups.
Several schools scheduled visits to the exhibition. We estimate that we had about 1,500 student visitors. A printed material with the content of the panels shown in the exhibition was made available to the school teachers who participated in the visits.
We should also highlight the excellent work done by the monitors, their dedication during the training period, the active participation in the exhibition. For the monitors, who were mainly undergraduate students, this activity was an environment to develop scientific communication strategies with the lay public, as well as a possibility to incorporate new knowledge beyond their usual courses.

Teaching activities

Coordinator : Prof. Dr. Lia Queiroz do Amaral

1) UPDATING COURSES FOR SCHOOL TEACHERS

We organized a teaching project, beginning in 2006, coordinated by Prof. Lia Queiroz do Amaral, with the purpose of offering updating courses of 40 hours to school teachers: **"COMPLEX FLUIDOS IN HIGH SCHOOL: properties and applications in physics, chemistry and biology"**.
Six editions of this course have been offered, with multidisciplinary teams, and the first one, a pilot course in 2007, defined the form of interaction between USP and the Secretary of Education of the State of São Paulo, in order to give points to the teachers attending the courses. 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.

Since 2009 the course has been offered annually, as an activity of INCT-FCx.
From 2011 these courses have been offered within the USP –School Meetings, promoted by the Committee of Culture and Extension of USP, at IFUSP.
In the week 15 - 19/07/2013 the last edition of this course was offered, with an emphasis on ferrofluids, with Dr. Daniel R. Cornejo as responsible, and a team of more 4 members from INCT.

Program of the Course:

Monday = morning: Nanoparticles: magnetic and electric properties (Daniel R. Cornejo). Afternoon: Water and aqueous systems (Lia Q. Amaral).
Tuesday = Morning: Demonstration with ferrofluids (Giancarlo E.S. Brito). Afternoon: visit to research laboratory and discussion (Giancarlo E.S. Brito).
Wednesday = Morning: Ferrofluids and nanobiotechnology (Lionel Gamarra). Afternoon: Visit to Brain Institute at Albert Einstein Hospital (Lionel Gamarra).
Thursday = Morning: Ferrofluids in liquid crystals (Sergio L. Gómez). Afternoon: Visit to Laboratory of Complex Fluids: experiments and discussion (Sergio L. Gómez).
Friday = Morning: Magnetic properties of ferrofluids (Daniel R. Cornejo). Afternoon: Visit to Laboratory of Magnetic Materials and discussion (Daniel R. Cornejo).

2) PUBLISHED BOOKS

The main goal of the teaching Project was to arrive to the publication of a book with the global scientific content given in the courses, in a level to be understood by the school teachers, since such a book did not exist yet. In July 2012 it became clear that two books should be published, the first focusing laboratory and demonstrations initiated in the pilot course in 2007, considered of direct interest to teachers and students of high schools. A first book "Da Física do Faraó ao Fóton", written by Alberto and Adriana Tufaile, has been published by Editora Livraria da Física, in 2013.
In the second book the focus should be on conceptual multidisciplinary themes, particularly in the interface Physics / Chemistry of aqueous systems, and arriving at biological fluids. The structure of this book, with 15 chapters written by 12 scientists who participated in the teaching project, was defined in 2012.
A first version of the text was ready in February 2013, and the title of the book was then defined as:
"**ENTRE SÓLIDOS E LÍQUIDOS" - Uma Visão Contemporânea e Multi-Disciplinar - Para Formação De Professores e Divulgação Do Conhecimento"**
(Between solids and Liquids – a contemporary and multi disciplinary vision - for teacher´s formation and dissemination of knowledge).
Organizer Lia Queiroz Do Amaral

The final text was elaborated along 2013 / 2014, and it was published by Editora Livraria da Física, being available at IFUSP in august 2014.
This book involved intensive collaboration among members of INCT from several institutions: IFUSP, EACH-USP, EPM–UNIFESP, DFI-UEMaringá, and UNIBAN, with co-authorship in 8 of the 15 chapters, which shows this collaboration.

A description of the book is can be seen in the site of the Editor:
http://www.livrariadafisica.com.br/detalhe_produto.aspx?id=142930

A comment on the book appeared in the section "Acontece na SBF" of the bulletin of the Brazilian Society of Physics 033 - 04/09/2014:
- Entry of book organized by USP faculty member:
Título: Between Solids and Liquids - Editora: Livraria da Física

According to its organizer, professor Lia Amaral, this book tries to present a contemporary and multidisciplinary vision of the topic, directed to the general public as scientific divulgation. Furthermore, it has the potential of complementing the formation of teachers of natural sciences. Read more in:

http://www.sbfisica.org.br/v1/index.php?option=com_content&view=article&id=591

CHAPTERS OF THE BOOK (Publications in 2014)

I. Introduction: From the atomic model to the everyday materials.
Lia Queiroz do Amaral, *IFUSP*

II. Determination of Avogadro´s number
Hatsumi Mukai and Paulo Ricardo Garcia Fernandes, *DFI/UEM*

III. Condensed Matter
Lia Queiroz do Amaral, *IFUSP*

IV. Thermodynamics, what is possible and what is spontaneous
Thomas Haddad and Adriana Tufaile, *EACH – USP*

V. Phase Transitions
Lia Queiroz do Amaral, *IFUSP*, Hatsumi Mukai, *DFI/UEM*, and Thomas Haddad, *EACH – USP*

VI. Water
Lia Queiroz do Amaral, *IFUSP*

VII. Ionization of water and pH
Paulo Boschcov, *EPM/UNIFESP*, Claudete Valduga, *UNIBAN*, and Hatsumi Mukai, *DFI/UEM*

VIII. Micellar Systems
Lia Queiroz do Amaral, *IFUSP*

IX. Liquid Crystals
Paulo Ricardo Garcia Fernandes, *DFI/UEM* and Antonio M. Figueiredo Neto, *IFUSP*

X. Measurements in Liquid Crystal Displays
Paulo Ricardo Garcia Fernandes and Hatsumi Mukai**,** *DFI/UEM*

XI. Calorimetry applied to Membranes and Proteins
Karin A. Riske e Katia Regina Perez, *EPM/UNIFESP*

XII. Foams
Alberto Tufaile and Adriana P. Biscaia Tufaile, *EACH – USP/Leste*

XIII. Emulsions
Claudete Valduga, *UNIBAN*

XIV. Ferrofluids
Giancarlo Brito, *IFUSP*

XV. Biological Fluids

Paulo Boschcov, *EPM/UNIFESP*