

Biology at University of São Paulo

Prof. Dr. Cristiano L. P. Oliveira

Complex Fluids Group, Department of Experimental Physics
Institute of Physics - University of São Paulo
Brazil

São Paulo City, State of São Paulo, Brazil



City of São Paulo

Founded: January 25, 1554

Area: 1,523 km²

Elevation: 760 m (2,493.4 ft)

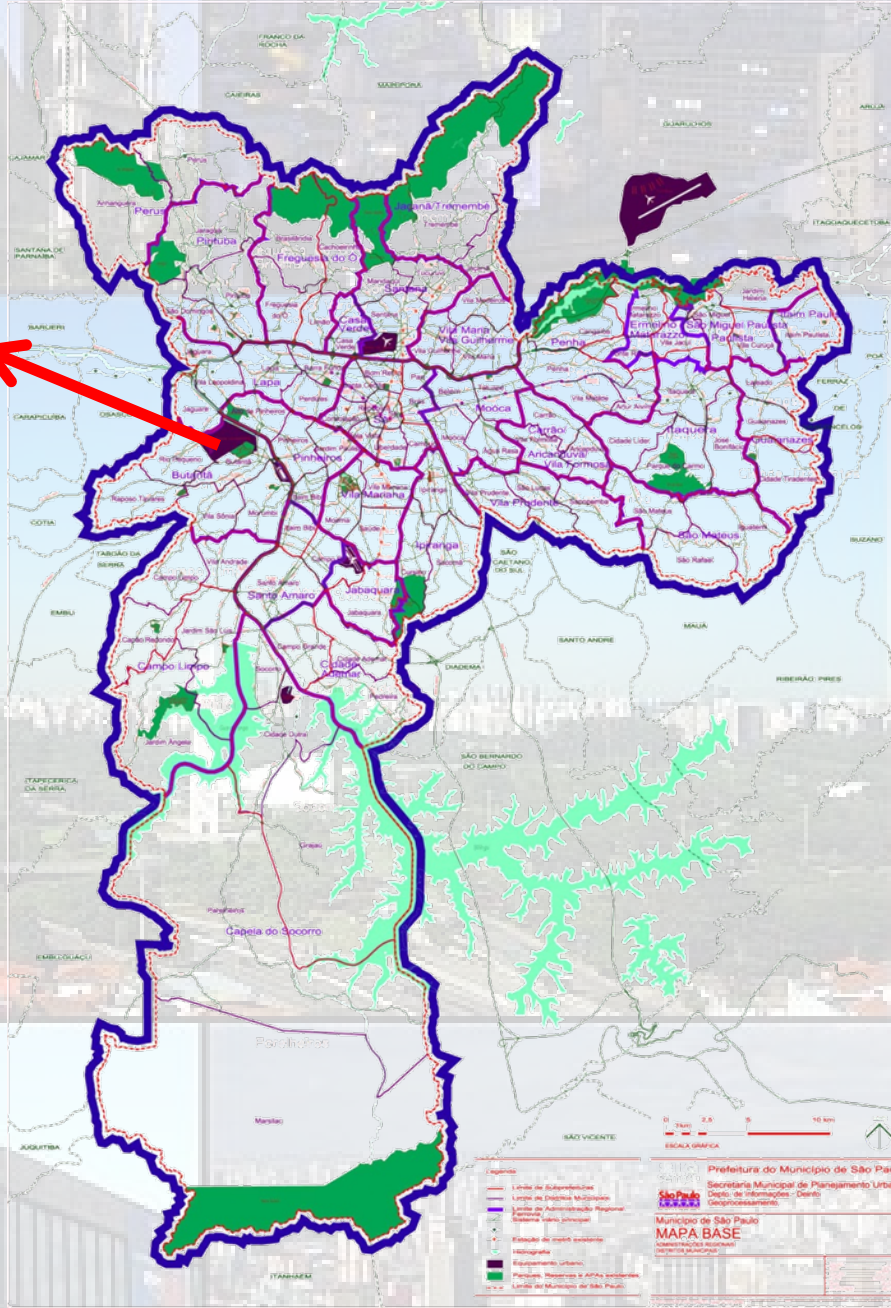
Population: 11,316,149 (2011)

São Paulo is the largest city in Brazil, the largest city proper in the southern hemisphere, in the Americas, and the world's sixth largest city by population.

The metropolis has the largest economy by GDP among Latin American and Brazilian cities

The city has lots of cultural options, restaurants and an intense nightlife.

USP



University of São Paulo

- Created in **1934**, the University of São Paulo is one of the most important institutions of higher learning in Brazil.
- Undergraduate program: **240 courses**, dedicated to all fields of knowledge, distributed in **42 units** of learning and research and offered to more than **57 thousand students**.
- Graduate program is composed of **239 programs** (with **308 Masters** degree courses and **299 Ph.D** courses). More than **25 thousand students**.
- **8 Campi**: São Paulo, Bauru, São Carlos, Lorena, Piracicaba, Pirassununga, Ribeirão Preto and São Sebastiao
- Ranking of Universities – Shanghai University (2010): USP was ranked in **143rd** position. The Times (2011) USP placed as number **250**. HEE&AC Taiwan (2010), **74th** position. Webometrics Ranking of World Universities, **43rd**.
- **One of the best universities in South America!!!**

USP campi



University of São Paulo

São Paulo Campus

School of Arts, Sciences and Humanities (EACH)
School of Communication and Arts (ECA)
School of Physical Education and Sports (EEFE)
School of Nursing (EE)
Polytechnic School (Poli)
School of Architecture and Urbanism (FAU)
School of Pharmaceutical Sciences (FCF)
Law School (FD)
School of Economics, Administration and Accounting (FEA)
School of Education (FE)
School of Philosophy, Literature and Human Sciences (FFLCH)
School of Medicine (FM)
School of Veterinary Medicine and Animal Husbandry (FMVZ)
School of Dentistry (FO)
School of Public Health (FSP)
Institute of Astronomy, Geophysics and Atmospheric Science (IAG)
Institute of Bioscience (IB)
Institute of Biomedical Sciences (ICB)
Electro-Technical and Energy Institute (IEE)
Institute of Advanced Studies (IEA)
Institute of Brazilian Studies (IEB)
Physics Institute (IF)
Geosciences Institute (IGc)
Institute of Mathematics and Statistics (IME)
São Paulo Institute of Tropical Medicine (IMT)
Psychology Institute (IP)
Chemistry Institute (IQ)
Institute of International Relations (IRI)
Oceanographic Institute (IO)

Baurú Campus

Baurú School of Dentistry (FOB)

São Carlos Campus

São Carlos School of Engineering (EESC)
Institute of Architecture and Urbanism (IAU)
Institute of Mathematical and Computer Sciences (ICMC)
São Carlos Institute of Physics (IFSC)
São Carlos Institute of Chemistry (IQSC)

Lorena Campus

Lorena School of Engineering (EEL)

Piracicaba Campus

Center of Nuclear Energy in Agriculture (CENA)
Higher School of Agriculture “Luiz de Queiroz”

Pirassununga Campus

School of Animal Husbandry and Food Engineering (FZEA)

Ribeirão Preto Campus

Ribeirão Preto School of Physical Education and Sports (EEFERP)
Ribeirão Preto School of Nursing (EERP)
Ribeirão Preto School of Pharmaceutical Sciences (FCFRP)
Ribeirão Preto Law School (FDRP)
Ribeirão Preto School of Economics, Administration and Accounting (FEARP)
Ribeirão Preto School of Philosophy, Science and Literature (FFCLRP)
Ribeirão Preto School of Medicine (FMRP)
Ribeirão Preto School of Dentistry (FORP)

USP – Cidade Universitária Armando de Salles Oliveira

USP PREFEITURA
Campus da Capital



7 443 770 m²

Biology at USP

- Difficult to quantify exact numbers : Biology is an object of study on several areas (physics, chemistry, biology, pharmacy, odontology, medicine, etc)
 - Some key groups for protein expression, purification and/or crystallization:
 - Prof. Igor Polykarpov (IFSC)
 - Prof. Glaucius Oliva / Richard Garrat (IFSC)
 - Prof. Roberto Salinas (IQUSP)
 - Prof. Shuck Farah (IQUSP)
 - Prof. Mariz Vainzof (IBUSP)
 - Prof. Antonio Carlos Pereira Martins (FMRP-USP)
 - **Among MANY MANY others...**
- Multidisciplinary / Interdisciplinary approaches
- Research Support Centers - NAP's (181 centers created in the last 3 years)

Research Financing

- FAPESP



- USP



- CNPQ



- CAPES



Institute of Physics

- Research in Physics started at the department of Physics, started in 1934, with the Foundation of USP
- The institute of Physics was formally created in 1970
- It is composed of 6 departments: **Department of Applied Physics**, **Department of Experimental Physics**, **Department of General Physics**, **Department of Nuclear Physics**, **Department of Materials Physics and Mechanics** and **Department of Mathematical Physics**

Department of Applied Physics

- analysis of materials
- crystallography 
- physics of the air pollution
- plasma physics and fusion research
- thin films of advanced materials
- analysis of materials

Department of Experimental Physics

- experimental quantum optics
- structural and optical properties of complex fluids 
- physics teaching
- new digital technologies and distance education
- experimental nuclear physics
- theoretical hadron physics

Department of General Physics

- electron microscopy applied to ceramic materials and biological tissues
- instrumentation for experimental high energy particle physics;
- molecular biophysics
- molecular modeling
- statistical physics
- NMR spectroscopy and imaging

Department of Nuclear Physics

- experimental study of nuclear structures
- experimental study of nuclear reactions
- nuclear astrophysics
- theoretical aspects of nuclear physics
- applied nuclear physics
- dosimetry
- radiation damage
- medical physics

Department of Materials Physics and Mechanics

- ultra-low temperature and high magnetic field effects, superconductivity
- optical, magnetic and electrical spectroscopy and microscopy
- synthesis and growth of semiconductor, magnetic and diluted magnetic materials
- nanomagnetism
- semiconductor, oxide and metallic nanostructures (theory and experiment)
- electronic, optical and magnetic properties of bulk and nanostructured systems (theory and experiment)
- organic and hybrid materials and nanostructures (theory)

Department of Mathematical Physics

- high energy collider physics
- gravitation and cosmology
- neutrino physics
- superstrings
- physics beyond the standard model
- mathematical physics
- quantum field theory
- theory of many body systems
- complex and non-linear systems

SAXS at IFUSP

- Profa. Lia Q. Amaral
- Prof. Aldo Craievich
- Profa. Marcia Fantini
- Profa. Rosangela Itri
- Giancarlo Espósito de Souza Brito
- Sérgio Luiz Morelhão
- Diomar R. S. Bittencourt

Cristalography Group
(Bruker Nanostar)

- Prof. Antonio M. F. Neto
- Profa. Elisabeth A. de Oliveira
- Profa. Suhaila Shibi
- Prof. Cristiano L. P. Oliveira

Complex Fluids Group
(Xenocs XEUS)

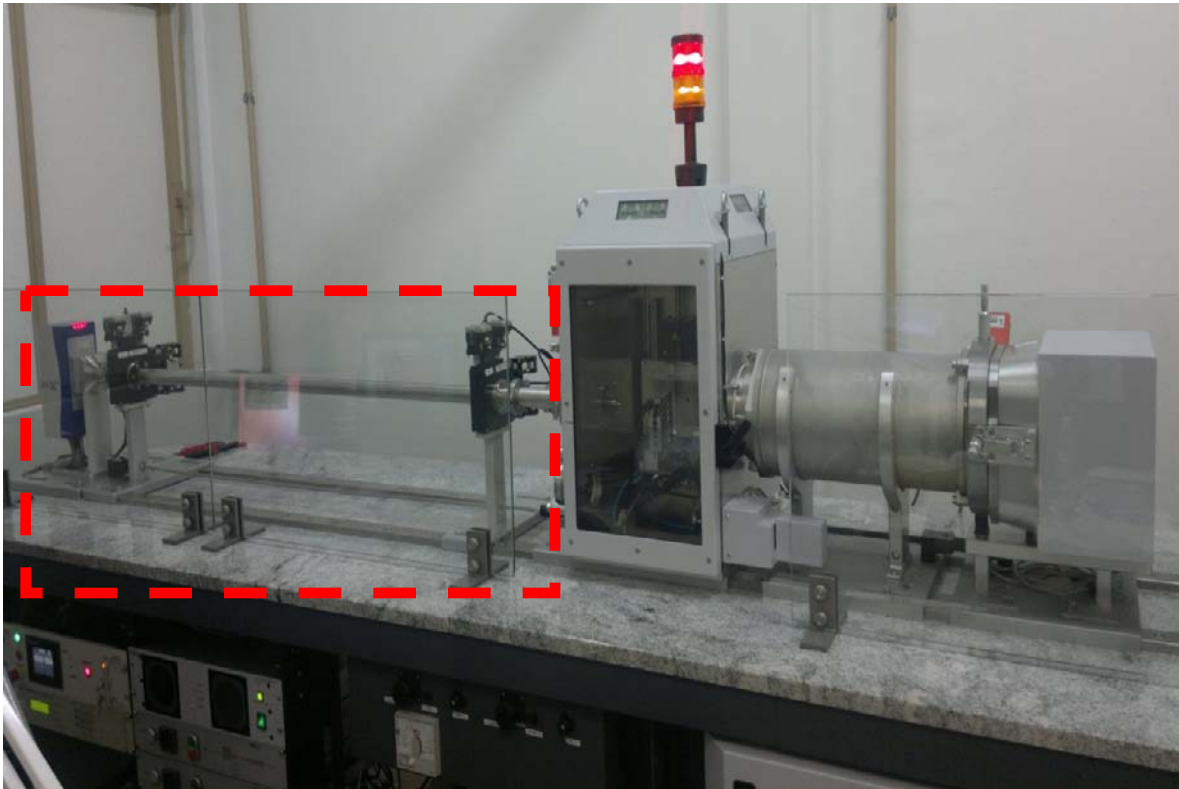
- Profa. Tereza Lamy
- Prof. Leandro Barbosa

Biophysics group

Among MANY other users

Laboratory SAXS Instrument

Coordinator: CLP Oliveira
IF/USP
2st Generation Lab. SAXS



A recent upgrade provided an increase of 40x in flux!!!

NanoSTAR



- Xenocs Microfocus Source and mirrors
- **Scatterless Slits.**
- An integrated vacuum
- A 2D-gas detector (**VANTEC2000**)



**High flux
Low
background**

Standard: 0.01 to 0.35 1/Å

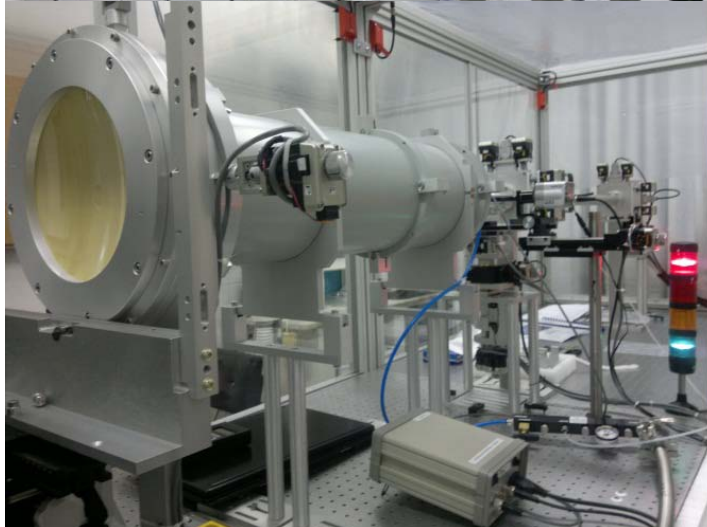
*Flux = **0.4×10^8** photons per sec*

Laboratory SAXS Instrument

Coordinators: AMF Neto, CLP Oliveira

GFCx IF/USP 2st Generation Lab. SAXS

Xeuss SAXS Systems



- Xenocs Microfocus Source and mirrors
- **Scatterless Slits.**
- Vacuum paths
- **Pilatus Detector**



**High flux
Low
background**

Standard: 0.01 to 0.35 1/Å

Flux = 0.4×10^8 photons per sec

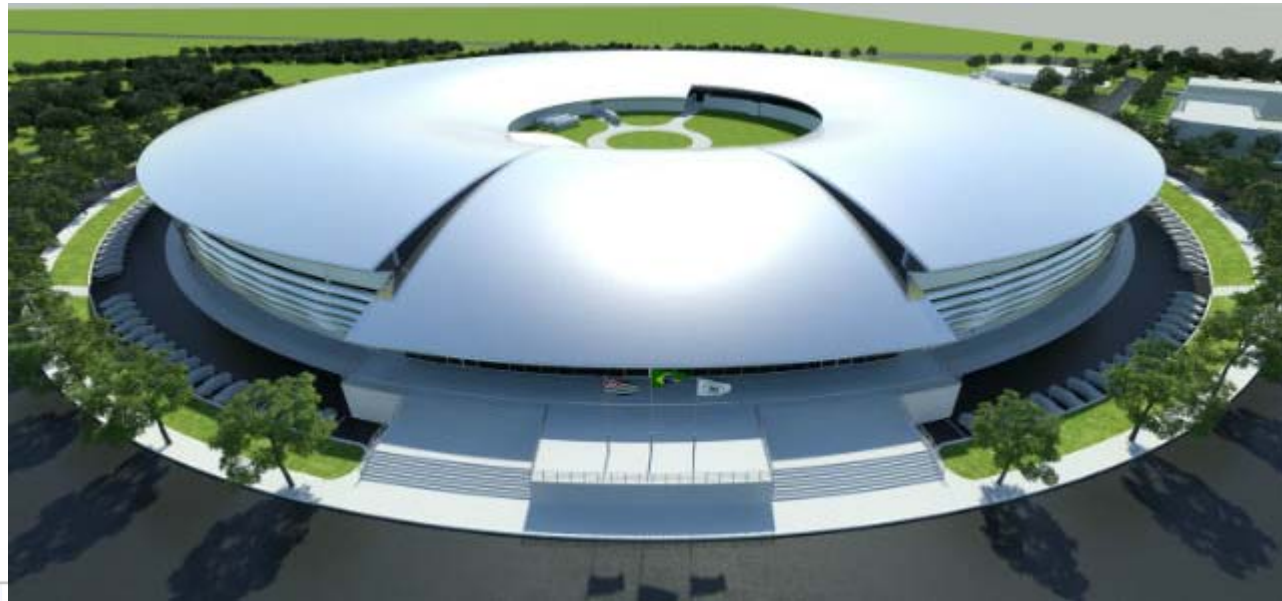
Synchrotron Laboratory

LNLS/Campinas
Two SAXS beamlines

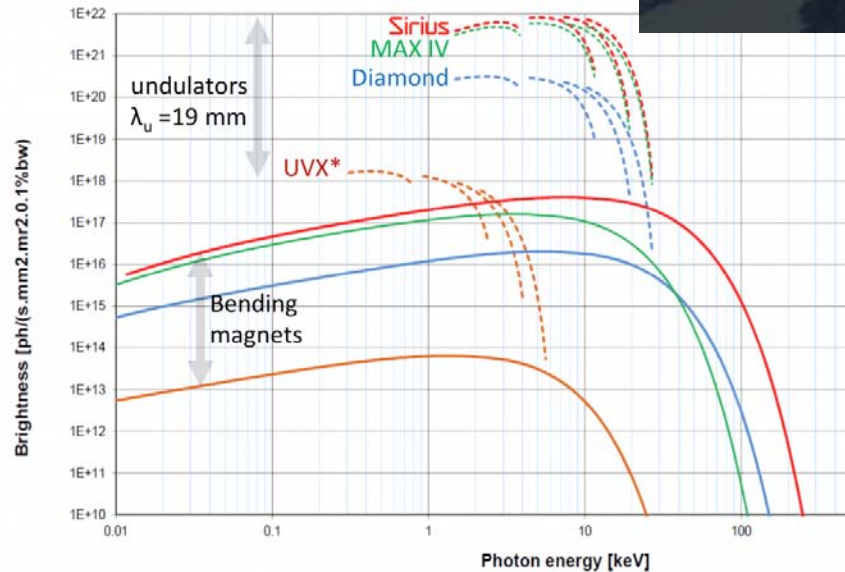


Future Brazilian Synchrotron

Sirius/Campinas



Available in 2016....



* UVX is the existing light source at LNLS

Standard SAXS beamlines
Coherent SAXS beamlines

More information next Sunday:
14:30 - 15:15: Mateus Cardoso - SAXS at LNLS:
UVX and Sirius



Instituto de Física
Universidade de São Paulo

Grupo
de Fluidos
Complexos



Prof. Antonio M. F. Neto

Profa. Elisabeth A. de Oliveira

Profa. Suhaila M. Shibli

Prof. Cristiano L. P. Oliveira

Several IC, MsC, PhD and Postdoc students

GFCx

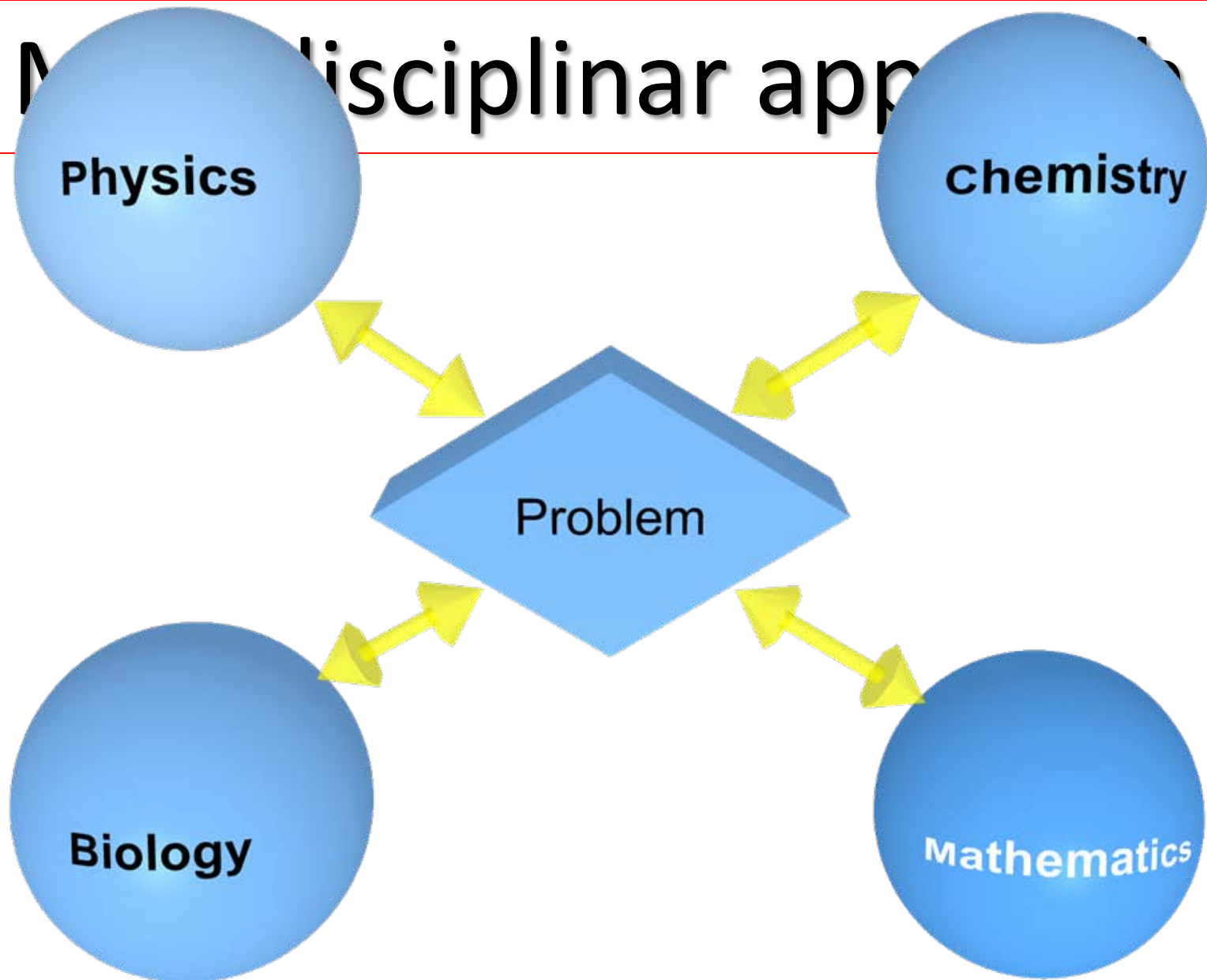
- All about complex fluids:
 - Polymers
 - Biopolymers
 - Ferrofluids
 - Membranes
 - Surfactants
 - Etc... Soft matter in general

INCT on Complex Fluids

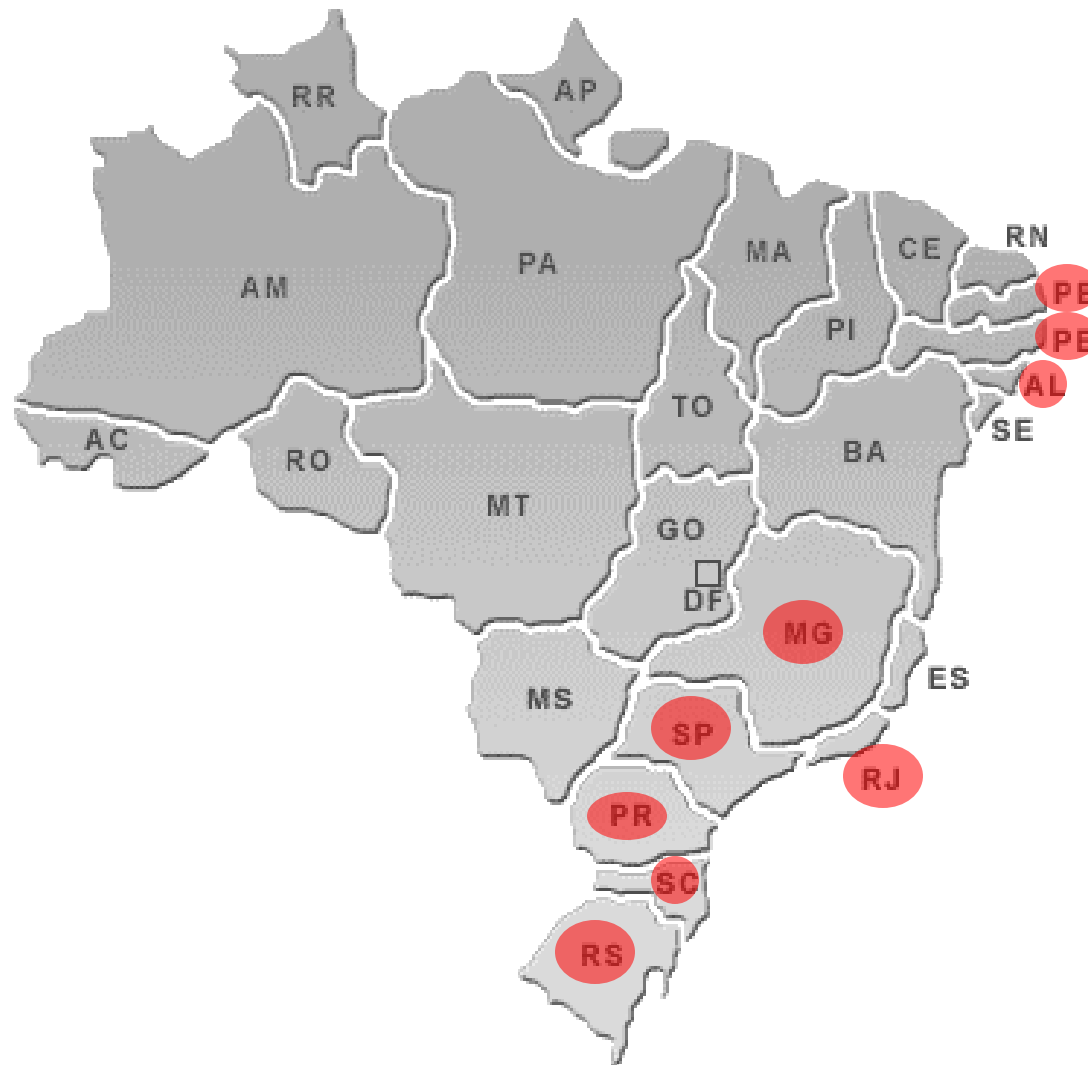
Instituto de Física da
USP

Head: Prof. Antonio M. F. Neto

Multidisciplinary approach

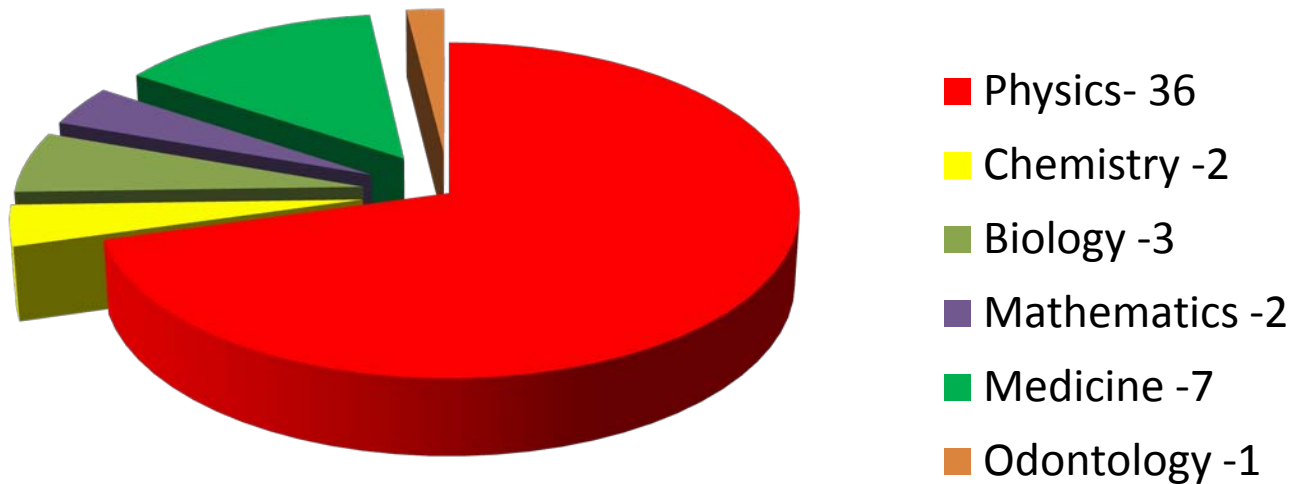


INCT-FCx in Brazil



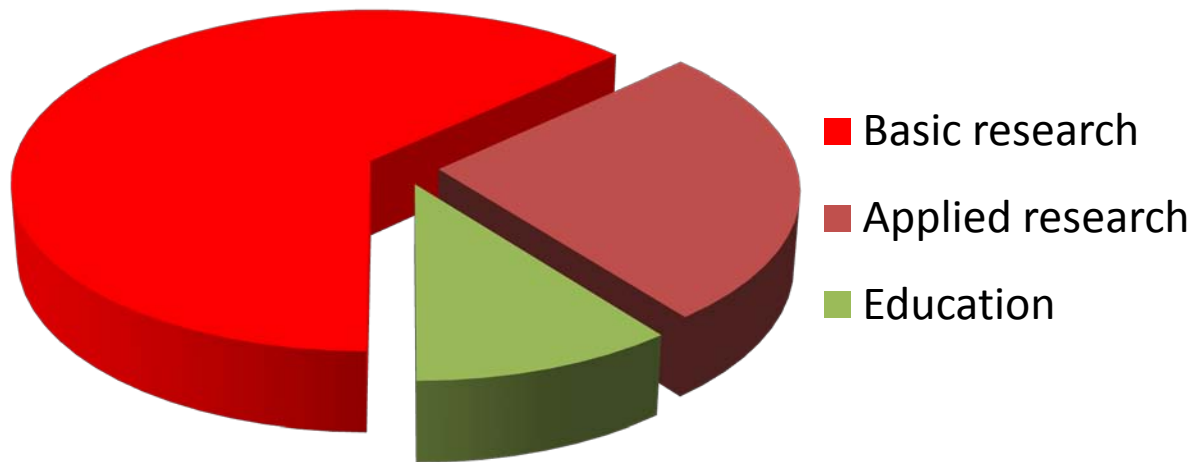
Specialities

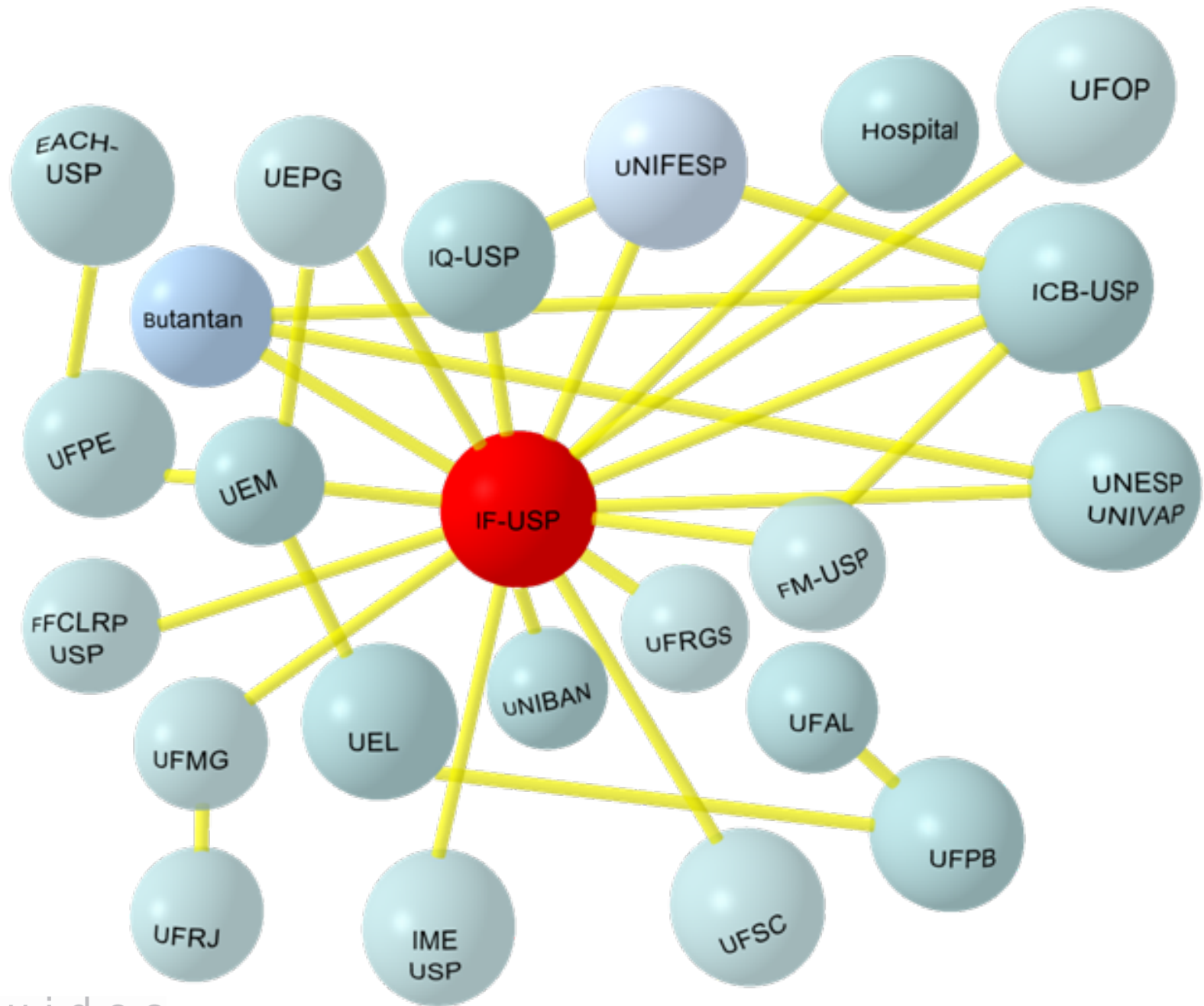
51 members



Performance

Activities



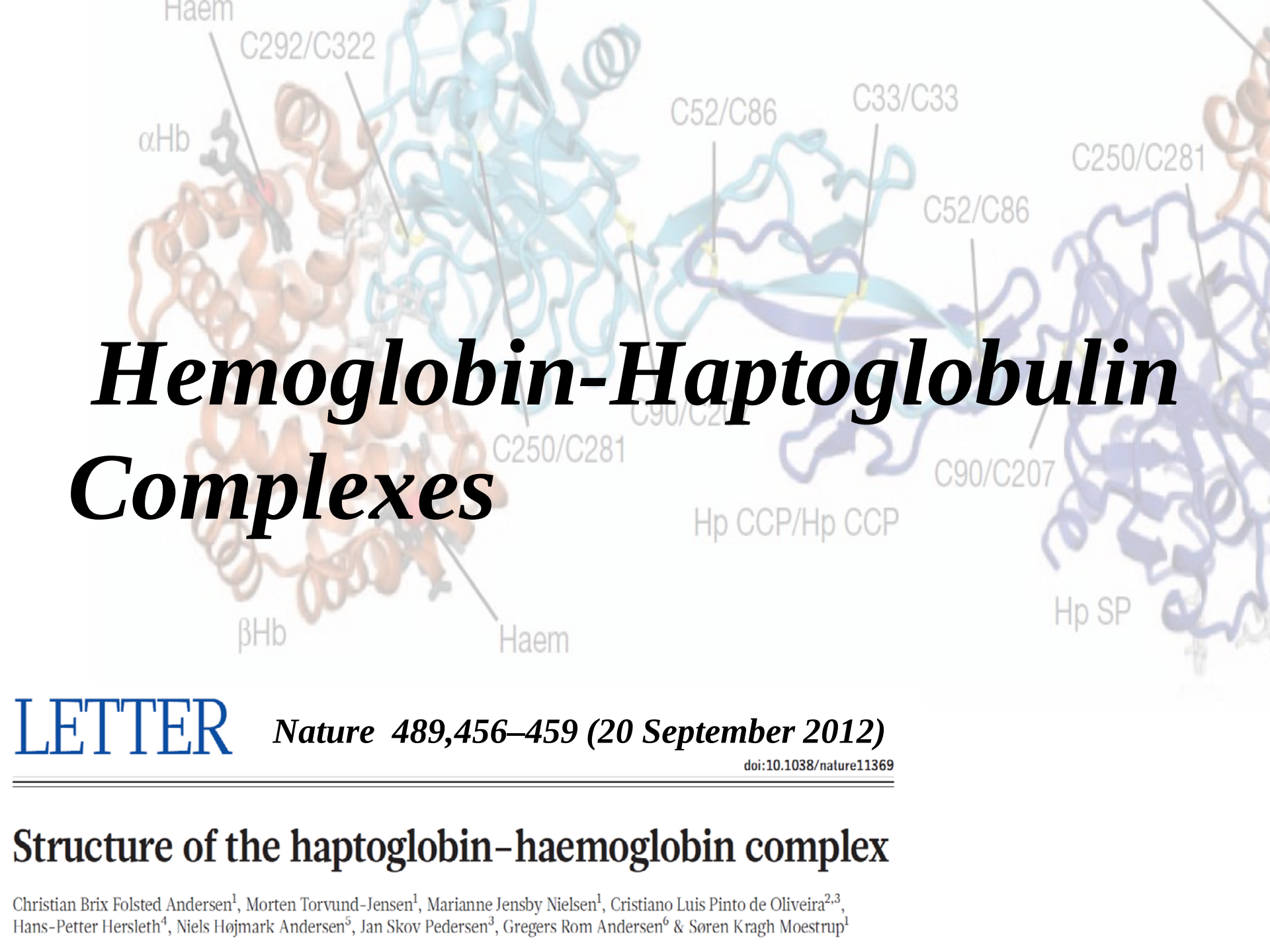


Research Interests

Prof. Cristiano L. P. Oliveira

- Small Angle Scattering theory
- Methods for modelling scattering data
- Soft matter and Biophysics:
 - Protein-protein interactions and complex formation
 - Protein-surfactant complexes
 - RNA/DNA self assembly structures
- Nanostructured materials / nanoparticles
- Instrumentation Development
- **Interdisciplinary / Multidisciplinary projects!**

Applications

A 3D ribbon diagram of the hemoglobin-haptoglobin complex. The hemoglobin (Hb) subunits are shown in orange and brown, with heme groups (Haem) visible as red discs. The haptoglobin (Hp) subunits are shown in blue and purple. Labels indicate specific residues and regions: αHb, βHb, C292/C322, C52/C86, C33/C33, C250/C281, C90/C207, Hp CCP/Hp CCP, and Hp SP. The title "Hemoglobin-Haptoglobin Complexes" is overlaid in large, bold, black serif font.

Hemoglobin-Haptoglobin Complexes

LETTER

Nature 489,456–459 (20 September 2012)

doi:10.1038/nature11369

Structure of the haptoglobin–haemoglobin complex

Christian Brix Folsted Andersen¹, Morten Torvund-Jensen¹, Marianne Jensby Nielsen¹, Cristiano Luis Pinto de Oliveira^{2,3}, Hans-Petter Hersleth⁴, Niels Højmark Andersen⁵, Jan Skov Pedersen³, Gregers Rom Andersen⁶ & Søren Kragh Moestrup¹

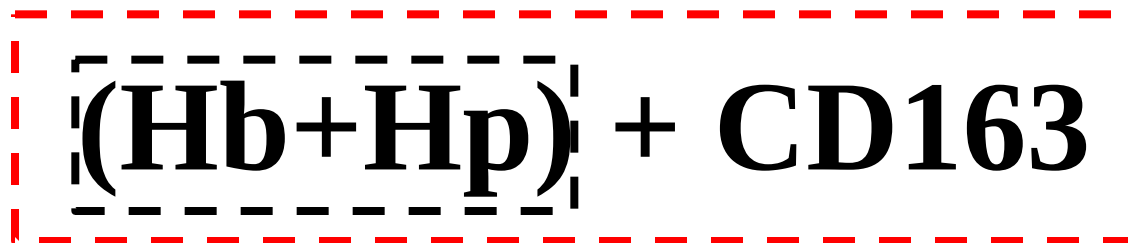
Hb-Hp complex

Haemoglobin (Hb): Fundamental oxygen-transporting molecule in blood

Haptoglobin (Hp): protective acute-phase protein, which captures the haemoglobin when it is released into the plasma.

This leads to formation of the haptoglobin–haemoglobin complex, which represents a virtually irreversible non-covalent protein–protein interaction

Receptor CD163: macrophage scavenger receptor



LETTER

Nature 489,456–459 (20 September 2012)

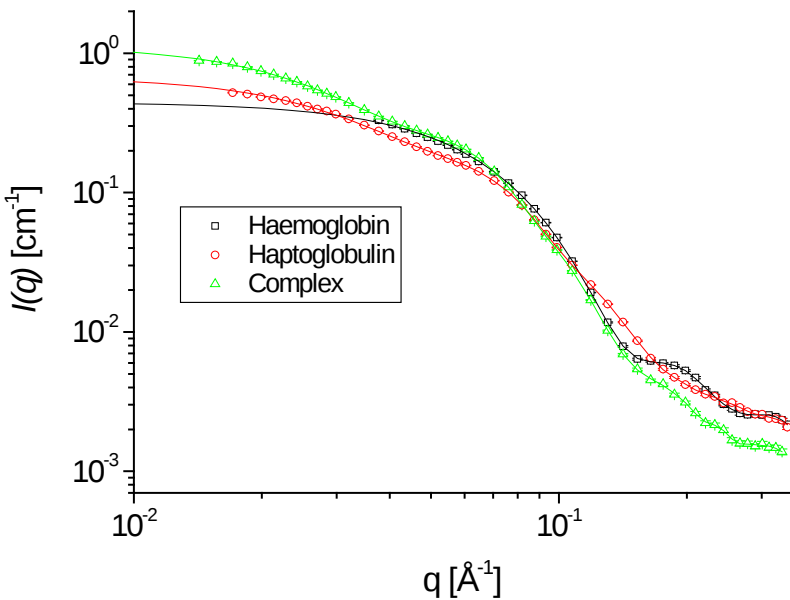
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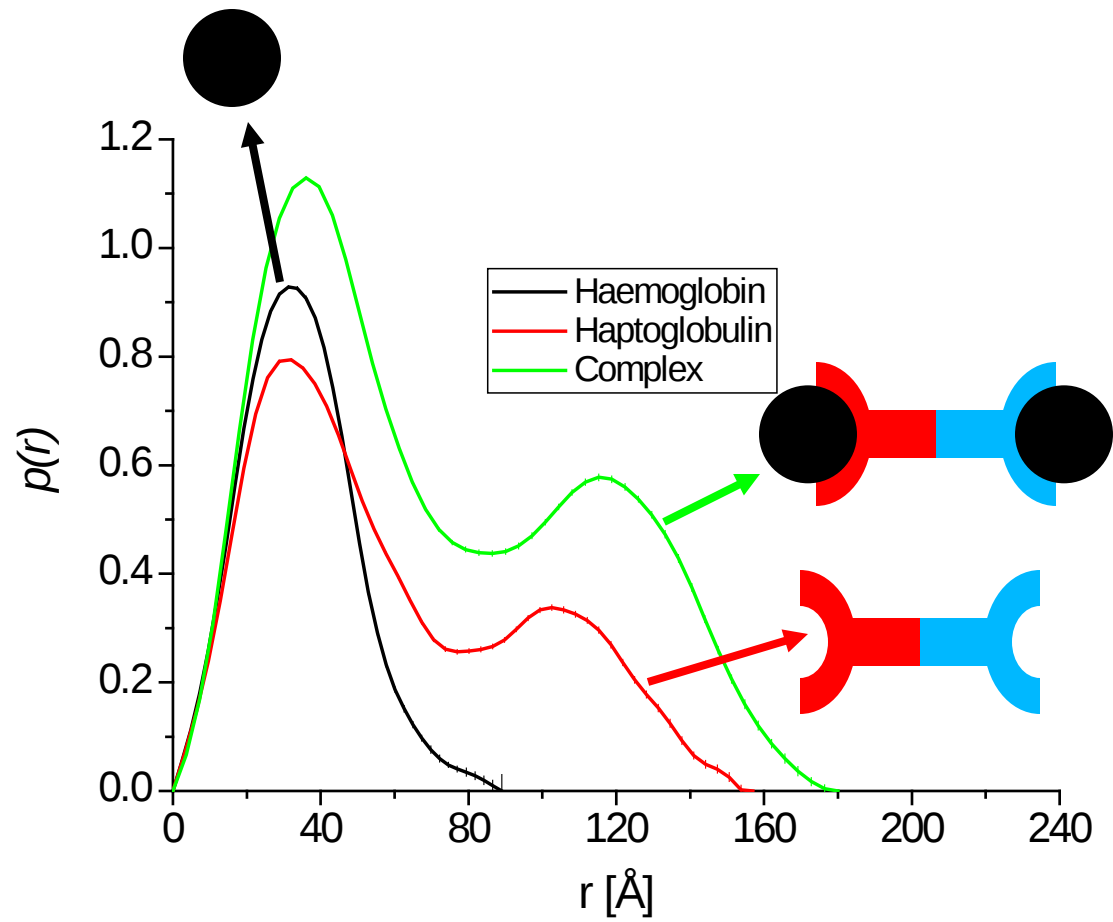
Christian Brix Folsted Andersen¹, Morten Torvund-Jensen¹, Marianne Jensby Nielsen¹, Cristiano Luis Pinto de Oliveira^{2,3}, Hans-Petter Hersleth⁴, Niels Højmark Andersen⁵, Jan Skov Pedersen³, Gregers Rom Andersen⁶ & Søren Kragh Moestrup¹

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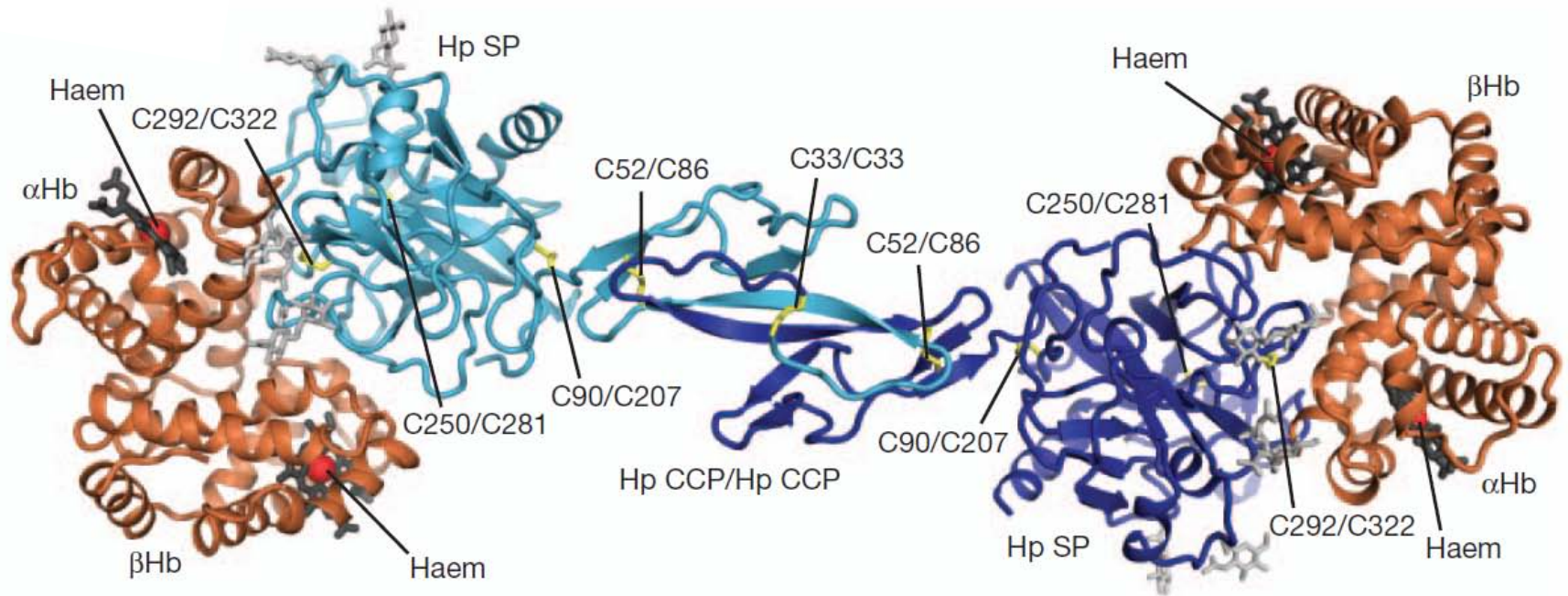
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Hemoglobin-Haptoglobin Complexes – SAXS investigations

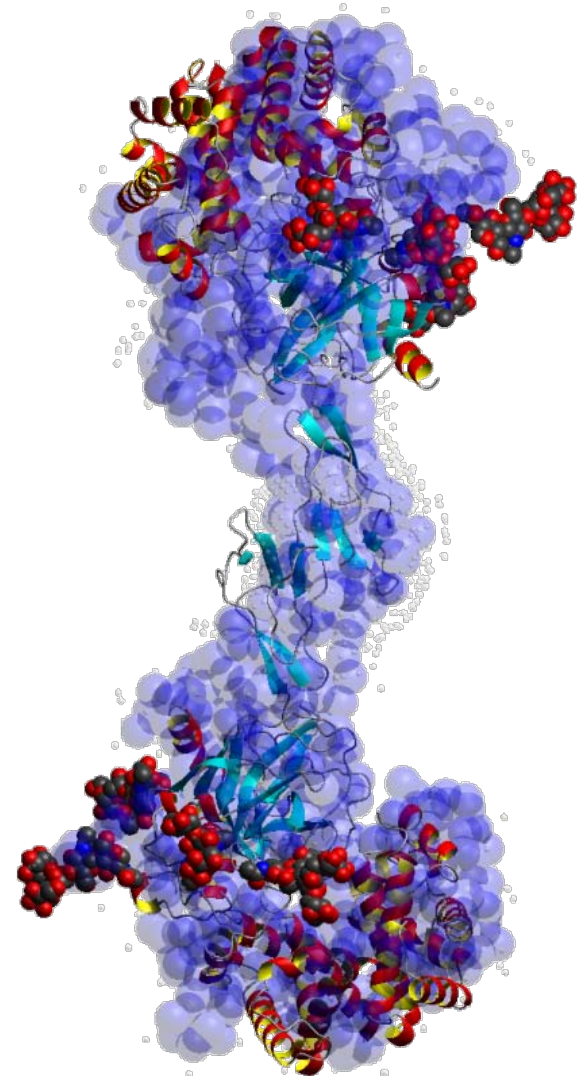
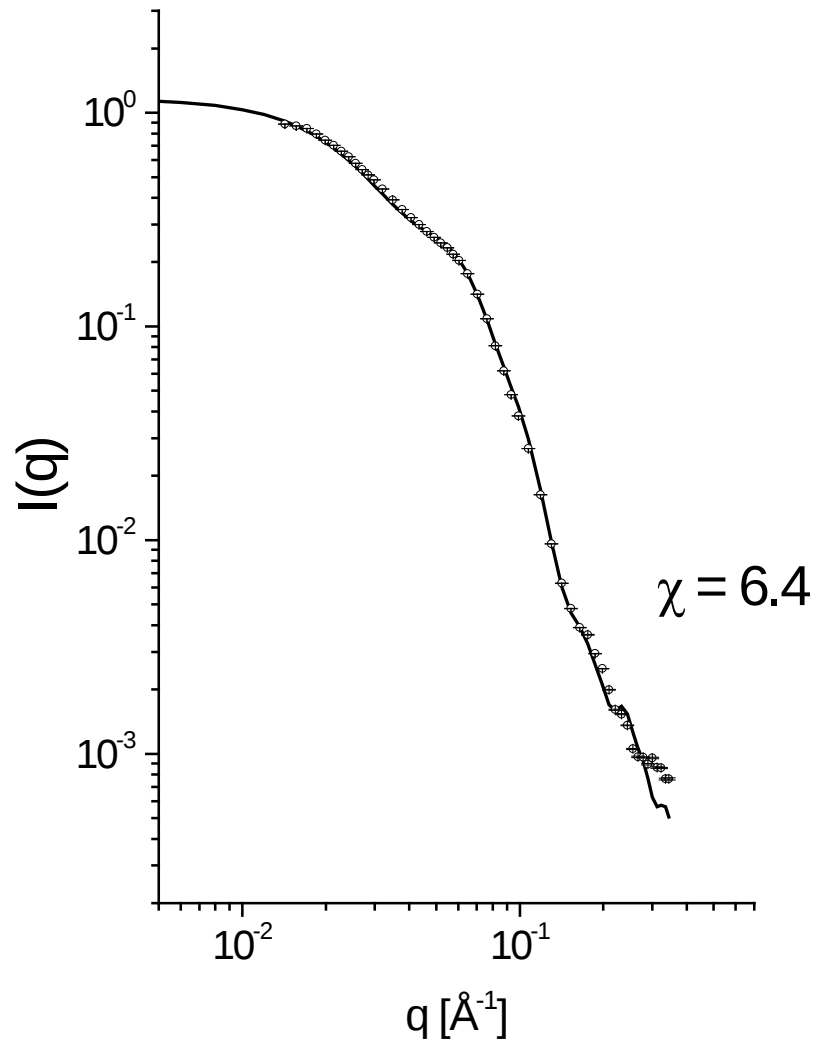
Which is the shape for the Hemoglobin, Haptoglobin and the Complex?



Protein Crystallography Results



SAXS Modeling and comparison with crystallographic structure



CD163 SRCR 1-5

α Hb

β Hb

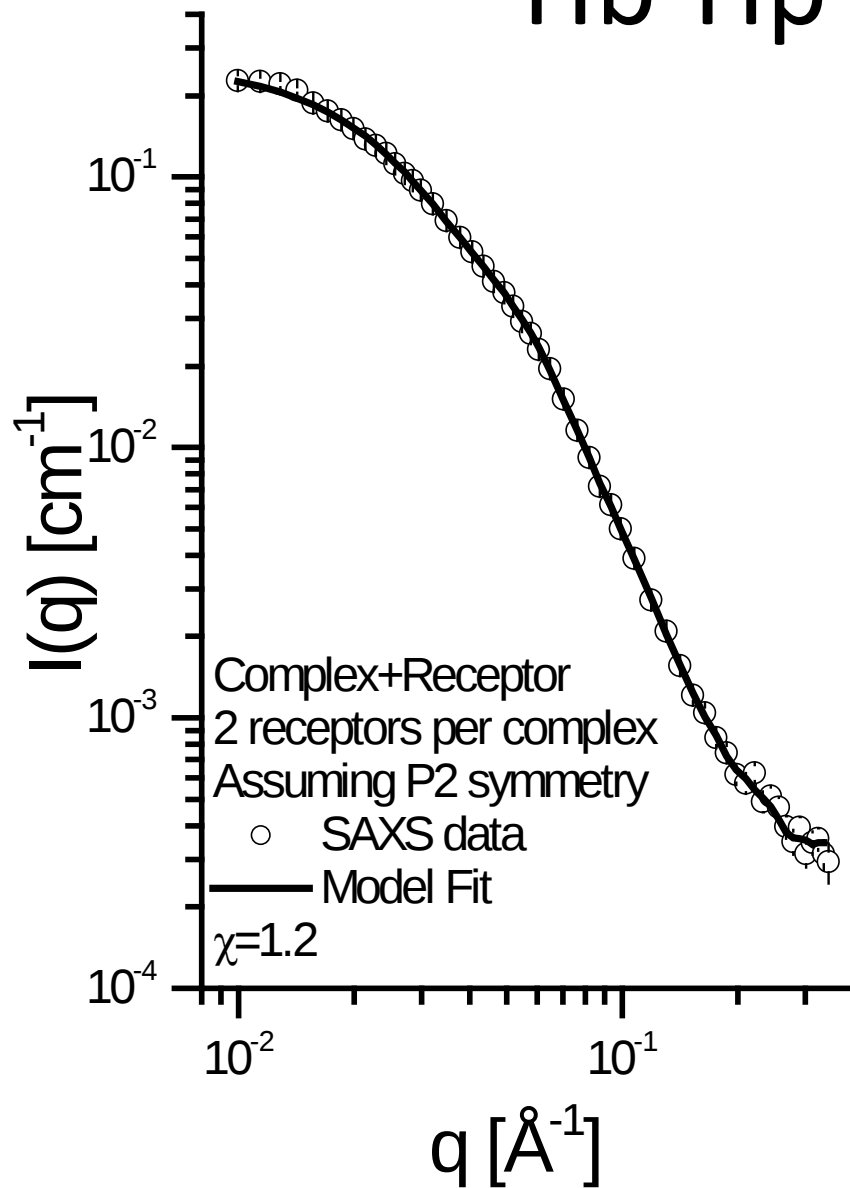
Hp SP

Hp CCP/Hp CCP

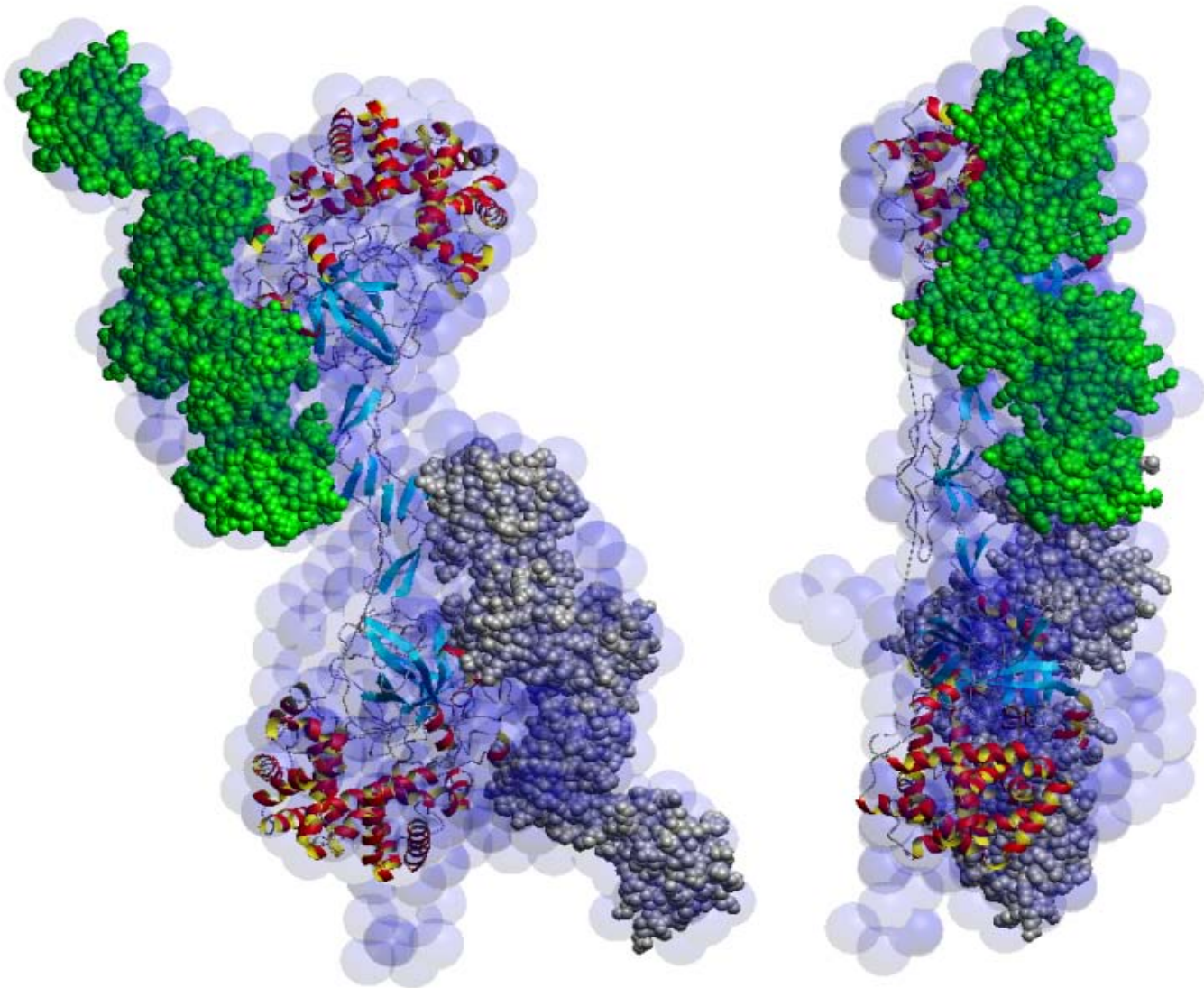
CD163 SRCR 1-5

α Hb

β Hb



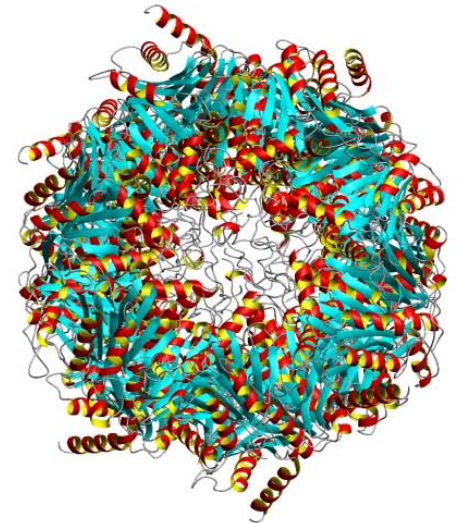
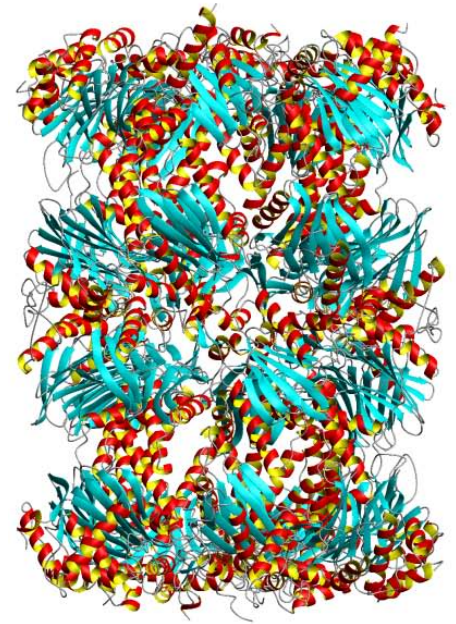
Hb-Hp+CD163



Proteasome Gating Control



The proteasome is a multimeric and multicatalytic intracellular protease responsible for the degradation of proteins involved in cell cycle control, various signaling processes, antigen presentation, and control of protein synthesis.



Redox Control of 20S Proteasome Gating

Gustavo M. Silva,^{1,2} Luis E.S. Netto,² Vanessa Simões,¹ Luiz F.A. Santos,³ Fabio C. Gozzo,³
Marcos A.A. Demasi,⁴ Cristiano L.P. Oliveira,⁵ Renata N. Bicev,⁵ Clécio F. Klitzke,⁶
Mari C. Sogayar,⁴ and Marilene Demasi¹

Redox Biology 2 (2014) 44–51



ELSEVIER

Contents lists available at ScienceDirect

Redox Biology

journal homepage: www.elsevier.com/locate/redox



Review Article

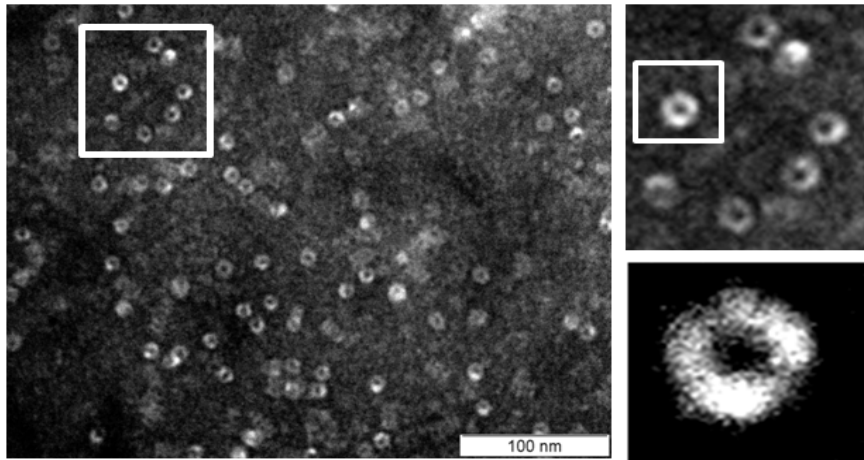
Redox regulation of the proteasome *via* S-glutathionylation[☆]

Marilene Demasi^{a,*}, Luis E.S. Netto^b, Gustavo M. Silva^{a,b,1}, Adrian Hand^a,
Cristiano L.P. de Oliveira^c, Renata N. Bicev^c, Fabio Gozzo^d, Mario H. Barros^e,
Janaina M.M. Leme^{a,b}, Erina Ohara^a

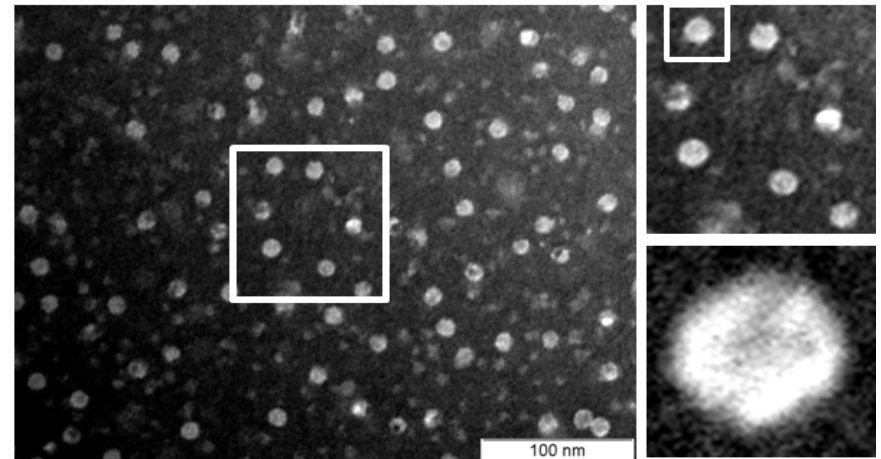


Proteasome Gating TEM studies

Native conditions
Plain Buffer

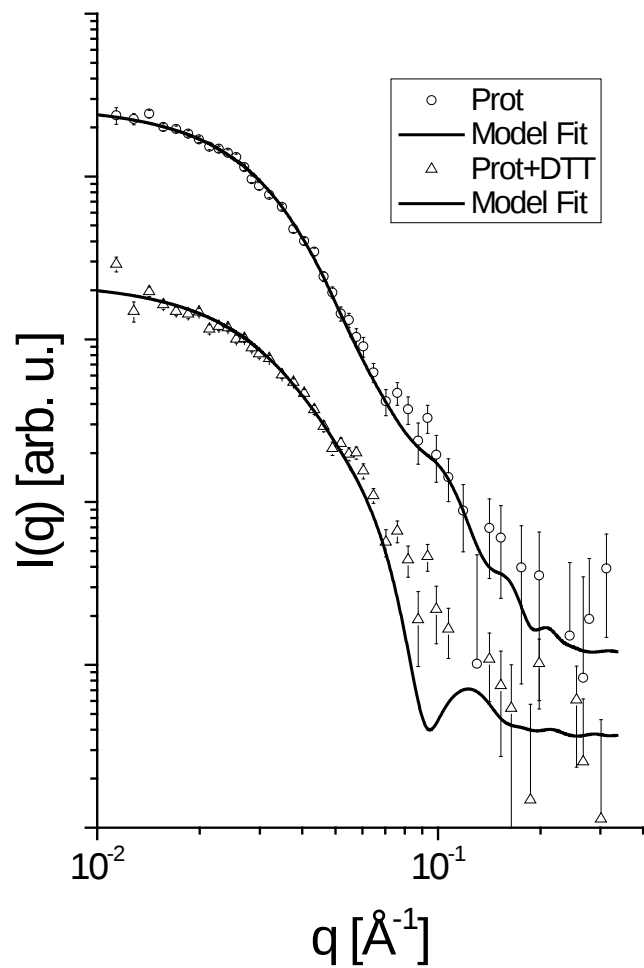


Plain Buffer + DTT

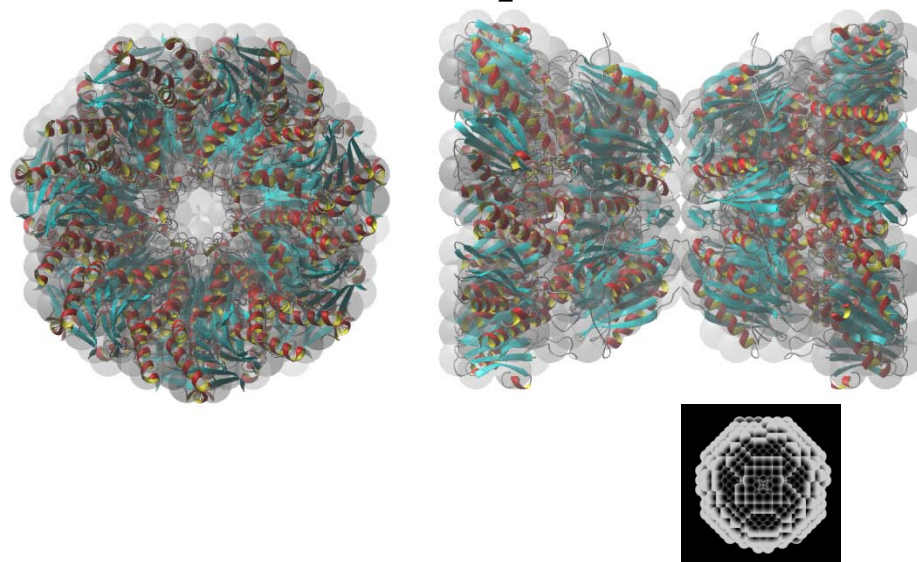


Solution Studies

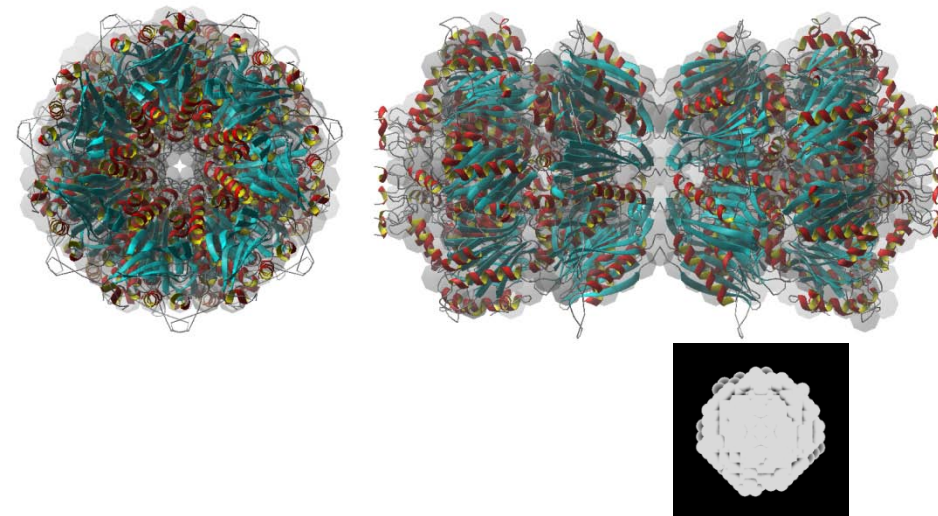
—————→ **SAXS**



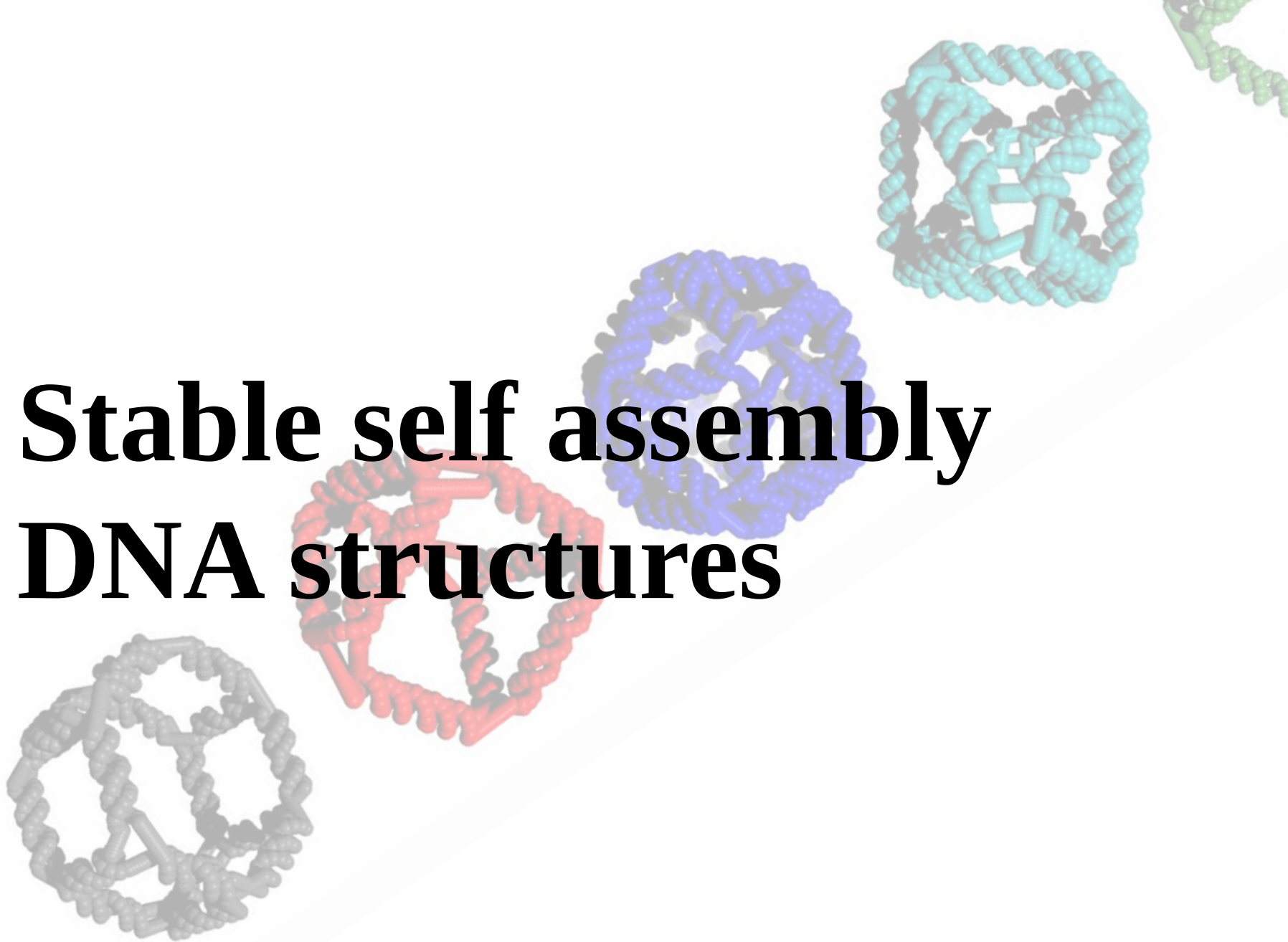
Model for native protein



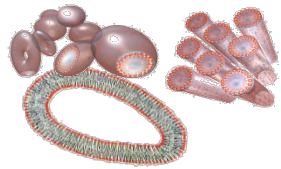
Model for Protein + DTT



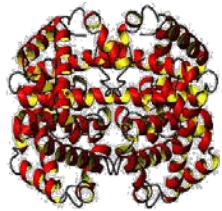
Stable self assembly DNA structures



Self Assembly in Nature

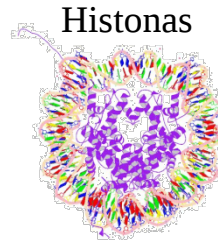


Surfactants and Lipids:
Micelles, vesicles, etc



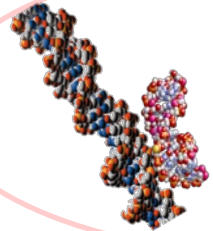
Aminoacids : Proteins,
Supramolecular complexes

Protein/DNA/RNA
Complexes

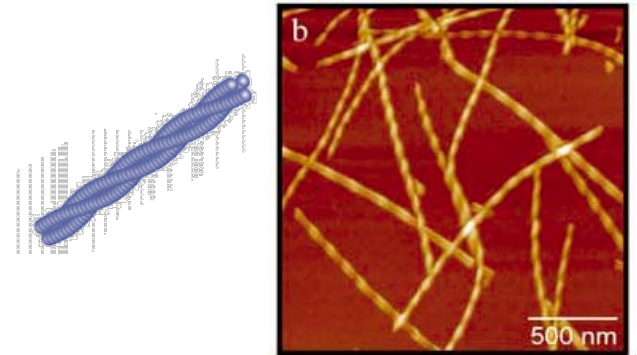


Histonas

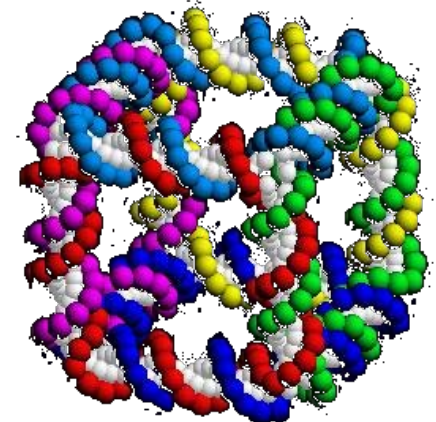
Nucleotides : DNA, RNA



Aggregation/Fibrillation

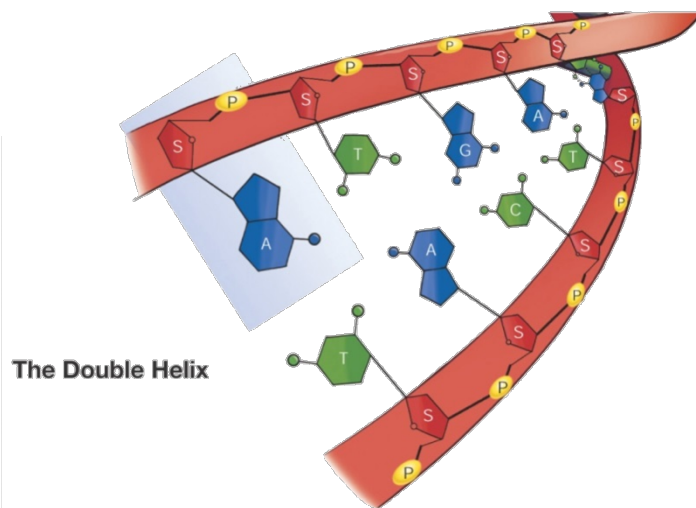
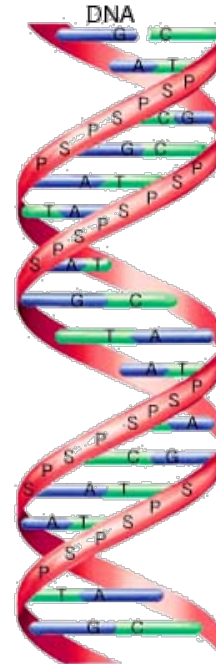


Controlled assembly of DNA



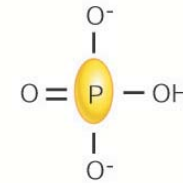
**Assembly strongly dependents on the
environment conditions!**

Winners of the Race to Learn DNA's Structure – Watson and Crick, 50's

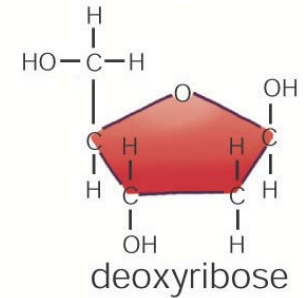


The Double Helix

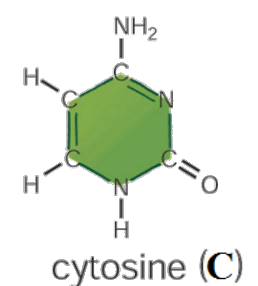
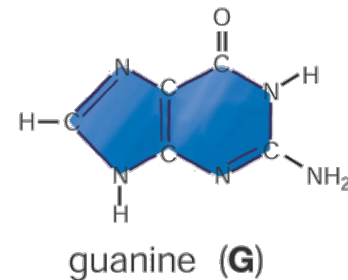
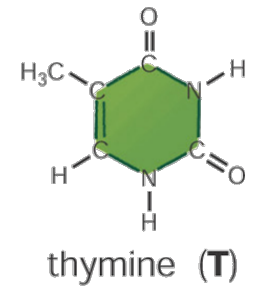
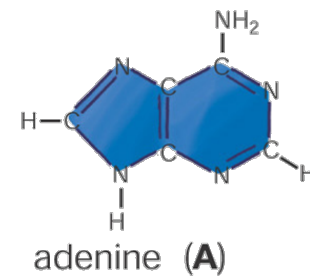
Phosphate group



Sugar



Bases



Simulative Analysis of a Truncated Octahedral DNA Nanocage Family Indicates the Single-Stranded Thymidine Linkers as the Major Player for the Conformational Variability

Francesco Oteri,[†] Mattia Falconi,[†] Giovanni Chillemi,[‡] Felicie F. Andersen,[§] Cristiano L.P. Oliveira,^{||,¶} Jan S. Pedersen,^{||} Birgitta R. Knudsen,[§] and Alessandro Desideri^{*,†,⊥}

VOL. 4 • NO. 3 • 1367–1376 • 2010 

Structure of Nanoscale Truncated Octahedral DNA Cages: Variation of Single-Stranded Linker Regions and Influence on Assembly Yields

Cristiano Luis Pinto Oliveira,^{*,¶} Sissel Juul,^{*,¶} Hanne Lærke Jørgensen,[‡] Bjarne Knudsen,[§] David Tordrup,[‡] Francesco Oteri,^{||} Mattia Falconi,^{||,⊥} Jørn Koch,^{||} Alessandro Desideri,^{||,⊥} Jan Skov Pedersen,[†] Felicie Faucon Andersen,^{*,*} and Birgitta Ruth Knudsen^{*,*}

VOL. 3 • NO. 7 • 1813–1822 • 2009 

Deciphering the Structural Properties That Confer Stability to a DNA Nanocage

Mattia Falconi,^{†,‡} Francesco Oteri,[†] Giovanni Chillemi,[§] Felicie F. Andersen,^{||} David Tordrup,^{||} Cristiano L. P. Oliveira,^{||} Jan S. Pedersen,^{||} Birgitta R. Knudsen,^{||} and Alessandro Desideri^{†,*,*}

Published online 20 December 2007

Nucleic Acids Research, 2008, Vol. 36, No. 4 1113–1119
doi:10.1093/nar/gkm1124

Assembly and structural analysis of a covalently closed nano-scale DNA cage

Felicie F. Andersen¹, Bjarne Knudsen², Cristiano Luis Pinto Oliveira³, Rikke F. Frøhlich¹, Dinna Krüger¹, Jörg Bungert⁴, Mavis Agbandje-McKenna⁴, Robert McKenna⁴, Sissel Juul¹, Christopher Veigaard¹, Jørn Koch⁵, John L. Rubinstein⁶, Bernt Guldbrandtsen⁷, Marianne S. Hede¹, Göran Karlsson⁸, Anni H. Andersen¹, Jan Skov Pedersen³ and Birgitta R. Knudsen^{1,*}

Joint Project

Prof. Cristiano L. P. Oliveira

PhD Student Cassio Alves – IFUSP

MsC Student Renata Bicev – IFUSP

Prof. Carla Columbano - IQUSP

Prof. Alessandro Desideri – Univ. Roma / Italy

Prof. Birgitta Knudsen – Univ. Aarhus / Denmark

Prof. Jan S. Pedersen – Univ. Aarhus / Denmark

Assembly / Simulation of new geometries

Automatic Sequence / Structure Generator

Combination of SAXS / TEM / MD / Molecular Biology



Modeling Method

research papers

Journal of
Applied
Crystallography

ISSN 1600-5767

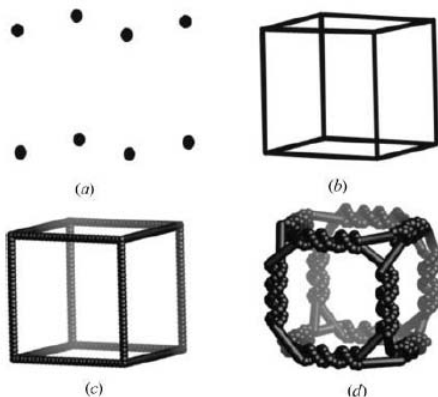
Received 17 May 2013

Accepted 17 October 2013

Modelling of nanoscale particles by small-angle scattering¹

Cassio Alves,^a Jan Skov Pedersen^b and Cristiano Luis Pinto Oliveira^{a*}

^aInstitute of Physics, University of São Paulo, Rua do Matão, 187, São Paulo, São Paulo, 05314-970, Brazil, and ^bDepartment of Chemistry, University of Aarhus, Gustav Wieds Vej 14, Aarhus, DK-8000 C, Denmark. Correspondence e-mail: crislpo@if.usp.br

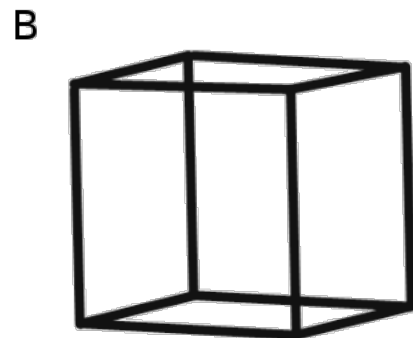
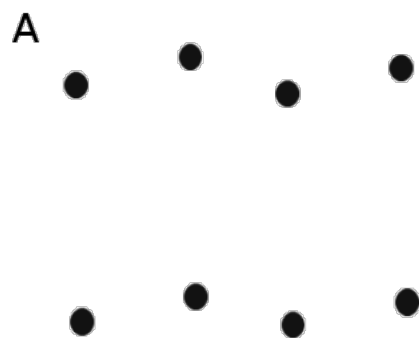


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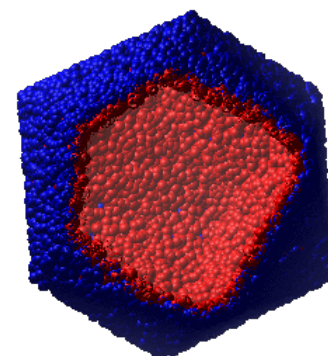
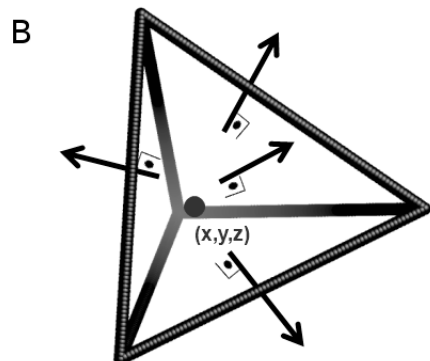
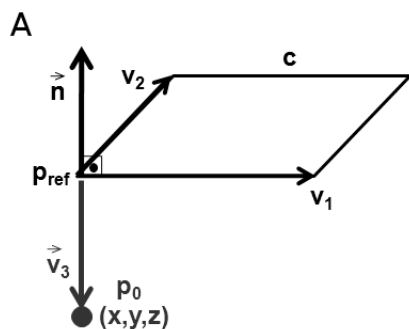
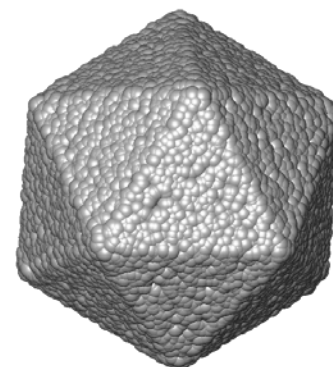
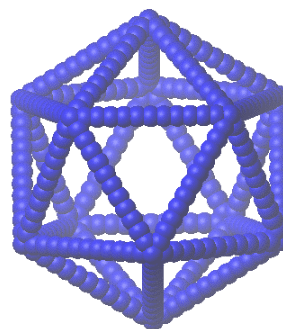
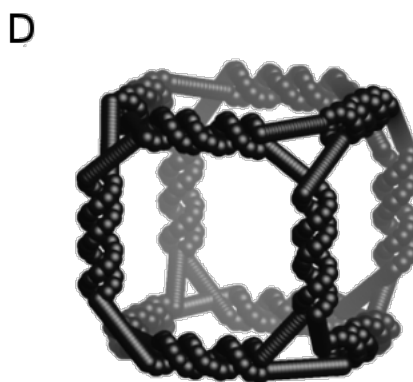
J. Appl. Cryst. (2014). 47
[doi:10.1107/S1600576713028549]

in press

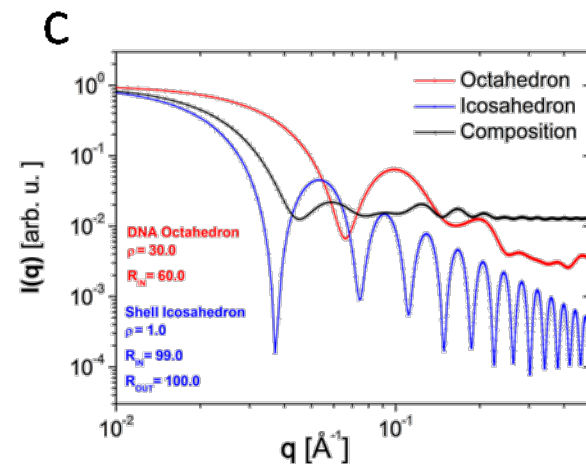
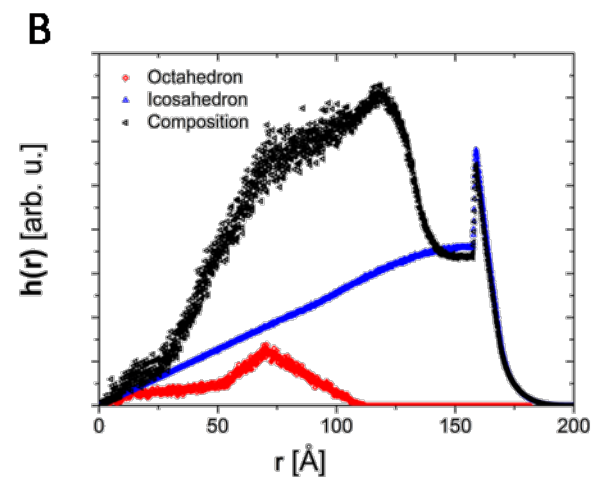
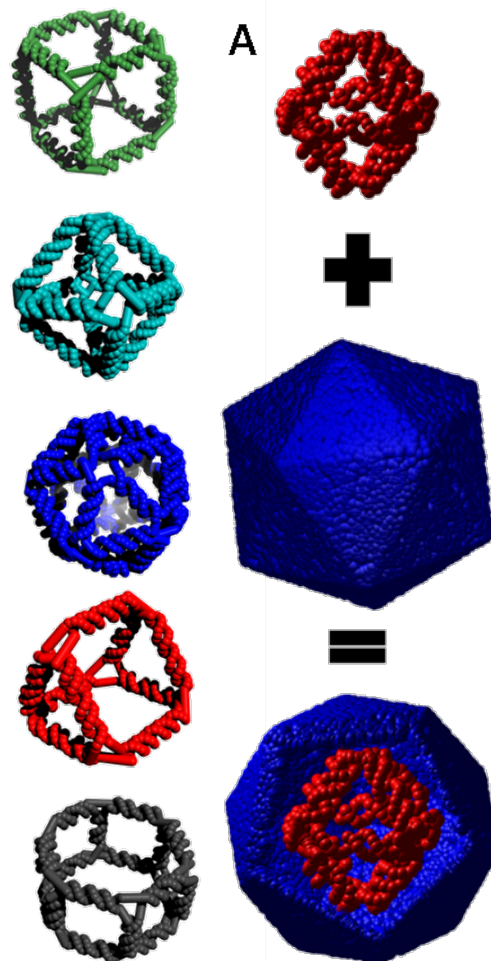
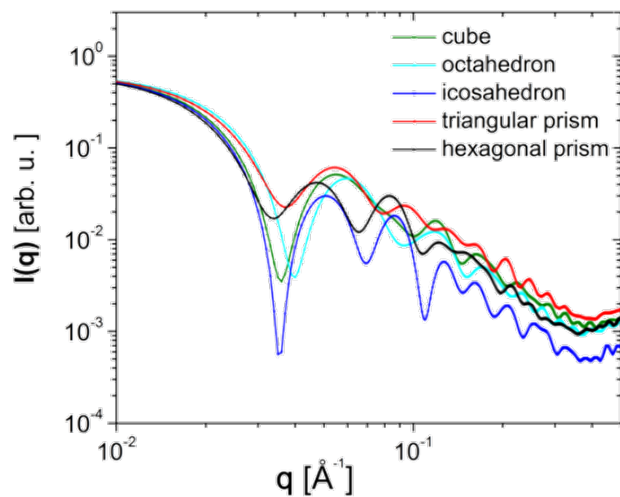
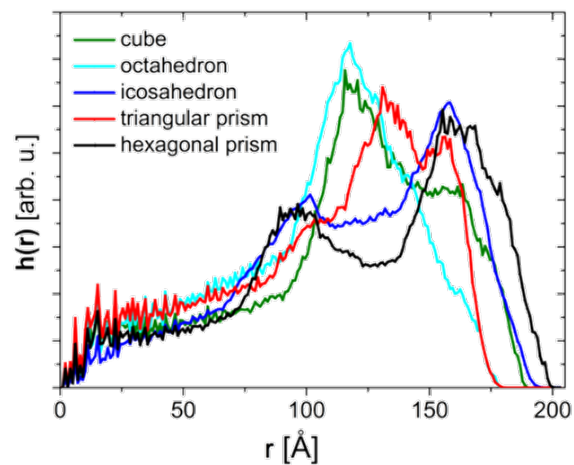
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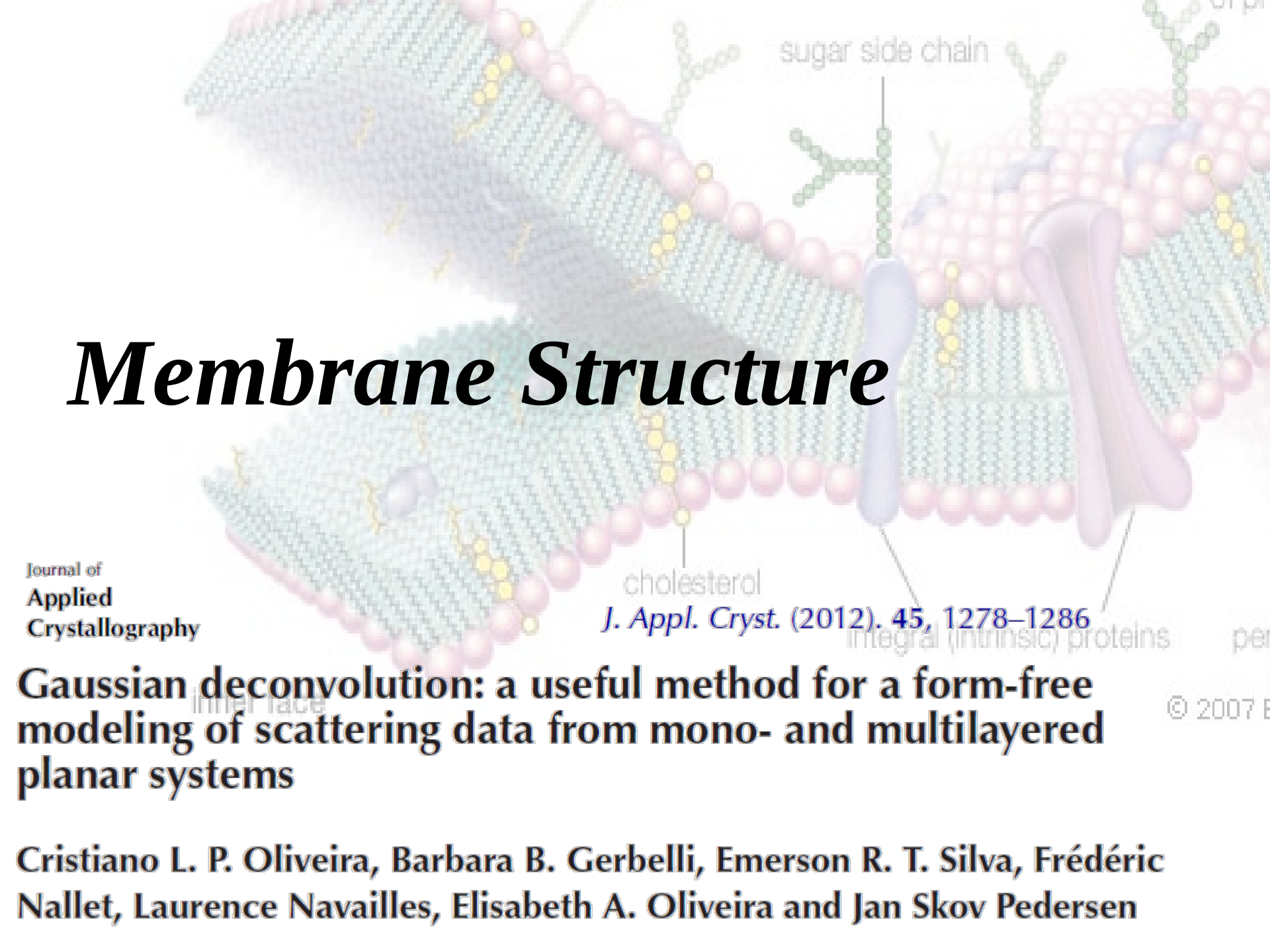


SAXS Modeling



SAXS Simulation





Membrane Structure

Journal of
Applied
Crystallography

J. Appl. Cryst. (2012). **45**, 1278–1286

integral (intrinsic) proteins

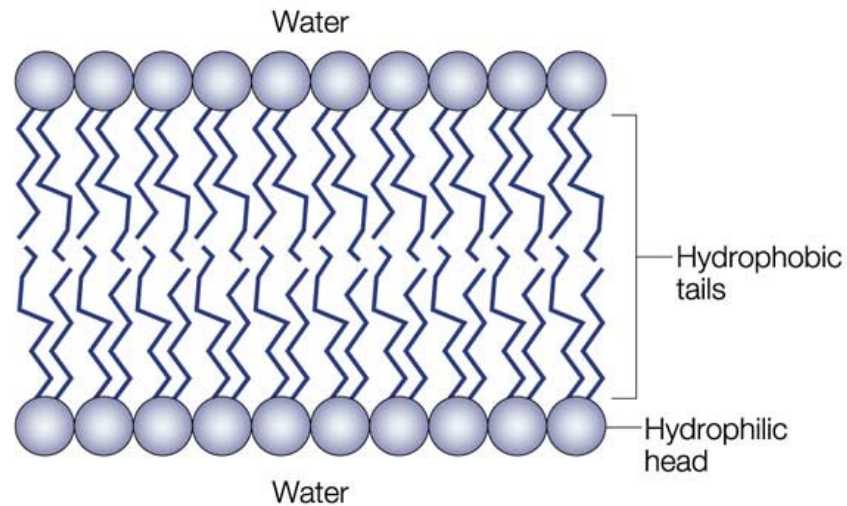
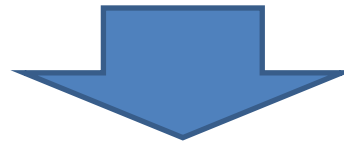
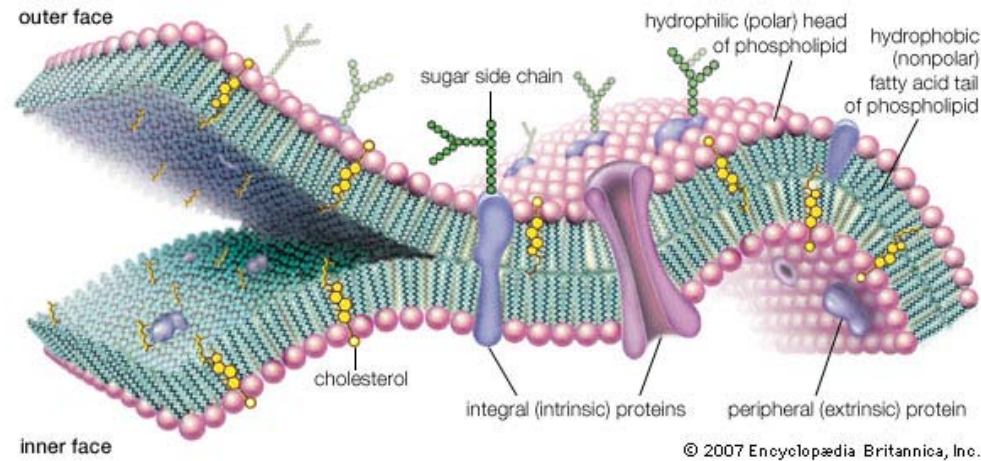
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© 2007 B

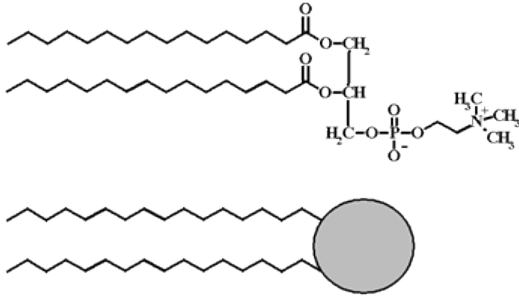
Gaussian deconvolution: a useful method for a form-free modeling of scattering data from mono- and multilayered planar systems

Cristiano L. P. Oliveira, Barbara B. Gerbelli, Emerson R. T. Silva, Frédéric Nallet, Laurence Navailles, Elisabeth A. Oliveira and Jan Skov Pedersen

Model Membranes



Model Membranes



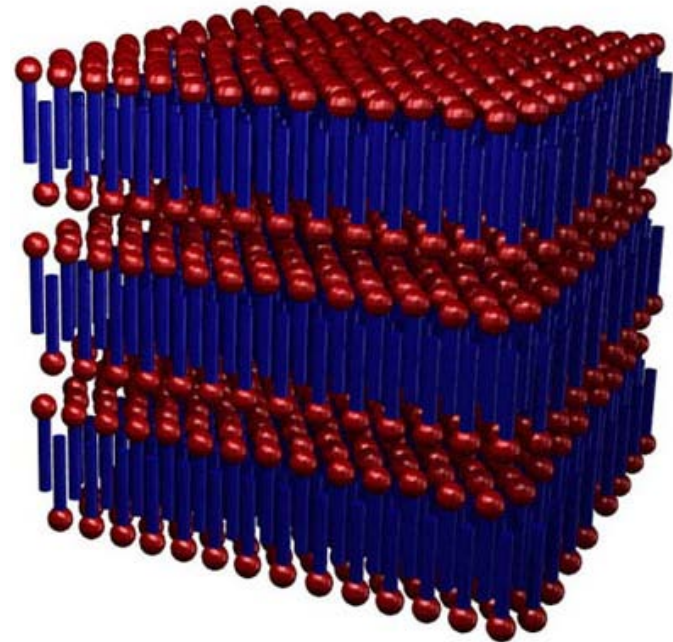
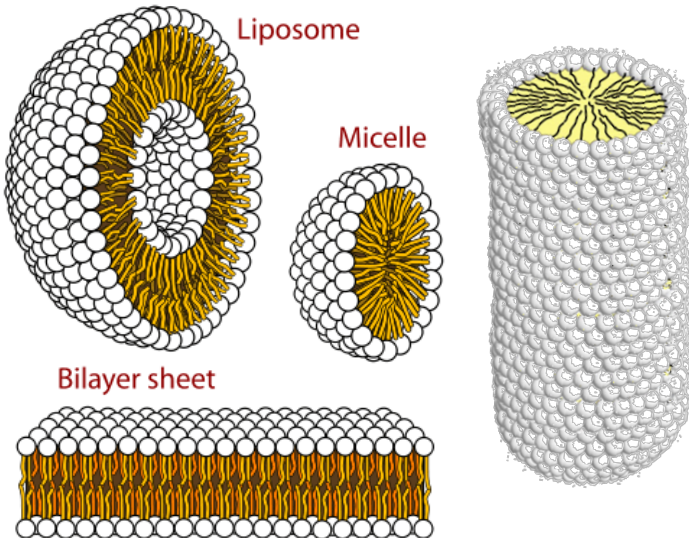
Vesicles / Liposomes



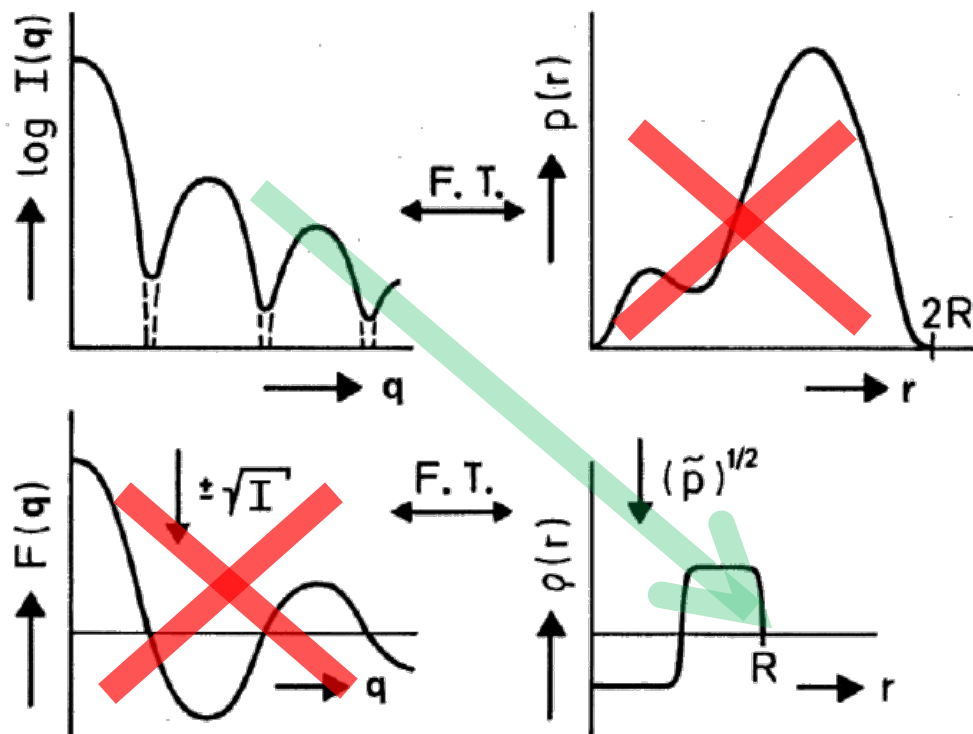
Unilamellar



Multi-lamellar



New Modeling Method



- Full curve fitting by the simultaneous modeling of the form factor and structure factor
- Direct modeling of the electron density profile with a high level of detail

research papers

JAC (2012), 45, 1278-1286

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Gaussian deconvolution: a useful method for a form-free modeling of scattering data from mono- and multilayered planar systems

Cristiano L. P. Oliveira,* Barbara B. Gerbelli, Emerson R. T. Silva, Frédéric Nallet, Laurence Navailles, Elisabeth A. Oliveira and Jan Skov Pedersen

Model stabilized by the point of inflection method

Received 25 June 2012
Accepted 6 October 2012

Gaussian deconvolution: a useful method for a form-free modeling of scattering data from mono- and multilayered planar systems

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Received 25 June 2012
Accepted 6 October 2012

Langmuir

Article

pubs.acs.org/Langmuir

(2012), *Langmuir* 28(31): 11535-11545

Correlation of the Physicochemical and Structural Properties of pDNA/Cationic Liposome Complexes with Their *in Vitro* Transfection

Tiago A. Balbino,[†] Antônio A. M. Gasperini,[‡] Cristiano L. P. Oliveira,[§] Adriano R. Azzoni,^{||} Leide P. Cavalcanti,[‡] and Lucimara G. de La Torre^{*,†}

Chemical Engineering Journal 226 (2013) 423-433



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Continuous flow production of cationic liposomes at high lipid concentration in microfluidic devices for gene delivery applications



Tiago A. Balbino^a, Nayla T. Aoki^a, Antonio A.M. Gasperini^b, Cristiano L.P. Oliveira^c, Adriano R. Azzoni^d, Leide P. Cavalcanti^b, Lucimara G. de la Torre^{a,*}

Langmuir

Article

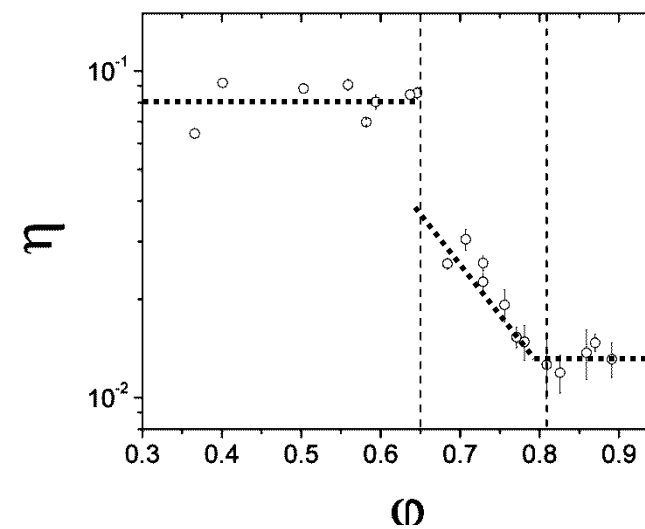
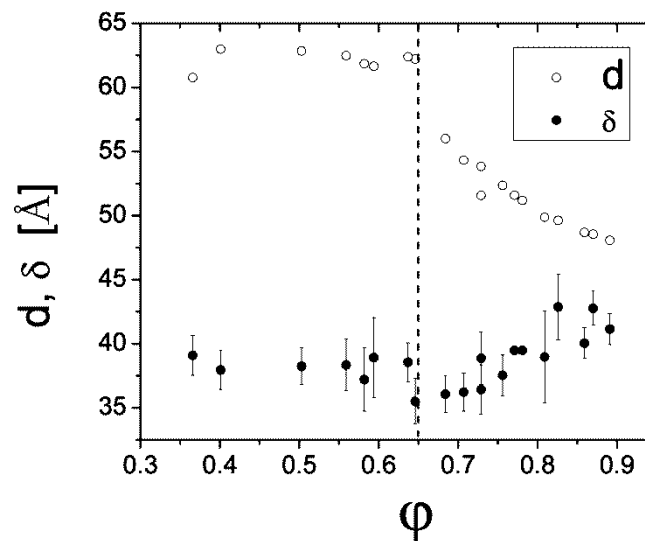
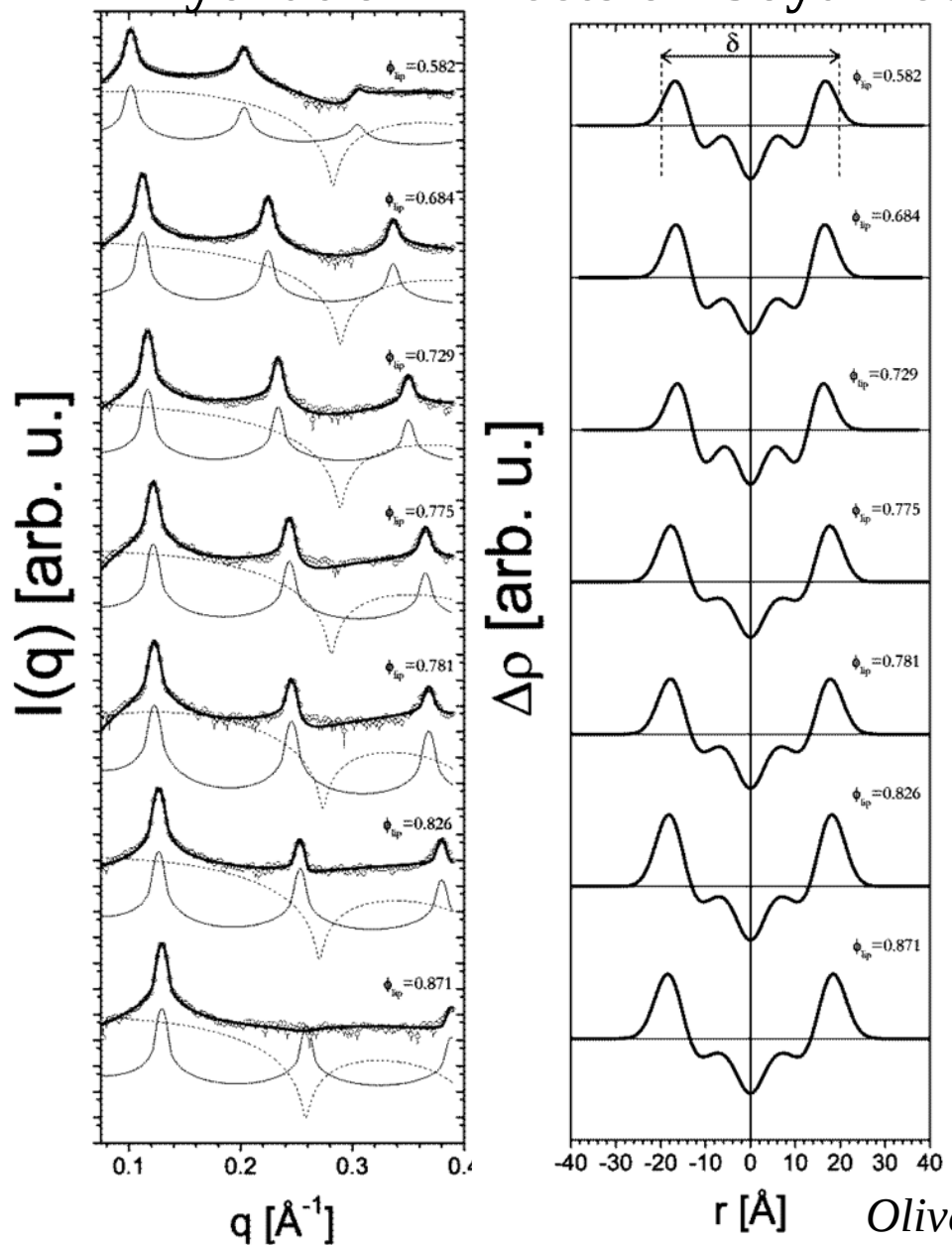
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Langmuir 2013, 29, 13717-13722

Steric-Induced Effects on Stabilizing a Lamellar Structure

Barbara B. Gerbelli,[†] Rafael L. Rubim,[†] Emerson R. Silva,^{†,§} Frédéric Nallet,[‡] Laurence Navailles,[‡] Cristiano L. P. Oliveira,[†] and Elisabeth A. de Oliveira^{*,†}

Hydration Effects on Soya Lectina – NANOSTAR IFUSP

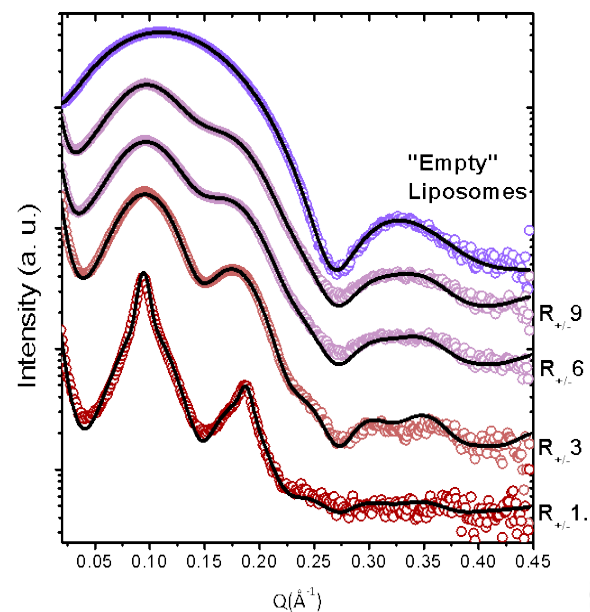


(2012), *Langmuir* 28(31): 11535-11545

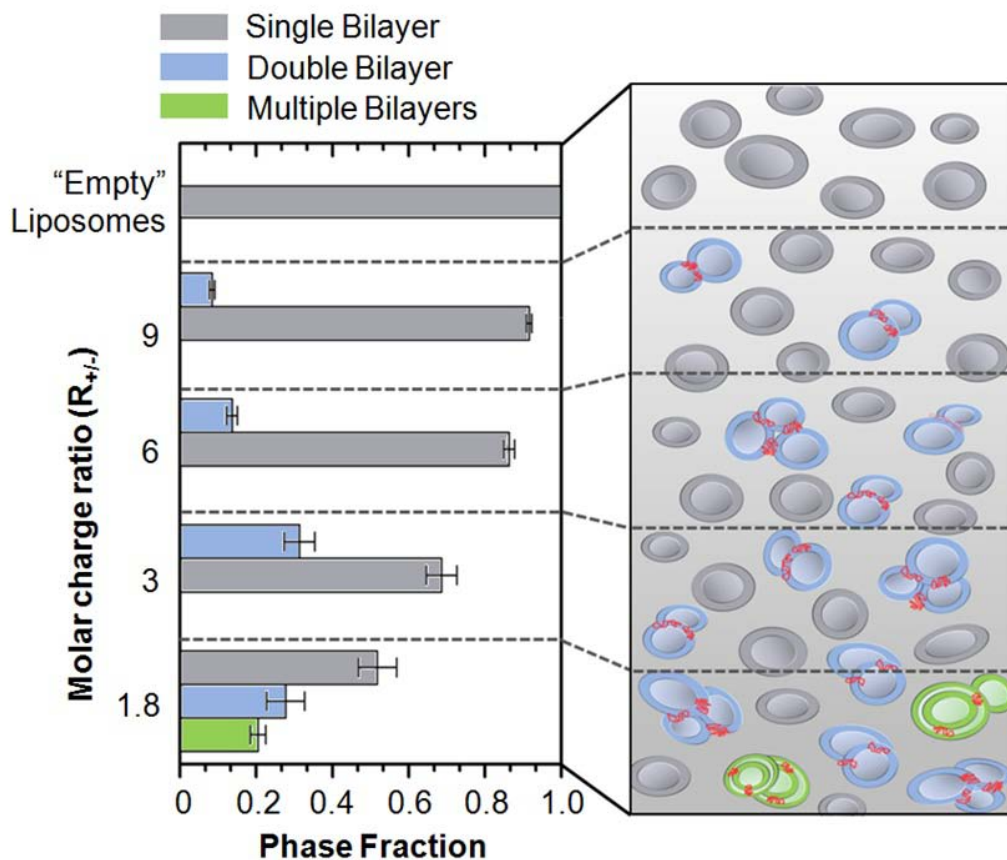
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Leide P. Cavalcanti,[‡] and Lucimara G. de La Torre^{*,†}

Data Collected at LNLS



Increase in DNA content

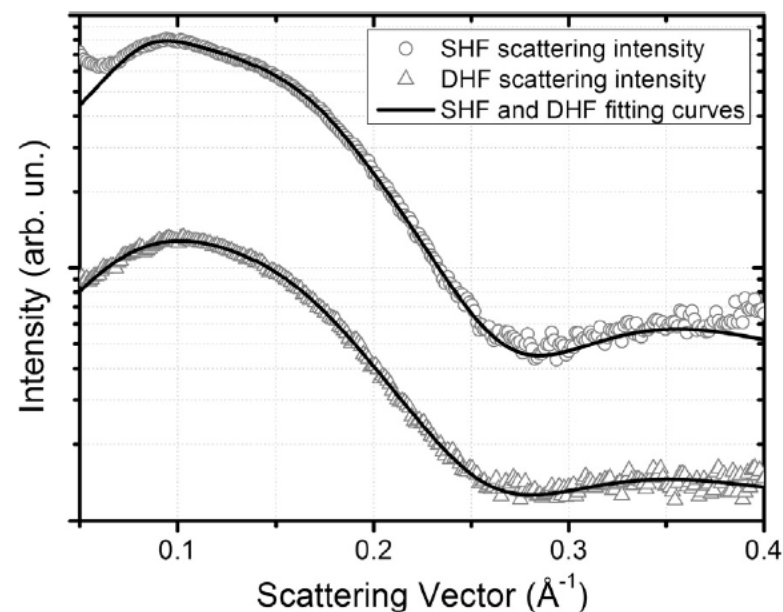
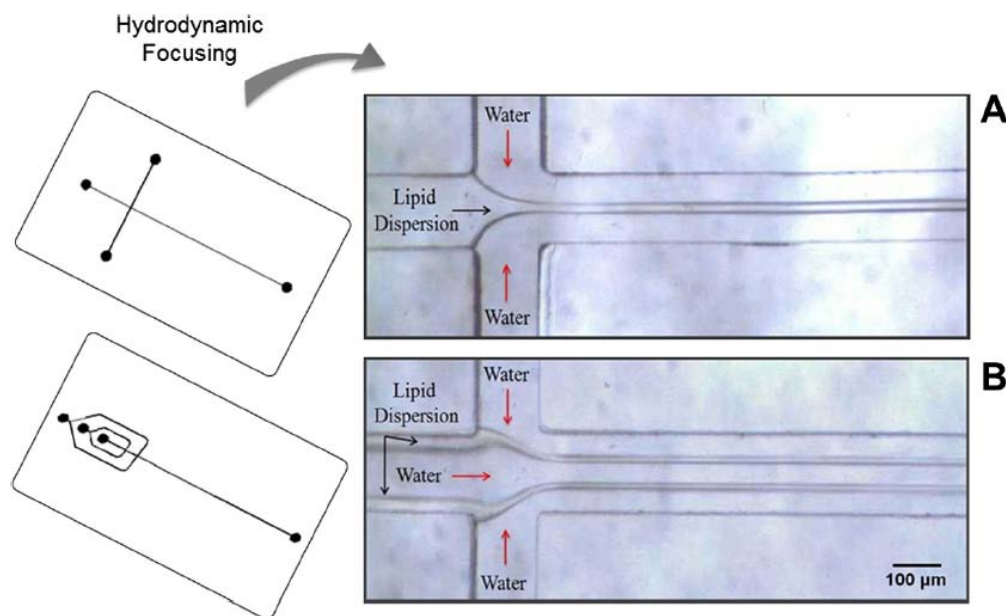


Increase in DNA content



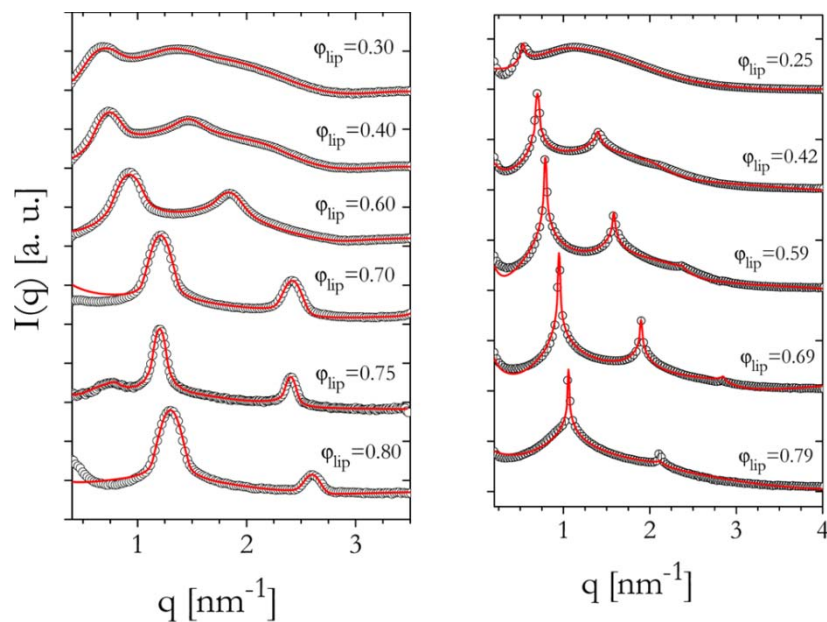
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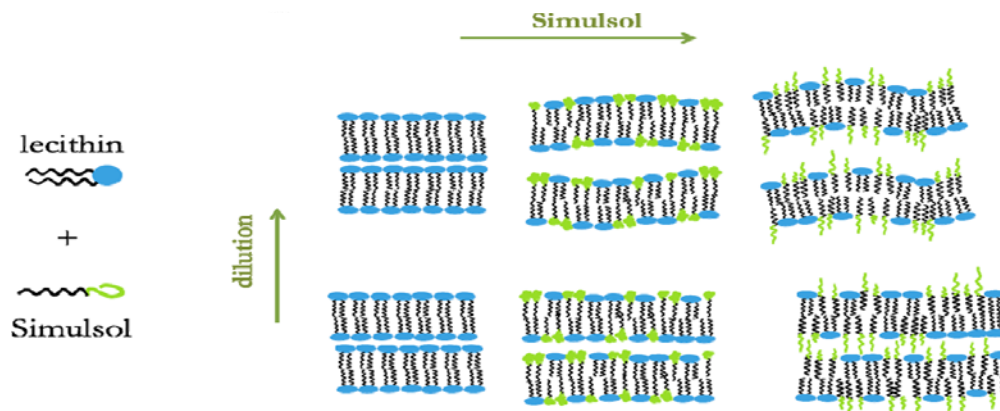
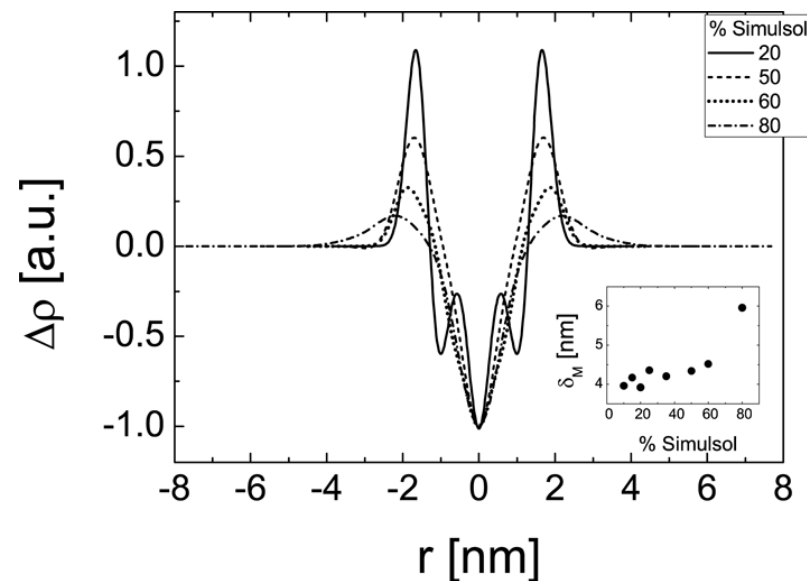


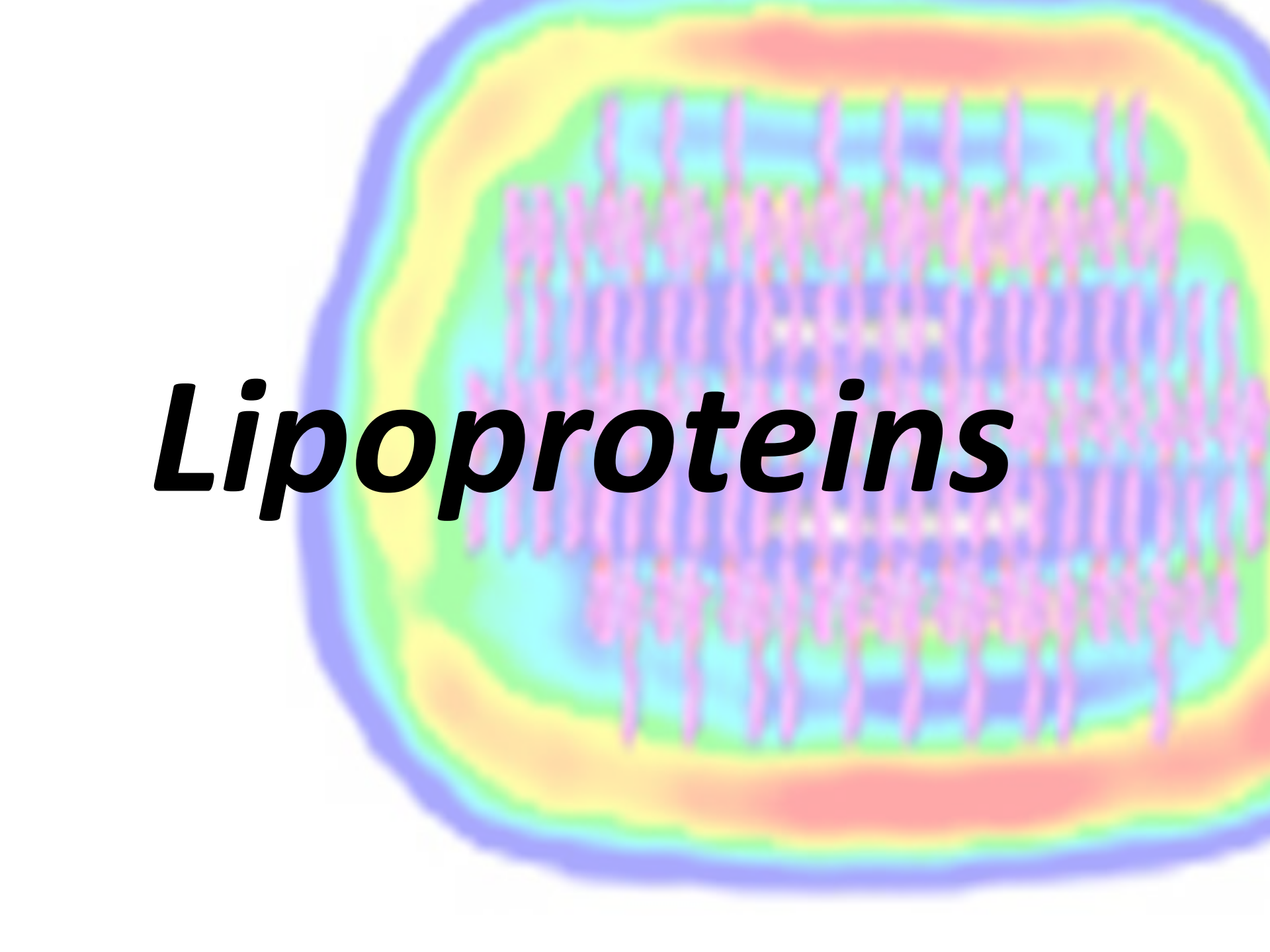
Steric-Induced Effects on Stabilizing a Lamellar Structure

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(a)





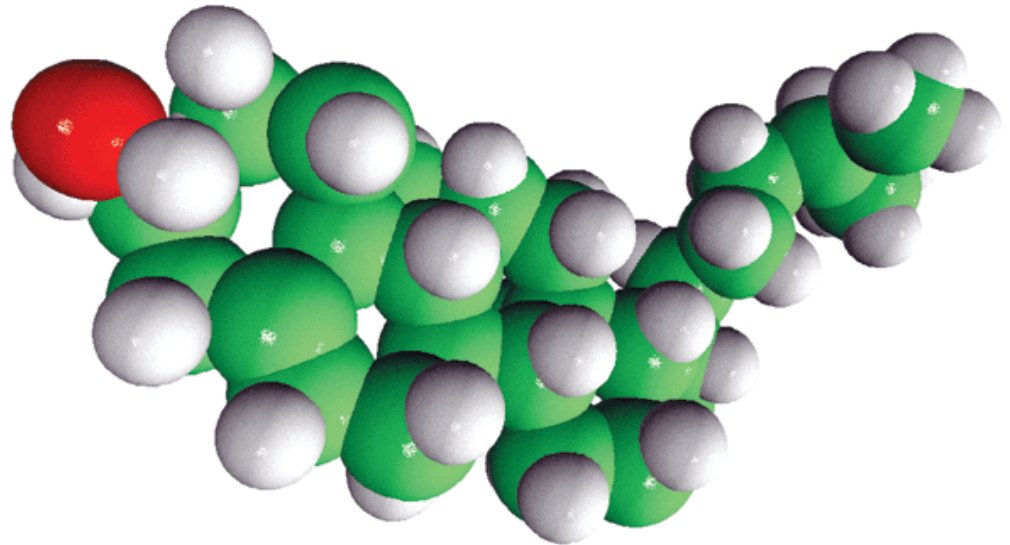
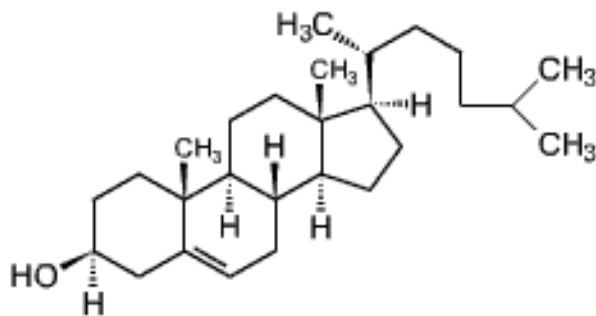
Lipoproteins

Motivation

Low-Density Lipoproteins → LDL

High-Density Lipoproteins → HDL

Main carrier of cholesterol, playing a critical role in the human cholesterol metabolism

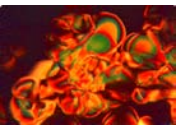


World Health Organization

Risk factor to cardiovascular diseases (atherosclerosis)

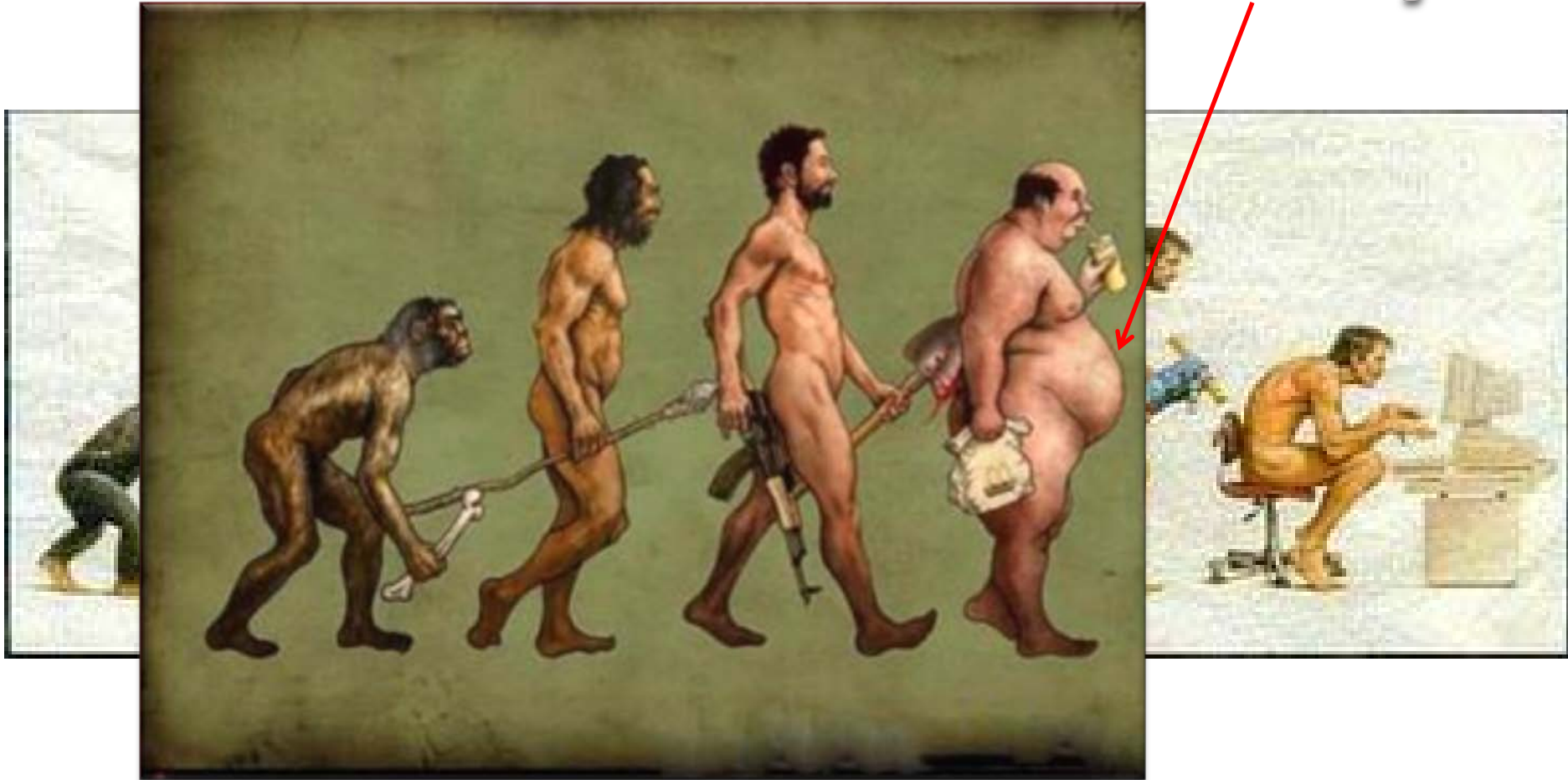
- **Abnormal blood lipids**

High total cholesterol, LDL-cholesterol and triglyceride levels, and low levels of HDL cholesterol increase risk of coronary heart disease and ischaemic stroke.



The life style

Visceral obesity



← HDL 

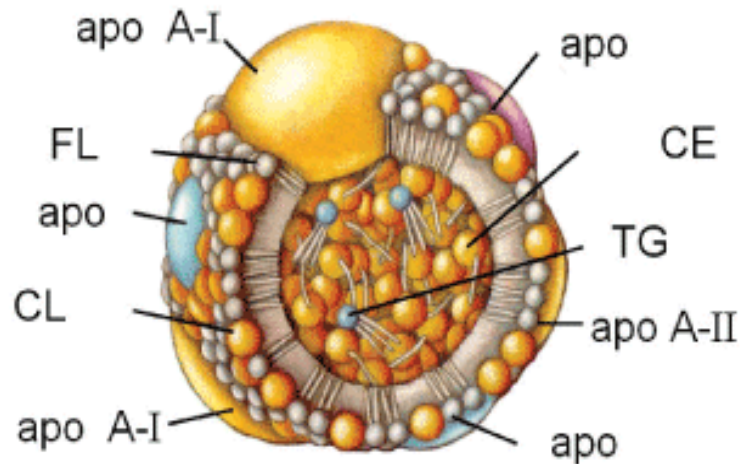
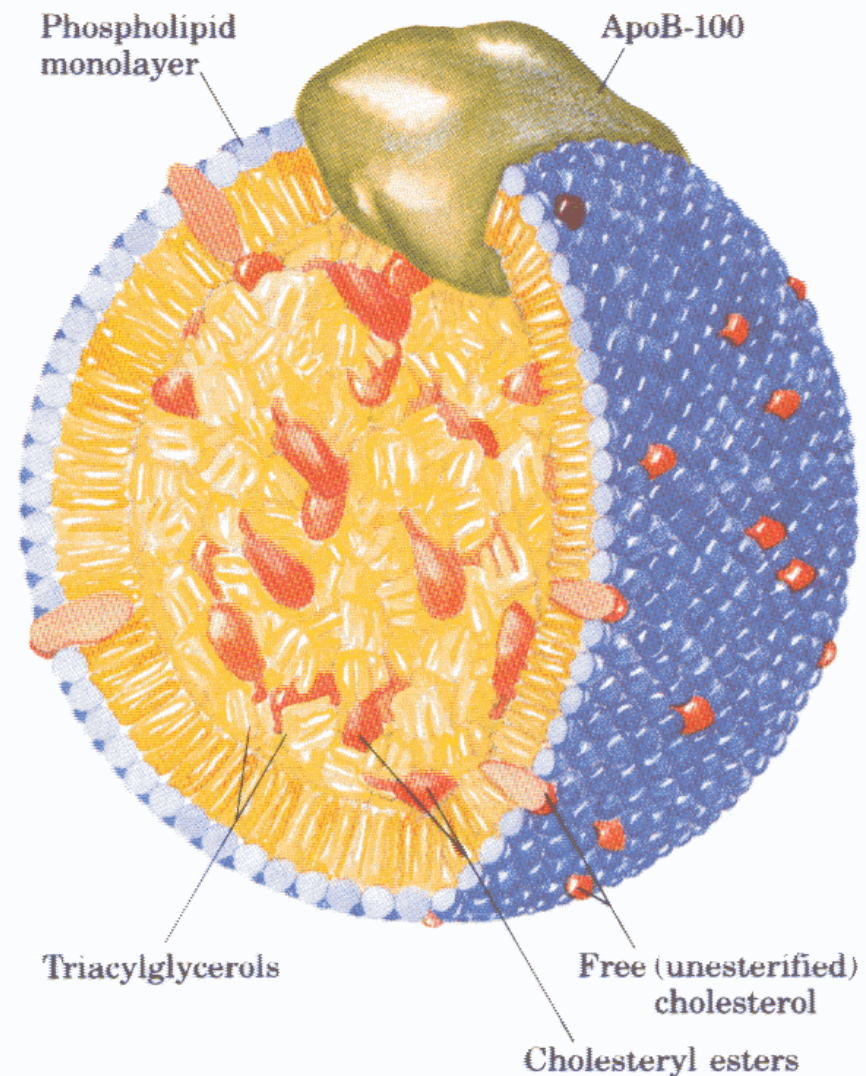
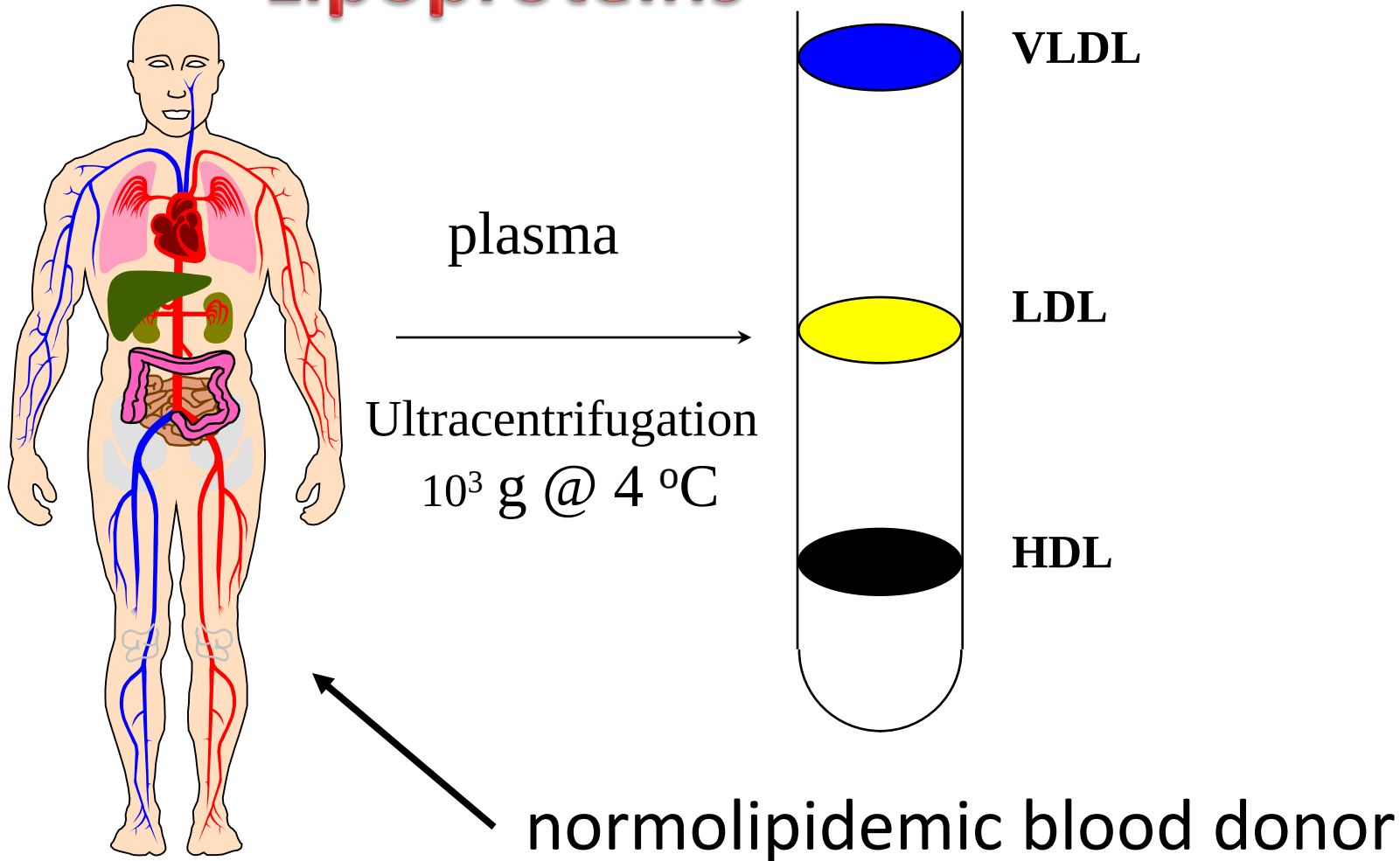


Fig. 1 - Constituição da lipoproteína de alta densidade (HDL).
 FL = fosfolípides; apo = apoproteína; CL = colesterol; CE = colesterol esterificado; TG = triglicérides.



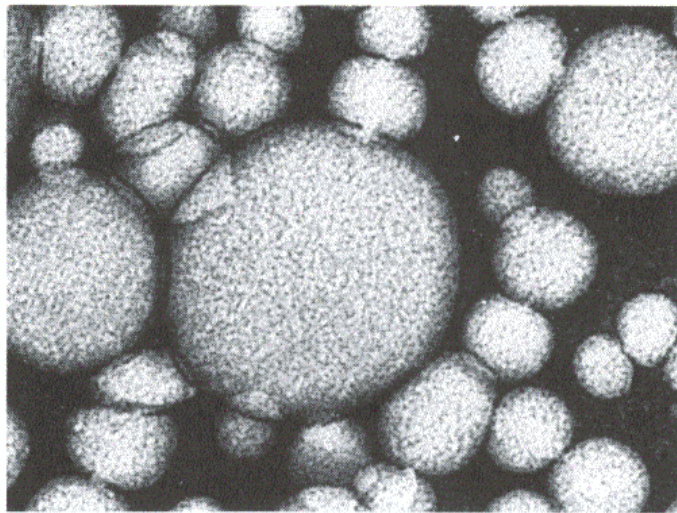
LDL →

Sample preparation: Lipoproteins

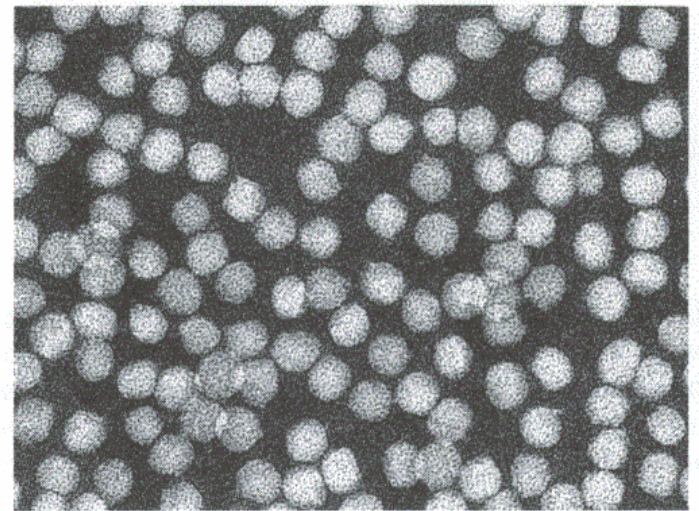


~~(volunteer)~~

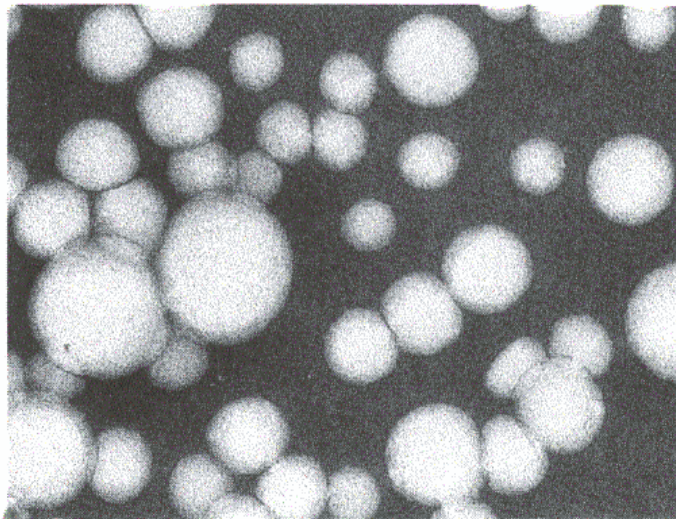
(student!)



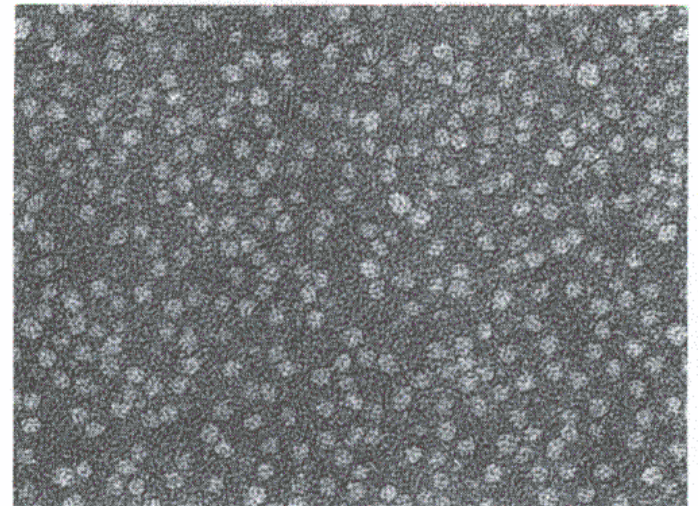
Chylomicrons ($\times 60,000$)



LDL ($\times 180,000$)

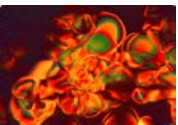


VLDL ($\times 180,000$)



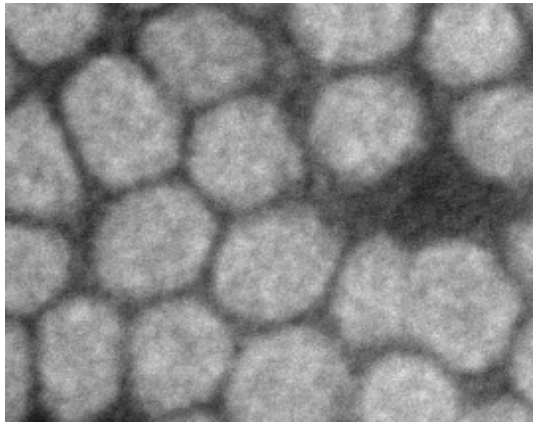
HDL ($\times 180,000$)

(b)

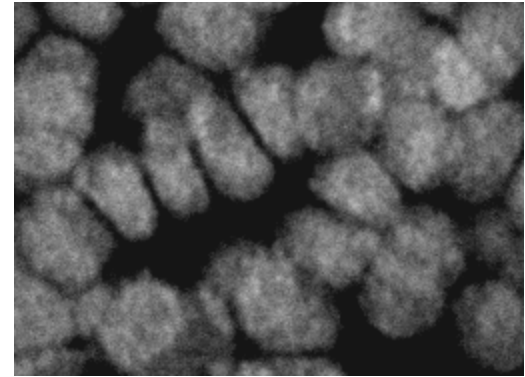


The oxidation of the LDL

“Normal” state

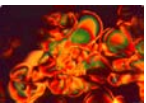


Disease state

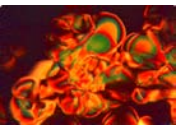
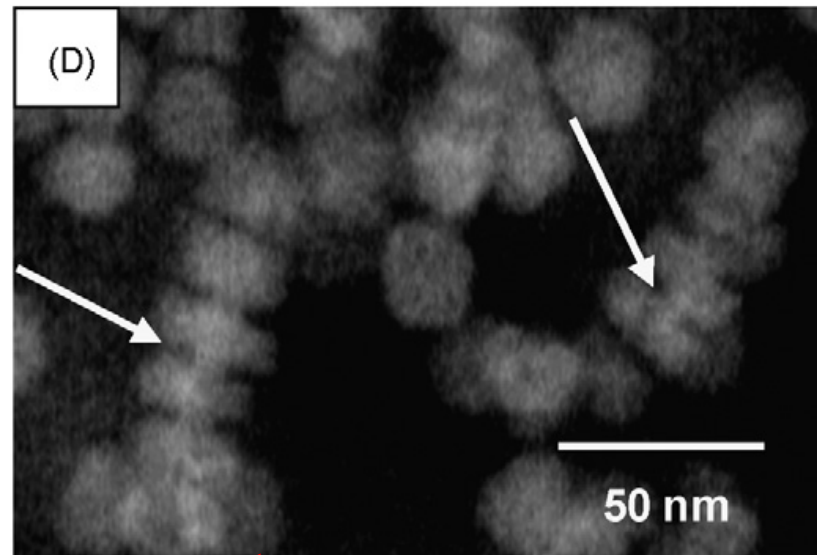
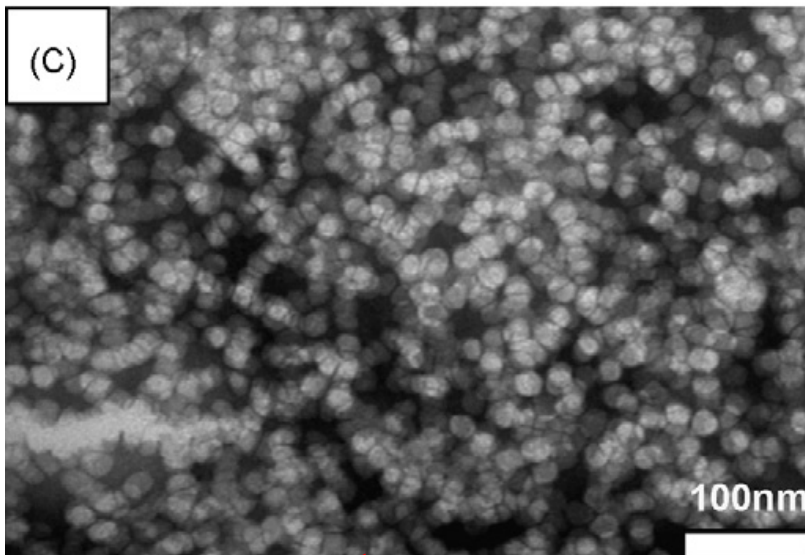
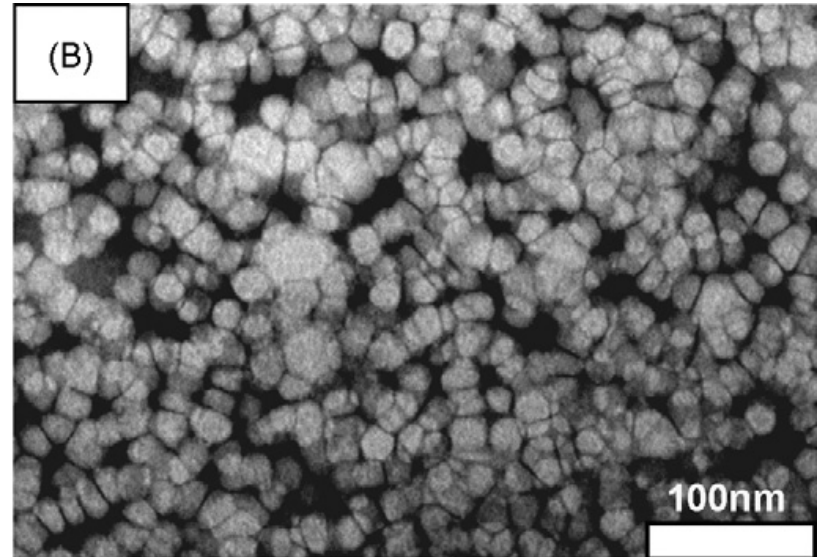
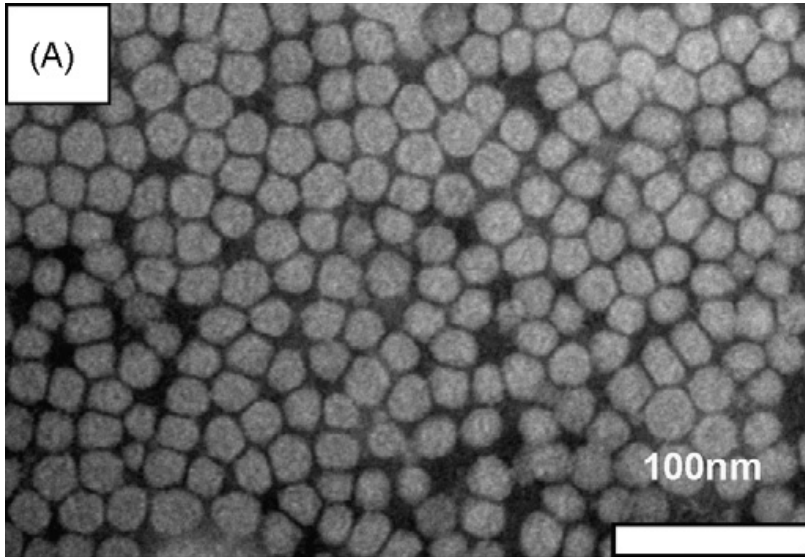


oxidized LDL - oxLDL
or moLDL

oxLDL induces the formation of aggregates



native → TEM images → CuLDL

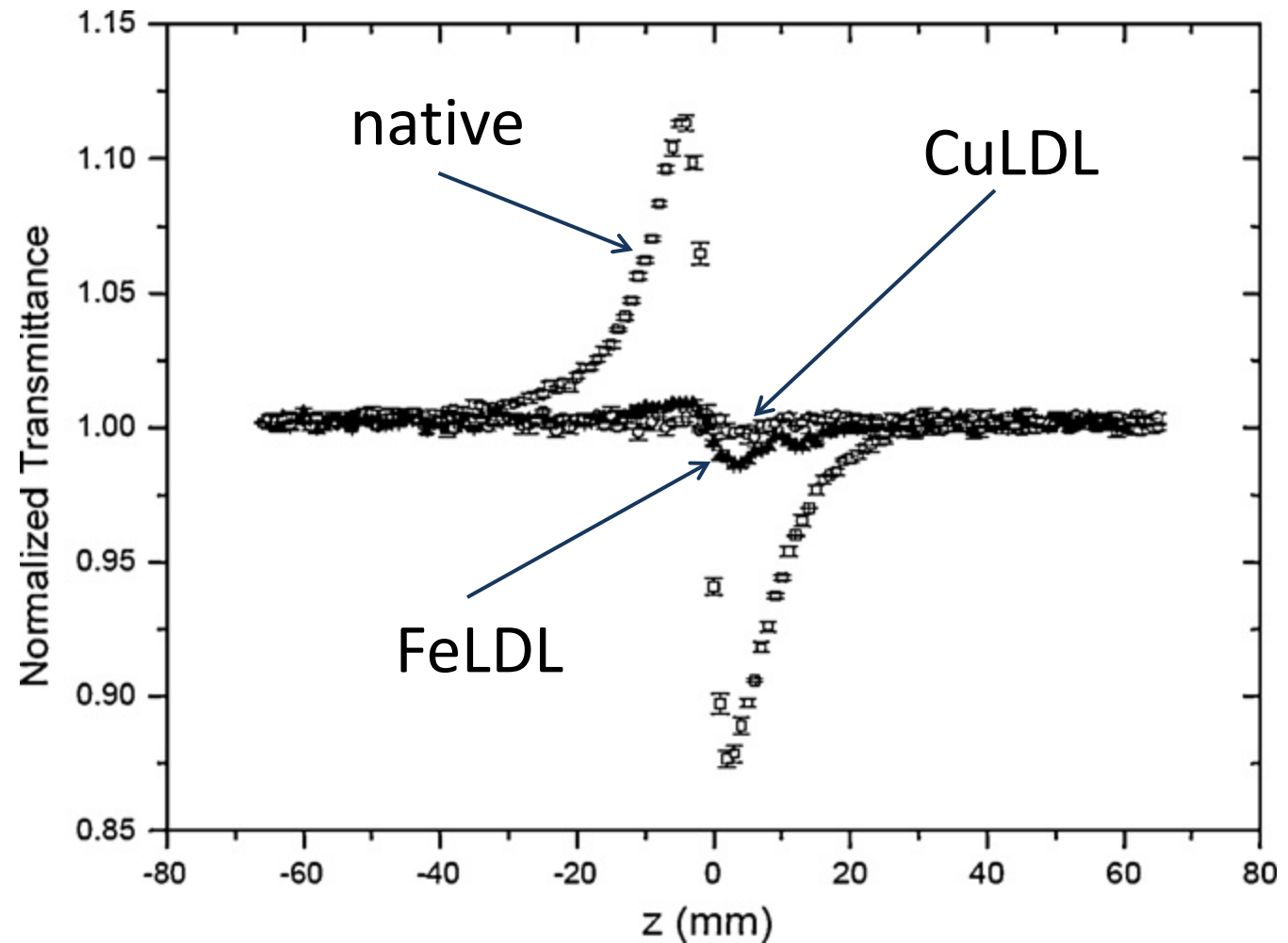


FeLDL

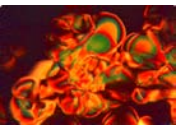
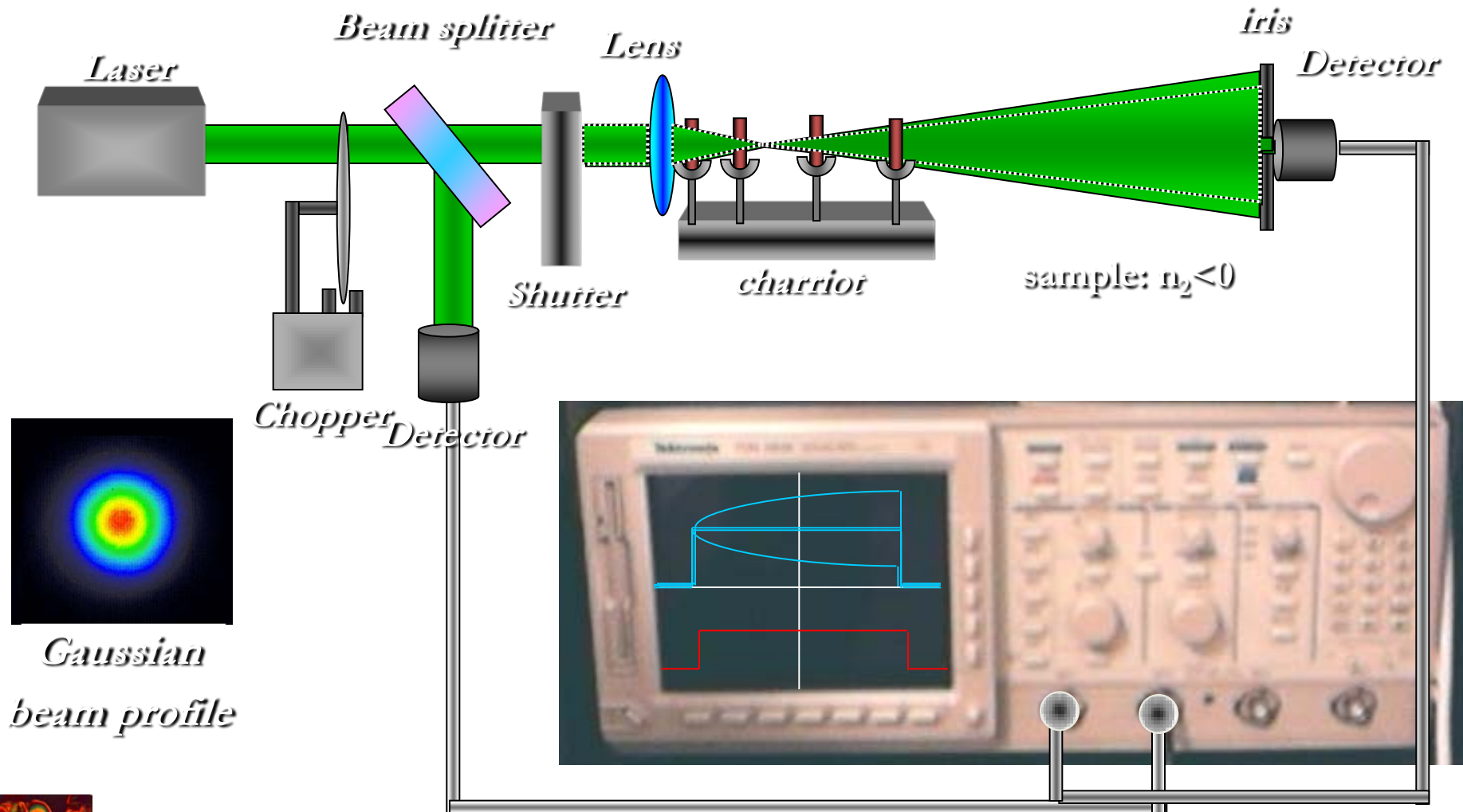
CuLDL

How to differentiate/quantify the "good" LDL and the "bad" LDL?

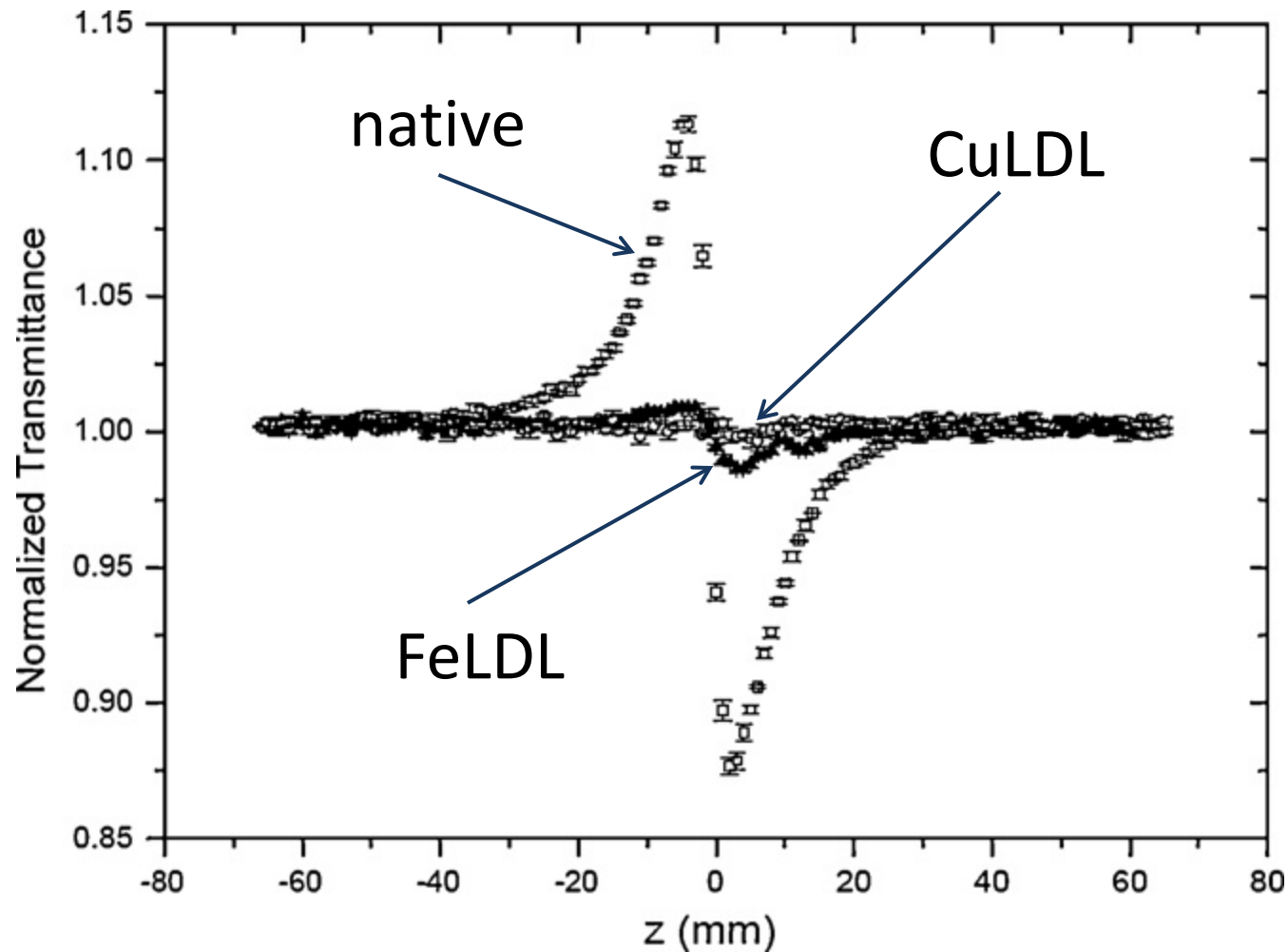
Z Scan technique!



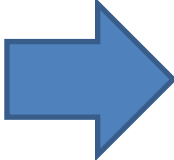
The Z-Scan Technique



Typical Z-Scan results



LDL / HDL

Structural
characterization in
solution  **SAXS**

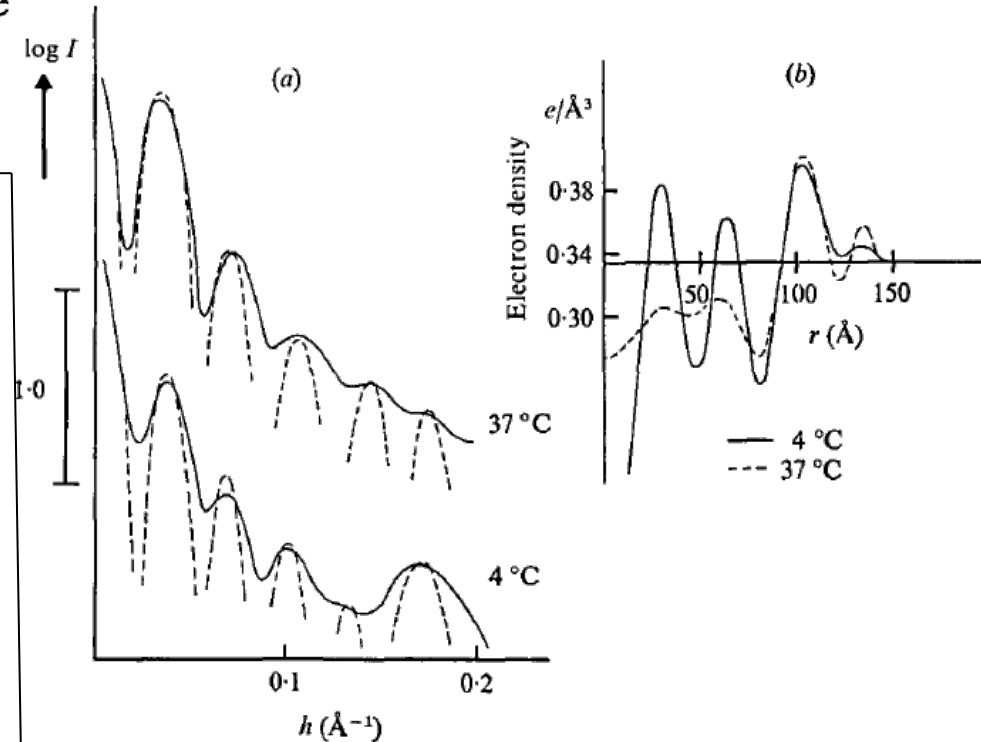
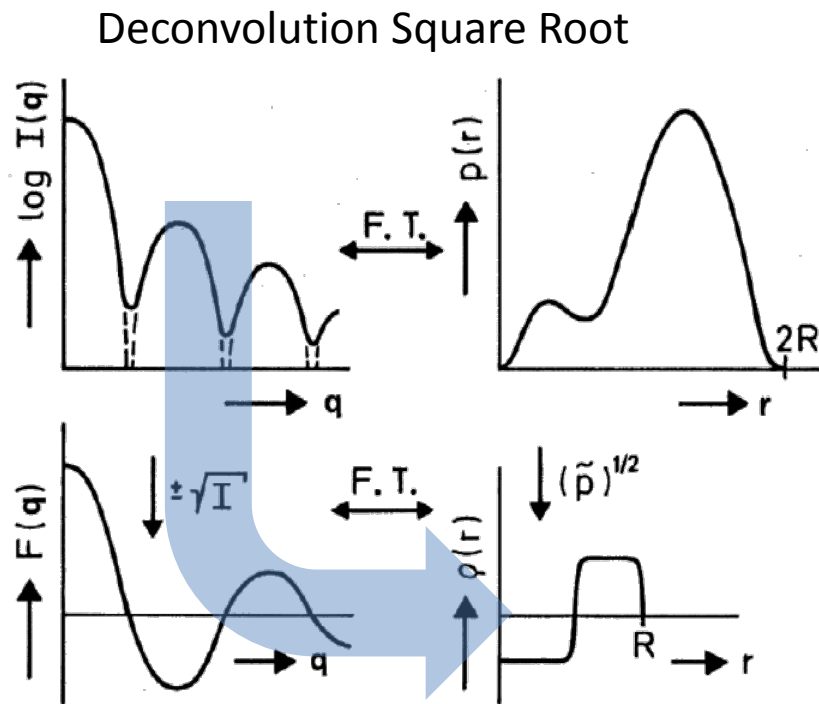
LDL studies by SAXS

Quarterly Reviews of Biophysics **11**, 3, (1978), pp. 371-425

Printed in Great Britain

The structure of serum lipoproteins as analysed by X-ray small-angle scattering

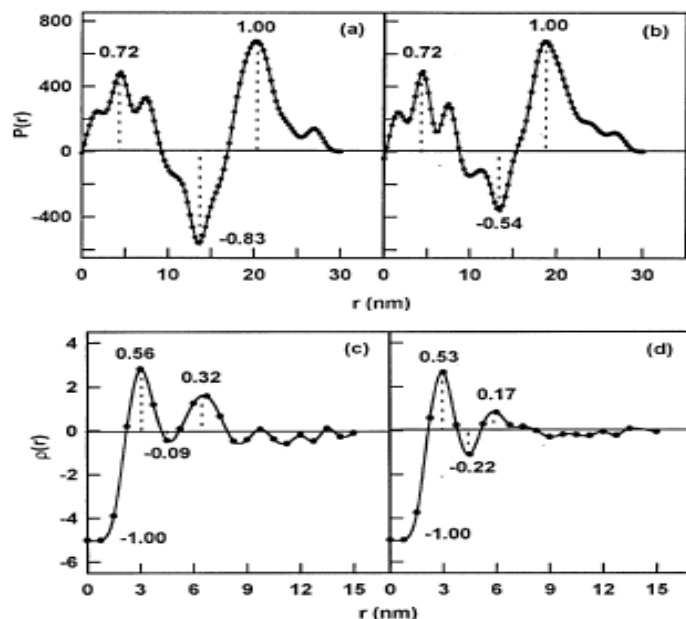
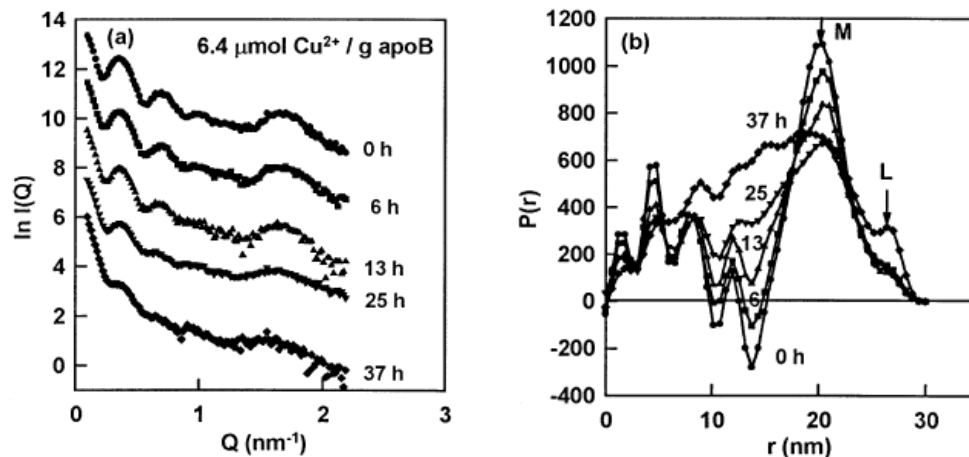
PETER LAGGNER AND KARL W. MÜLLER



Assuming spherical shape

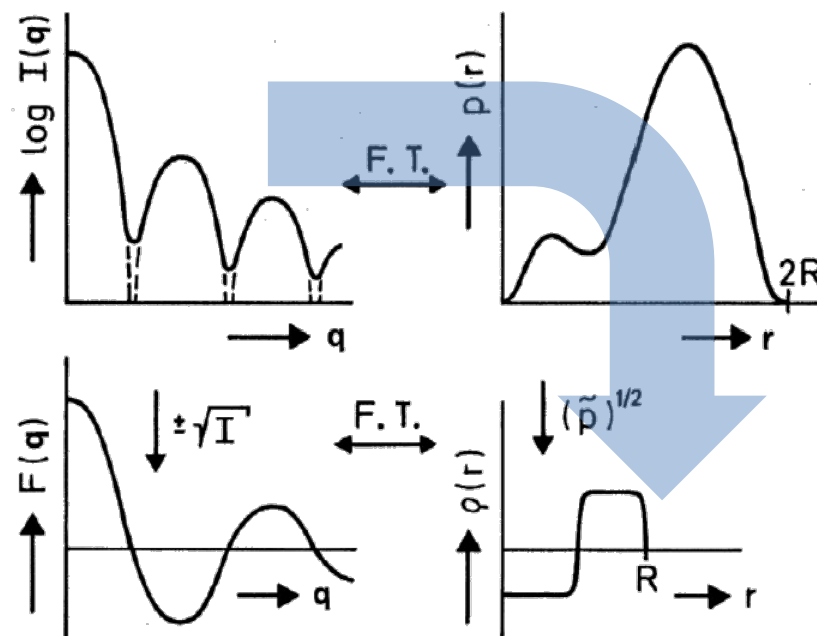
Time-course studies by synchrotron X-ray solution scattering of the structure of human low-density lipoprotein during Cu^{2+} -induced oxidation in relation to changes in lipid composition

David F. MEYER*, Adam S. NEALIS*, Colin H. MACPHEE†, Pieter H. E. GROOT†, Keith E. SUCKLING†, K. Richard BRUCKDORFER*



Assuming spherical shape

Deconvolution Square Root



Glatter, O. (1981), J. Appl. Crystallogr. 14:101–108

Final Remarks

- University of São Paulo is one of the most important universities in South America
- Studies in Molecular biology has an important whole in the university research
- Although some groups already use SAS on solution studies there is a huge space for the growth of this technique and its correlation with other experiments
- The use of Laboratory SAXS equipments provides nice data and a good way of planning experiments
- The current and future Brazilian Synchrotrons together with a future SANS line will strength even more the SAS technique. Therefore the training of students and scientists **is crucial!**

Acknowledgments

- **Denmark:**
 - Prof. Jan Skov Pedersen, University of Aarhus, Denmark
 - Prof. Birgitta Knudsen, University of Aarhus, Denmark
- **France**
 - Prof. Frédéric Nallet, CRPP, France
 - Profa. Laurence Navailles, CRPP, France
 - Profa. Marianne Impérator-Clark, ILL, France
- **Italy**
 - Prof. Alessandro Desideri, University of Rome, Italy
 - Prof. Mattia Falconi, Italy
- **Brazil**
 - Profa. Elisabeth Andreoli de Oliveira, IFUSP
 - Prof. Antonio M. F. Neto, IFUSP
 - Profa. Márcia Fantini, IFUSP
 - Prof. Marilene Demasi, IB
 - PhD Student Cassio Alves
 - MsC Student Renata Bicev

Among **MANY** others





Thank you !