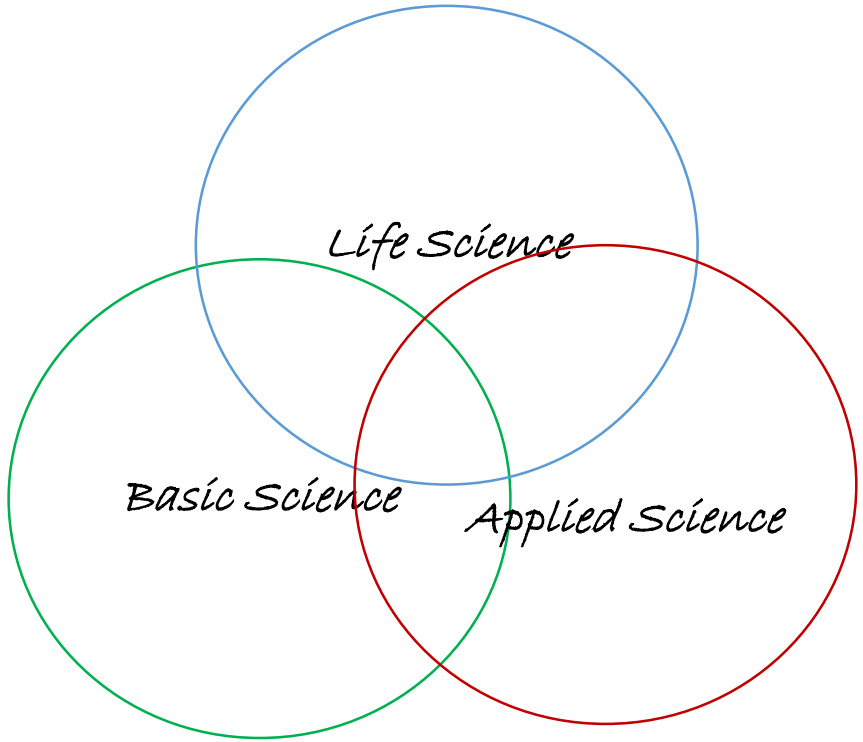
Nanotechnology Research Groups at UFMG

PRINT Seminar

November 23rd 2018

Multidisciplinary approach



Presentation outline – Research Groups

- ✓Biochemistry and Immunology;
- ✓Chemistry;
- ✓Clinical Analysis and Toxicology/Pharmaceutical Sciences;
- ✓Computer Science;
- ✓Infectology and Tropical Diseases;
- ✓Innovation;
- ✓Dentistry;
- ✓Mechanical Engineering;
- ✓Metallurgical and Materials Engineering;
- ✓Physics
- ✓Physiology and Pharmacology

http://www.pgbiq.icb.ufmg.br/

pg-biq@icb.ufmg.br

Programa de Pós-Graduação em
BIOQUÍMICA E IMUNOLOGIA
Instituto de Ciências Biológicas
Universidade Federal de Minas Gerais

PÓS-GRADUAÇÃO EM BIOQUÍMICA E IMUNOLOGIA 50 ANOS

One of the first Graduate Programs in Brazil (Master and PhD)

Capes **Level 7** (excellence/highest level)

Consistent enviroment for innovative projects – **set up of BioTech enterprises**

Currently 20 research lines (Biochemistry, Immunology, Molecular Biology)

38 Professors **43 Post-Docs** **138 graduate students (Master and PhD)**

Highlights:

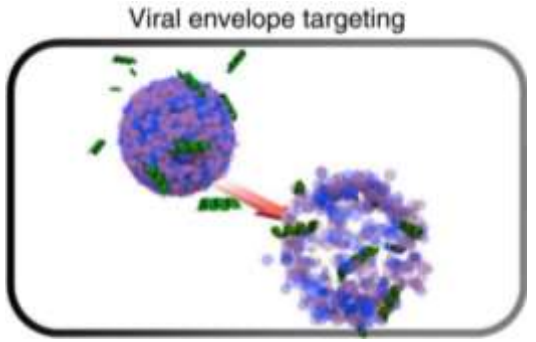
1) Dr. Mauro M. Teixeira

Collaborator: Dr. Namjoon Cho da Nanyang Technological University, Singapore

Anti-viral effect of peptides – studies on interactions with enveloped nanostructures

Study derived from Jackman, JA, Teixeira, MM, Cho, NJ et al in ***Nature Materials*, vol. 17, p 971–977 (2018)**

keywords: Zika virus, brain-penetrating antiviral peptide, enveloped nanostructures, therapy



Adapted from Nature Materials, vol. 17, p 971–977 (2018)

Funding sources:

NANYANG TECHNOLOGICAL UNIVERSITY

CAPES

CNPq Conselho Nacional de Desenvolvimento Científico e Tecnológico

FAPEMIG

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Programa de Pós-Graduação em
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50 ANOS PÓS-GRADUAÇÃO EM BIOQUÍMICA E IMUNOLOGIA

Highlights:

2) Dr. Paulo Sérgio L. Beirão/Dr. Eliane N. Silva

Collaborator: Dr. Rodrigo Gribel Lacerda, Department of Physics, UFMG

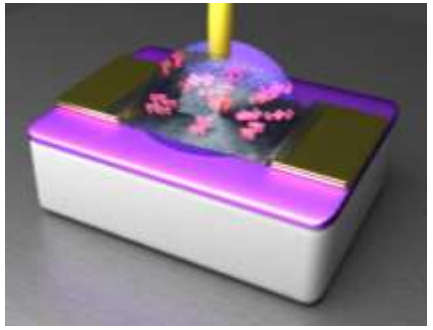
Development of a graphene field-effect transistor biosensor to detect aflatoxin B1

keywords: aflatoxin B1, biosensor, functionalized graphene

Funding sources:

INCT Instituto Nacional de Ciência e Tecnologia em Nanomateriais de Carbono

CAPES



Representative model of the Graphene FET biosensor for Aflatoxin B1

3) Dr. Rafael P. Vieira

Collaborators: Dr. Tim Storr, Simon Fraser University, Canada / Dr. Heloisa Beraldo, Department of Chemistry, UFMG /
Dr. Lucas A. Ferreira, Faculty of Pharmacy, UFMG
Preparation and characterization of new drug and prodrug candidates and their pharmaceutical preformulations and formulations

Collaborator: Dr. Ado Jorio, Department of Physics, UFMG
Characterization of promising metal-based biomarkers

keywords: Alzheimer's Disease, neurodegenerative disorders, metallomics, biomarkers, formulations, therapy, diagnosis

Funding sources:

Finep INOVAÇÃO E PESQUISA

CAPES

CNPq Conselho Nacional de Desenvolvimento Científico e Tecnológico

FAPEMIG

Prof. Luciano Montoro

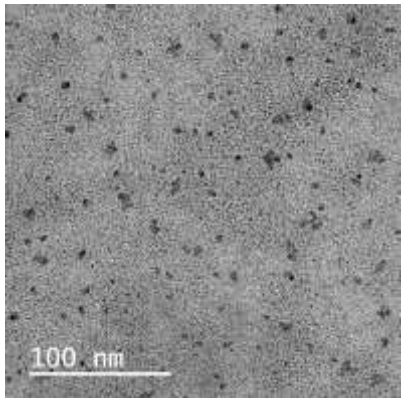
- Development and advanced characterization of materials and devices; including rechargeable batteries, biomass for fuel production, metal matrix composites, study of fluid dynamics in oil recovery in porous rocks.
- Nanostructured Niobium Compounds and Applications

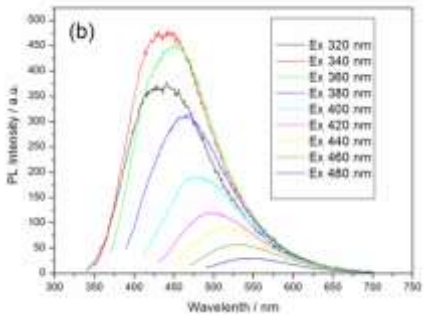
Profs. Glaura Goulart, Rodrigo Lavall

- Carbon nanotubes, graphene

Prof. Fabiano V. Pereira

Preparation and characterization of carbon quantum dots for different applications, including energy (solar cells)





bioimaging,
sensors,
photocatalysis,
solar cells

Multifunctionalized nanoparticles for tumor diagnosis and therapy

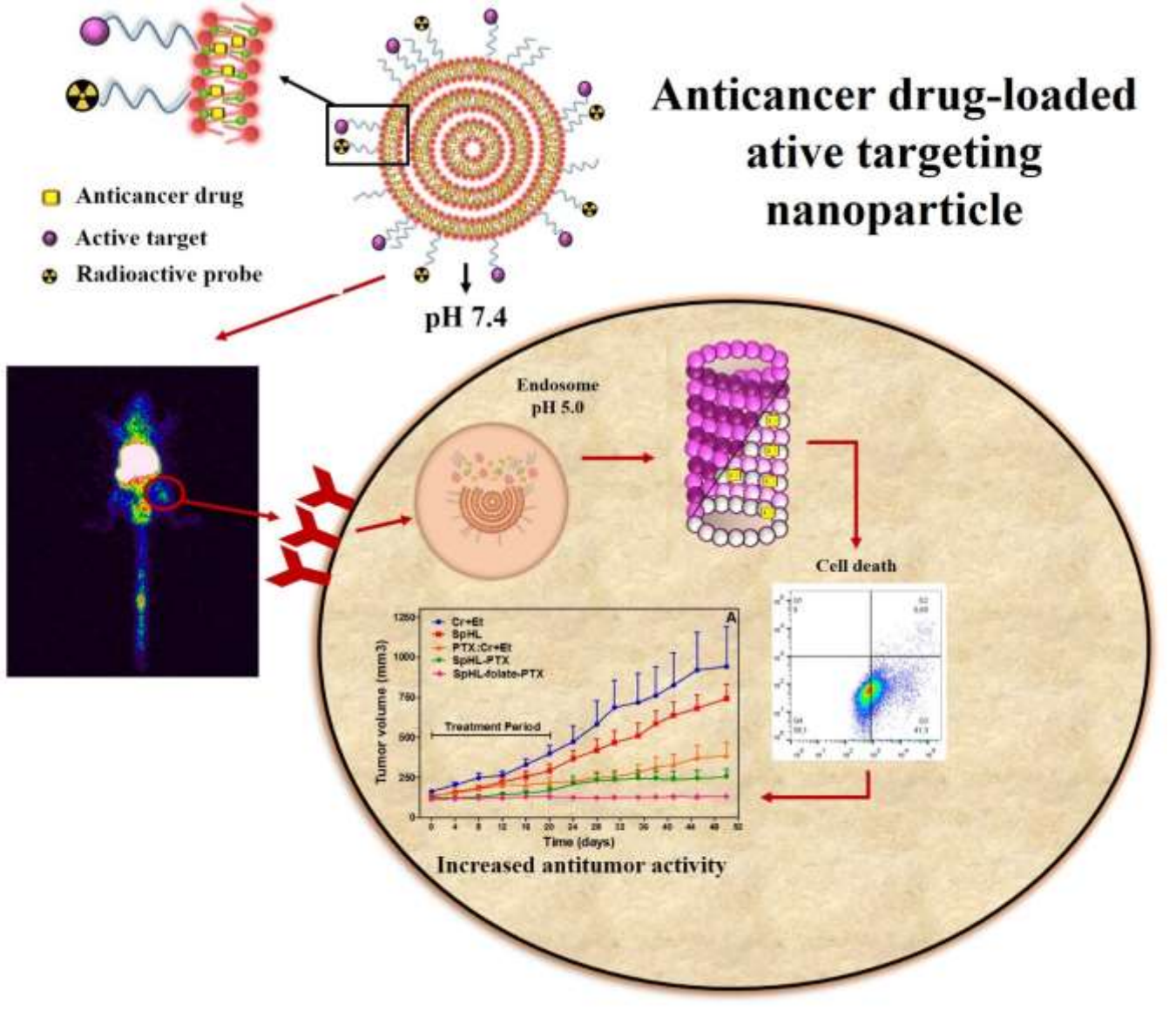
Prof. André Barros (albb@ufmg.br)

Prof. Mônica Oliveira (monica@farmacia.ufmg.br)

Keywords:

- ✓ Drug delivery systems
- ✓ Tumor targeting
- ✓ Radiolabeled nanoparticles
- ✓ Molecular imaging
- ✓ Diagnosis
- ✓ Treatment

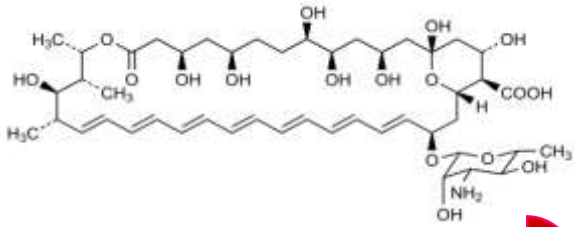
Collaborators:
Prof. Abass Alavi; Prof Andrew Tsourkas (UPENN – USA)
Prof. Danyelle Townsend (MUSC – USA)
Prof. Peter Caravan (Harvard Medical School – USA)
Prof. Laleh Alisaraie (MUN – Canada)
Prof. Sylvain Richard (U Montpellier -France)

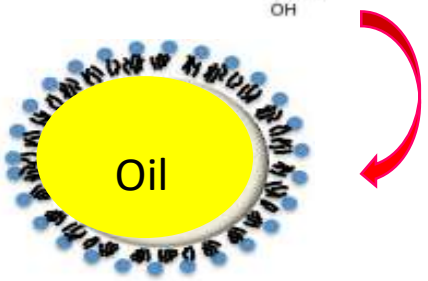


Neglected Diseases
Tegumentar and Visceral Leishmaniasis

Prof. Mônica Oliveira (monica@farmacia.ufmg.br)

Development of Drug Delivery Systems (Lipid and Micelles)





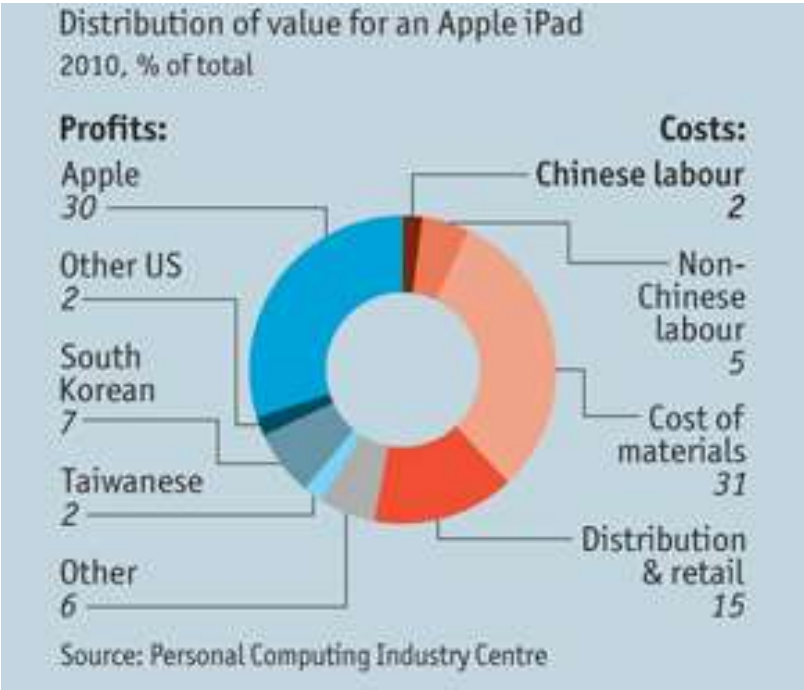
Nanoemulsion

Based on New Drugs
Incremental Technology
Association of Photodynamic Therapy

Keywords: Leishmaniasis, Liposomes, Polymers, Micelles, Nanoemulsions

Funding sources:

Rational: Computational Materials Science and materials for nanocomputing



Materiais&software represent over 60% of computing products

Thrust 1: Computational Materials Science:
rapid discovery and prototyping of materials systems that would otherwise take incomensurable times, using machine learning methods

Thrust 2: Nanocomputing:
novel computing platforms, devices and systems, challenging von Neumann paradigm, beyond Silicon. Covers storage, computing and communications.

Metrics of interest: Cost, power, performance, integration potential

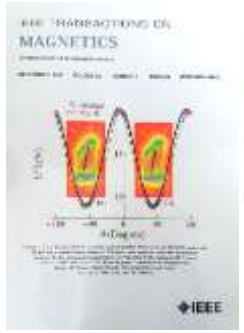
PIs: Prof. Omar Paranaiba Vilela Neto and Gilberto Medeiros Ribeiro

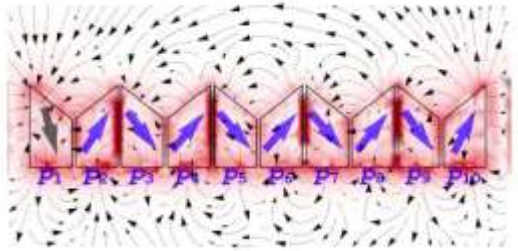
DCC
DEPARTAMENTO DE CIÊNCIA DA COMPUTAÇÃO

nanocomp LABORATÓRIO DCC - UFMG

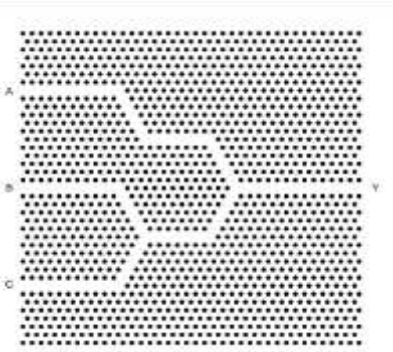
Computational Materials Science and materials for nanocomputing

New Materials for Emerging Computing Systems: Logic, Memory and Communication





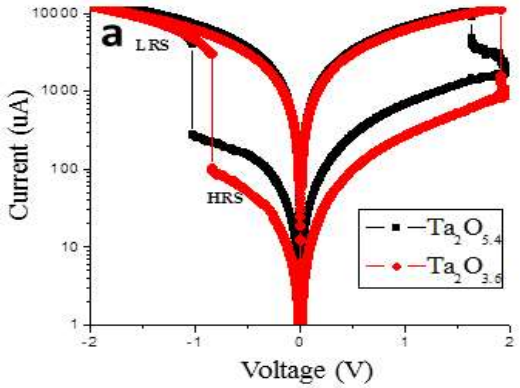
magnetic

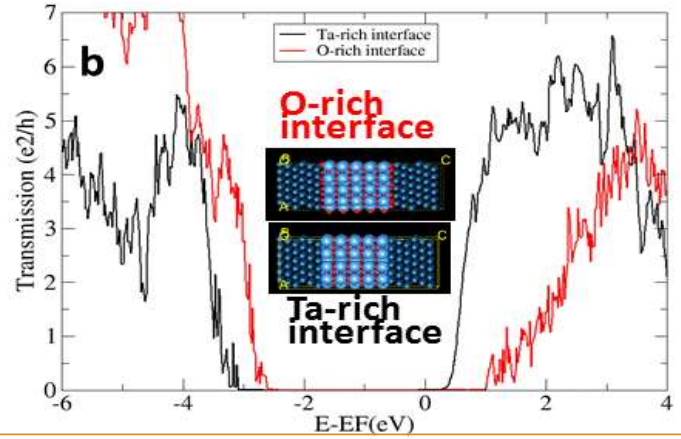


optical

Computing

Memory: Non-volatile storage





Intelligent Computational Nanotechnology: Discovery of New Materials by Machine Learning and Optimization

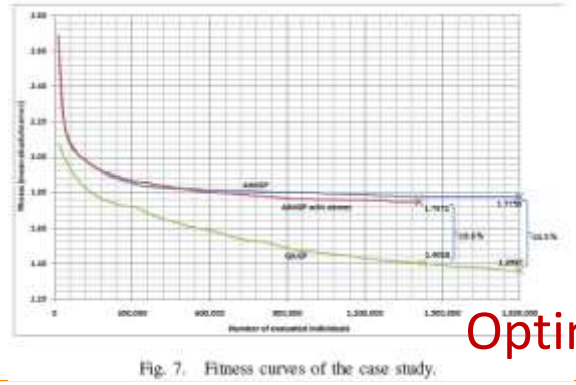
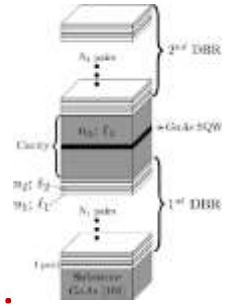
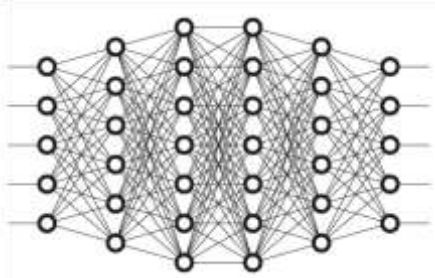


Fig. 7. Fitness curves of the case study.



Optimization

Data Management



Machine Learning

O Programa de Pós-Graduação (PPG) em Ciências da Saúde: **Infectologia e Medicina Tropical,** situado na Faculdade de Medicina da UFMG foi credenciado pelo Conselho Federal de Educação no mês de setembro de 1974. Atualmente, o Programa possui nota 6 na avaliação quadrienal (2013-2016) da CAPES. Há 21 orientadores permanentes cadastrados, três orientadores colaboradores e cerca de 100 alunos de mestrado e doutorado e quatorze pós-doutorandos vinculados formalmente. No ano de 2018 ultrapassamos as 500 dissertações e teses defendidas e recebemos o Grande Prêmio UFMG de Teses 2017, no grupo das Grandes Áreas de Ciências Agrárias, Ciências Biológicas e Ciências da Saúde e Menção Honrosa no Prêmio CAPES-INTERFARMA de Inovação e Pesquisa, por meio de tese de doutorado desenvolvida no Programa. Possuímos 15 linhas de pesquisa atuais, nas quais há 118 projetos de pesquisa cadastrados. As linhas de pesquisa que têm relação ao tema de "Novos materiais e Nanotecnologia" são:

-Clínica, Diagnóstico e tratamento das doenças infecciosas e tropicais.
Os pesquisadores envolvidos com projetos nesta linha desenvolvem ensaios clínicos em modelos animais e no homem, avaliando a eficácia e segurança da farmacoterapia contra doenças infecciosas, tropicais e/ou negligenciadas, avaliando também aspectos imunológicos relacionados à aplicação de novos biomarcadores diagnósticos por meio de plataforma de diagnóstico rápido empregando antígenos recombinantes de *Leishmania* incorporados a sistemas *point-of-care* desenvolvidos por tecnologia de microfluidos, na prevenção sob a forma do desenvolvimento de novas plataformas vacinais empregando nanotecnologia e na pesquisa por fármacos ativos e entregues em sistemas inovadores de delivery.

Interesse de nosso PPG:

Acreditamos em nosso interesse no tema “Novos materiais e Nanotecnologia” a fim de podermos ofertar know-how para aplicação em nossos modelos animais e pacientes as novas tecnologias desenvolvidas para a prevenção, diagnóstico ou tratamento de doenças, além da expertise de nossos professores envolvidos. Trabalhamos com a descoberta de novos biomarcadores, que possam ser englobados em plataformas de nanotecnologia por parte de pesquisadores estrangeiros que tenham interesse em aplica-las para a melhoria do diagnóstico, tratamento e prognóstico das diversas doenças. Temos interesse também no intercâmbio entre discentes e docentes, a fim de possibilitar maior interação entre os grupos tanto para o desenvolvimento de novos materiais e produtos quanto para seus testes pré-clínicos ou clínicos abrangendo as doenças infecciosas, tropicais e/ou negligenciadas, que são abordadas em nosso Programa de Pós-Graduação.

Palavras-chave: ensaios clínicos (humanos); análises in vitro e in vivo; vacina; diagnóstico; tratamento; doenças infecciosas.

Doutorado em Inovação

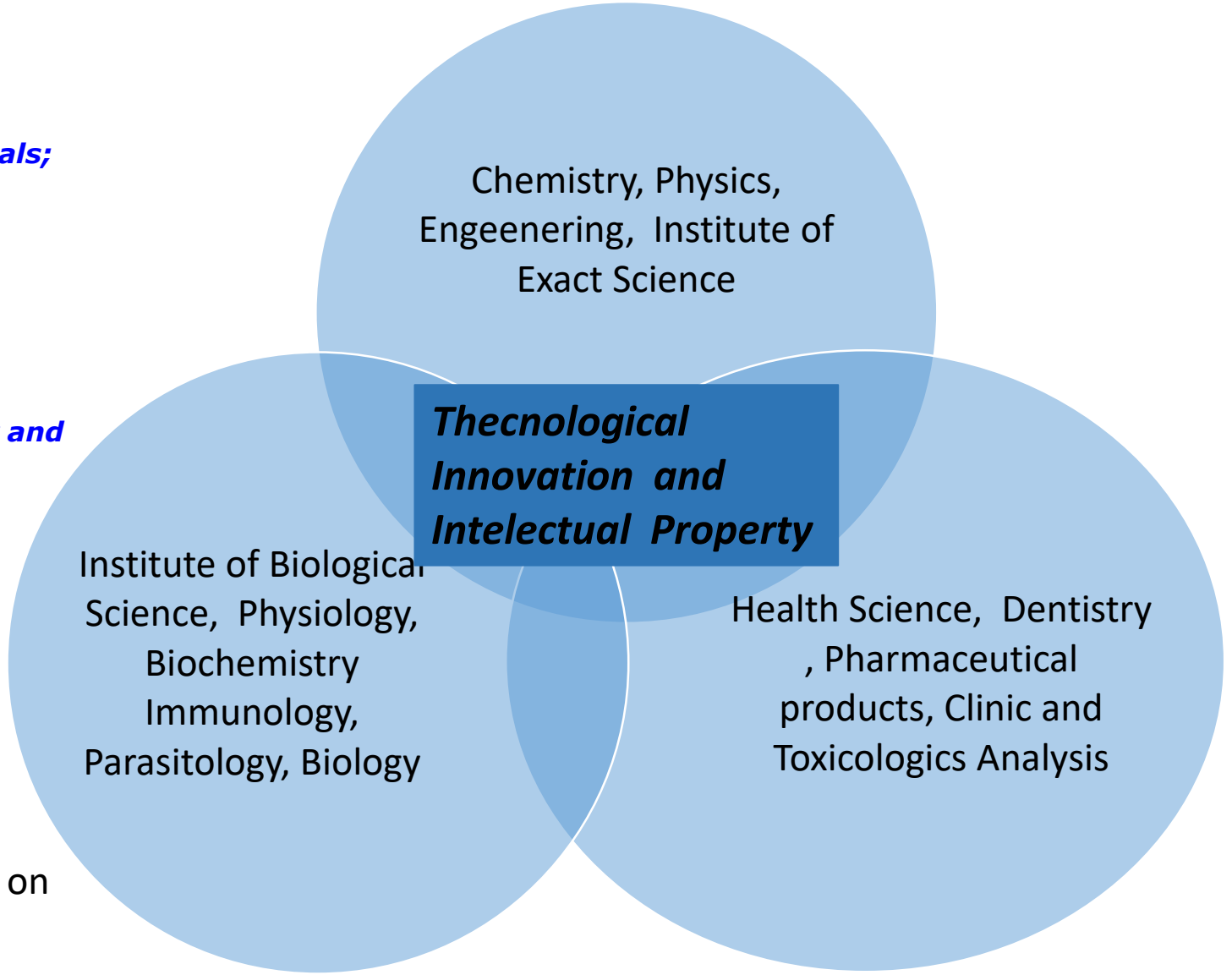
Doctoral Program in Thecnological Innovation and Intelectual Property - UFMG

- ***Development of new drugs and biopharmaceuticals;***
- ***Biotechnology approaches in drug and immunobiological development;***
- ***Systems of controlled drug release and nanostructured systems for health;***
- ***Humoral and neural control of the cardiovascular and renal systems;***
- ***Drugs for intermediate metabolism;***

25 Professors in the program

38 Alunos

18 Laboratories and research groups working on Nanotechnology and Novel Materials



Foreigner Partners:

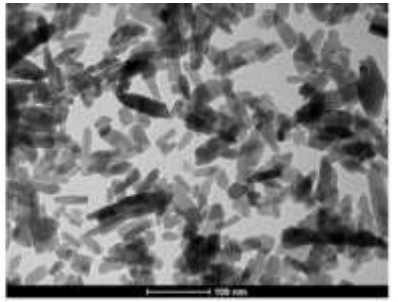
Northwestern University	Chicago	EUA
Pontificia Universidad Javeriana	Bogotá	Colômbia
University of Rice	Houston	EUA
Massachusetts Institute of Technology	Boston	EUA
University of Santiago da Compostela-Pharmacy phaculty	Santiago da Compostela	
University of Freiburg	Freiburg	Alemanha
University of Porto	Porto	Portugal

Contact:

- ***Professor Maria Esperanza Cortes***
- ***mecortes@ufmg.br***
- ***Dentistry Faculty and Doctoral Program in Thecnological Innovation and Intelectual Property UFMG/***

FAO UFMG
FACULDADE DE ODONTOLOGIA

Clinical Dentistry – Faculty of Dentistry

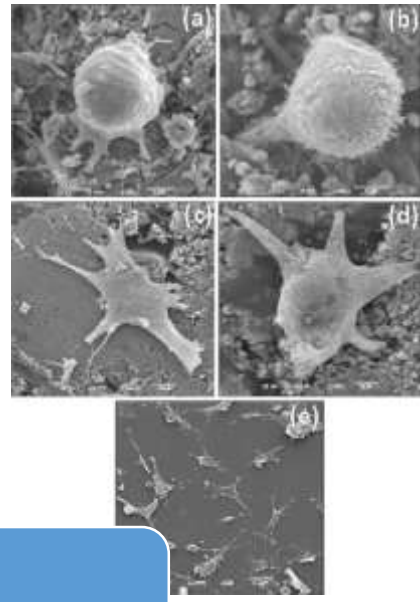


Systems of controlled drug release and nanostructured systems for bone and dental tissues;

Nanoparticles for regenerative tissue engineering,

Wound healing in diabetes, Monitoring and control of foreign body response,

Biomaterials and cell material interactions, and targeted delivery of therapeutic molecules, new biomacromolecules and cells.



Development of new drugs → Formulations → In vitro, In vivo pre-clinical trials → Clinical trials

Contact:
Professor Maria Esperanza Cortes
mecortes@ufmg.br
Dentistry Faculty and Doctoral Program in Thecnological Innovation and Intelectual Property UFMG/

Multi-Functional Nano-Membranes: From Morphing Wings to Flexible Electronics

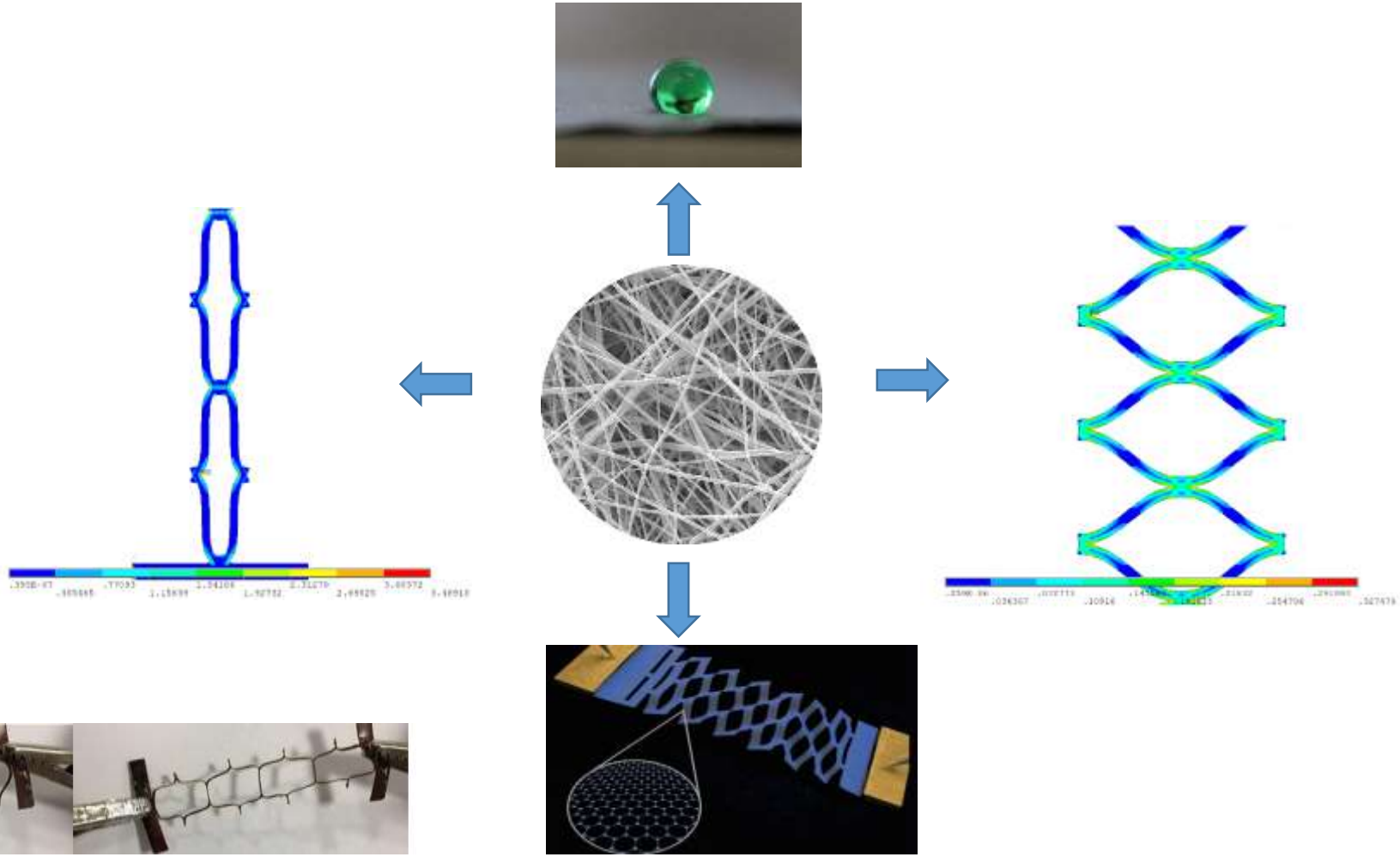
Keywords: Aerospace materials, wearable devices, water treatment

PI. Antonio Avila, Rudolf Hubner, Wen Chan, Ozden Ochoa.

Funding: Bill Gates Foundation, AFOSR, Boeing, EMBRAER, CNPq, FAPEMIG, CAPES.

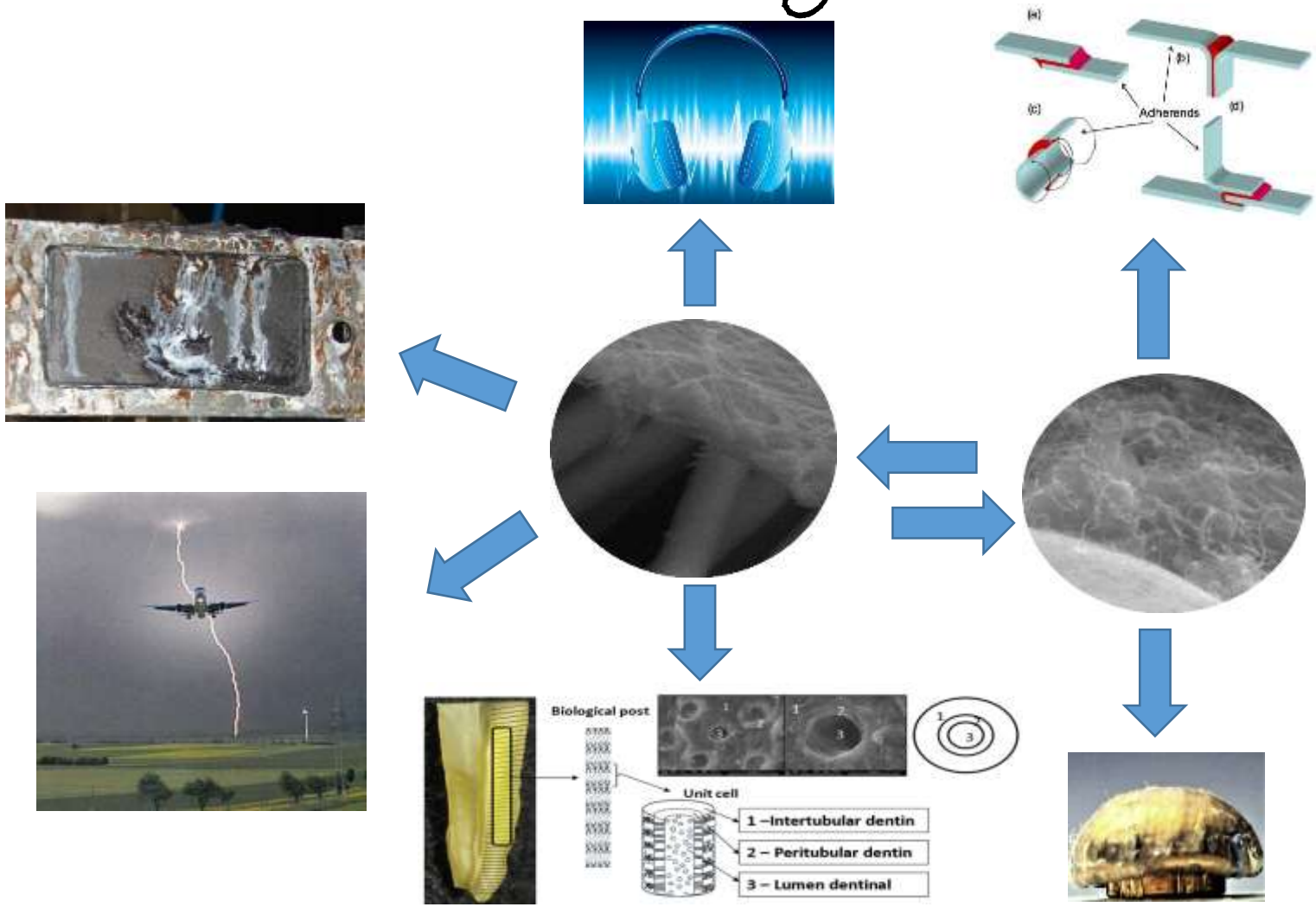
Partners: U Texas Arlington, Texas A & M.

Contact: avila@ufmg.br



PPGMEC – Mechanical Engineering Graduate Studies Program

Nano-Composites: Ranging from Lightening Strike Protection Systems to Dental Implants



Keywords: Ballistic, Bonded-Joints, Lightning Strike, Dental Implants, Acoustics, Corrosion Protection

PI: Antonio Avila, Hermano Nascimento Olesya Zhupanska

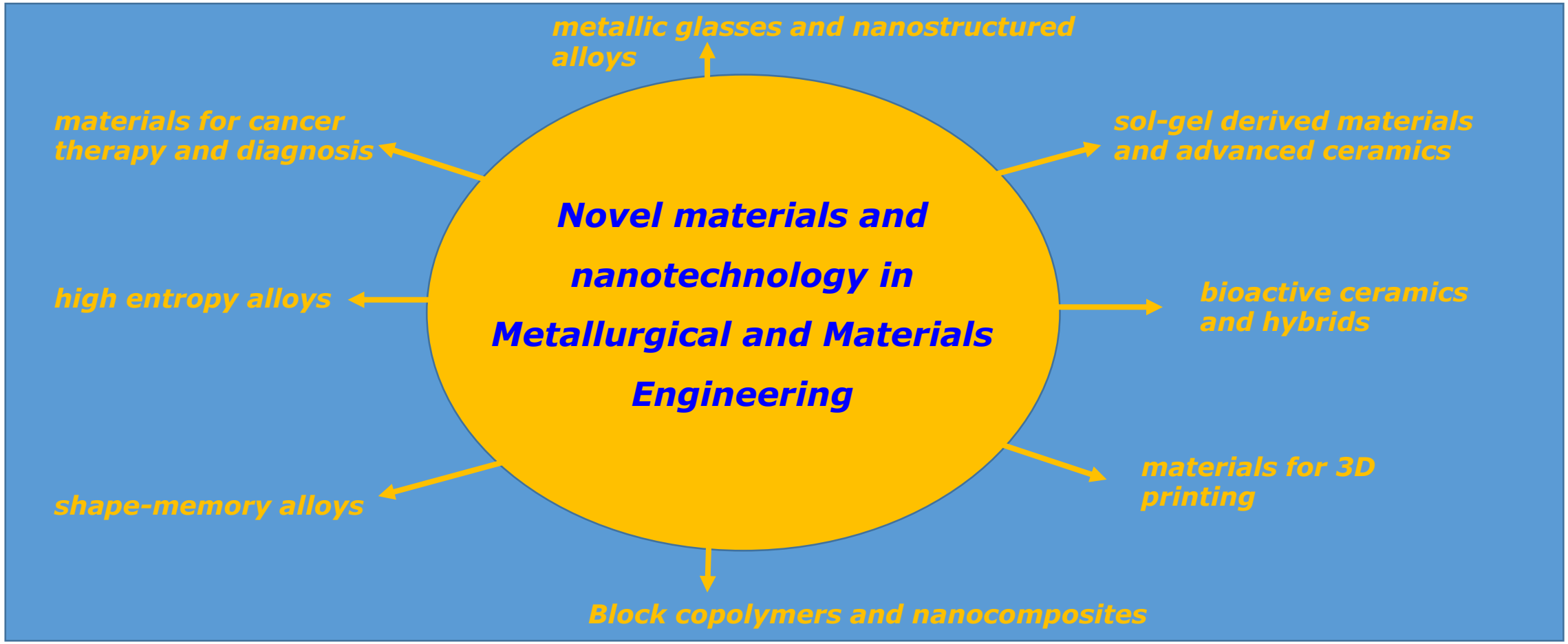
Funding: EMBRAER, AFOSR, FIAT, CAPES,FAPEMIG, CNPq

Partners: U Arizona

Contact: avila@ufmg.br

Novel materials and nanotechnology in Metallurgical and Materials Engineering: biomedical, environmental and structural applications

GRADUATE PROGRAM IN METALLURGICAL, MATERIALS AND MINING ENGINEERING (PPGEM-UFMG)



<u>Keywords</u>: materials for cancer therapy and diagnosis; sol-gel derived materials; bioactive ceramics and hybrids; block copolymers; metallic glasses; shape-memory alloys; high entropy alloys; quantum dots; materials for 3D printing.

Novel materials and nanotechnology in Metallurgical and Materials Engineering: biomedical, environmental and structural applications

GRADUATE PROGRAM IN METALLURGICAL, MATERIALS AND MINING ENGINEERING (PPGEM-UFMG)

COLLABORATIONS AND FINANCIAL SUPPORT

Collaborations

- University of Florida (USA)
- University of Southampton (Great Britain)
- Cornell University (USA)
- Imperial College (Great Britain)
- Carnegie Mellon (USA)
- University of Queensland (Australia)

Financial support

- FAPEMIG
- CNPq
- FINEP
- CAPES
- Instituto Serrapilheira
- Petrobras, Usiminas, Vallourec, ArcelorMittal, Gerdau

PÓS GRADUAÇÃO FÍSICA UFMG

Graduate program in Physics (Level 7 Capes)

Master and PhD courses in several theoretical and experimental areas related to Nanotechnology and Novel Materials

Biotechnological Applications of Nanomaterials, Condensed Matter Physics, Electronic Structure of Solids, Surfaces and Nanostructures, Magnetic Materials and Magnetic Properties, Semiconductor Physics, Surface Physics, Optical Properties of Nanomaterials

Instititional projects related to Nanothcnology and Novel Materials

CTNANO UFMG

MG Grafeno

INCT National Institute of Science and Technology Carbon Nanomaterials

59 Professors in the program

15 Laboratories and research groups working on Nanotechnology and Novel Materials

Institutional Laboratory LIPq devoted to the research in this field

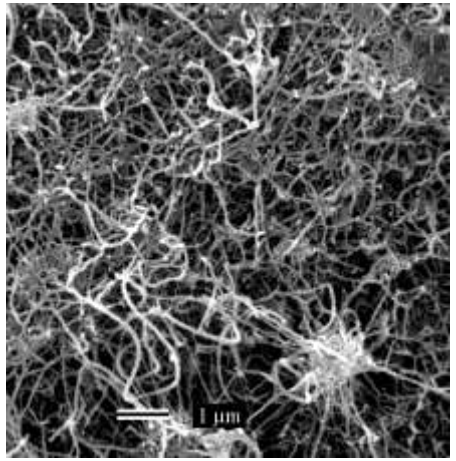
LCPnano

Laboratory of Characterization and Processing of Nanomaterials

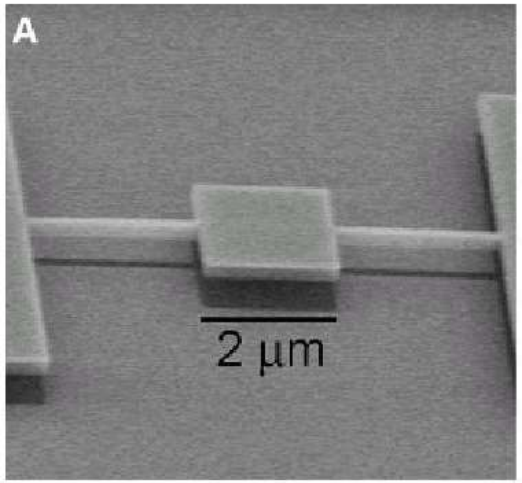
PÓS GRADUAÇÃO FÍSICA UFMG

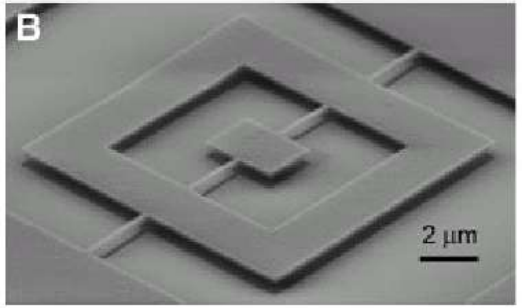
Many projects invloving Nanotechnology and Novel Materials on Synthesis, Processing, characterization of physical properties and applications

Synthesis

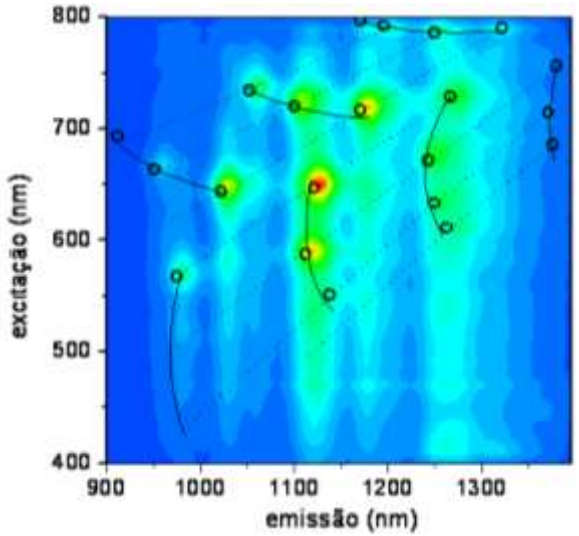


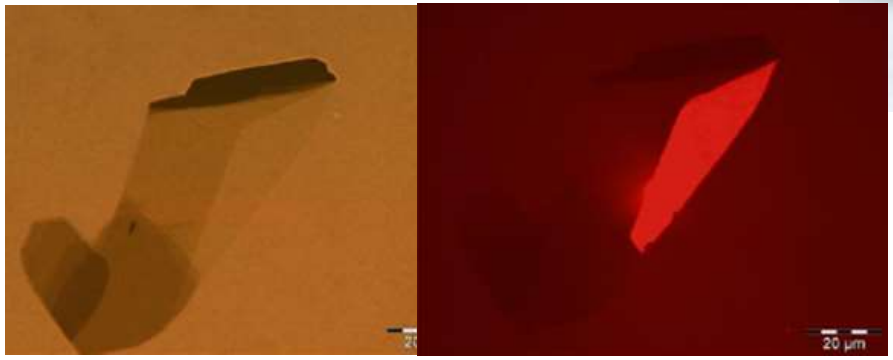
Processing



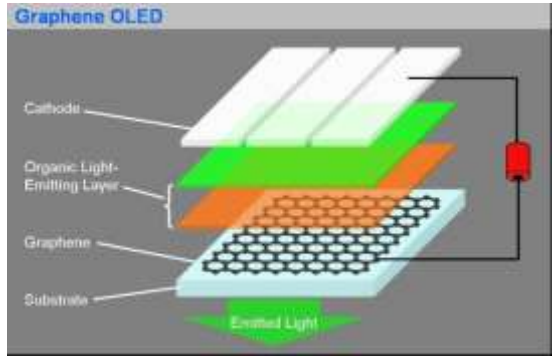


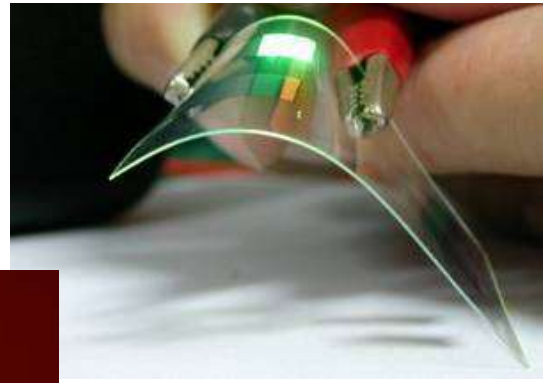
Characterization





Applications





PÓS GRADUAÇÃO FÍSICA UFMG

Established International Colaborations

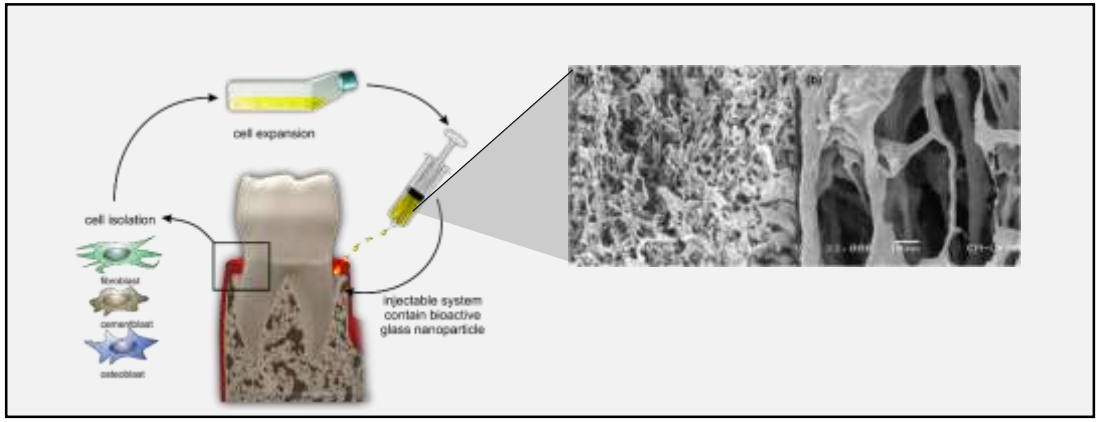
Freie Universitat	Berlin	Germany
Munchen Universitat	Munchen	Germany
University of Southampton	Southampton	UK
Massachusetts Institute of Technology	Boston	USA
Politecnico di Milano	Milan	Italy
University of Limerick	Limerick	Ireland
Université d'Orléans	Orleans	France
Penn State University	Pennsylvania	USA
Université de Toulouse	Toulouse	France
Université de Montpellier	Montpellier	France
University of Texas Austin	Austin	USA
Columbia University	New York	USA
Universidad Tecnica Federico Santa Maria	Valparaiso	Chile

DESIGN AND DEVELOPMENT OF INNOVATIVE NANOPARTICLES FOR CLINICAL APPLICATION

Bioactive glass nanoparticles for dentistry applications

PI: Maria de Fatima Leite
leitemd@ufmg.br

Partner: Yale University School of Medicine, USA

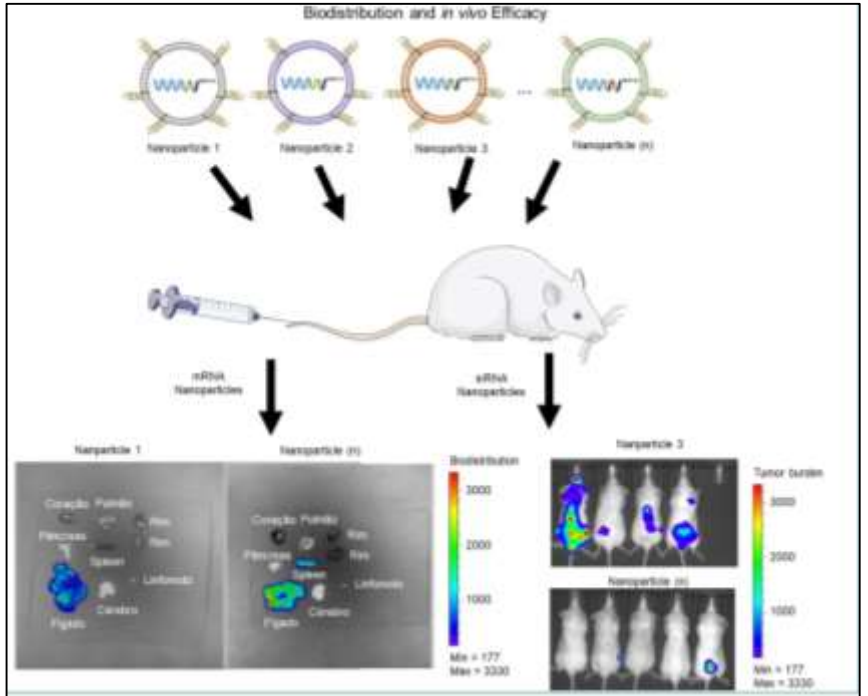


Keywords: Bioactive glass; periodontal regeneration; gene delivery, cancer therapy, immunotherapy

Targeted polymer-lipid nanoparticle platform to inhibit tumor progression via mRNA and/or RNAi

PI: Pedro Guimarães
ppiresgo@gmail.com

Partner: MIT, USA.



DESIGN AND DEVELOPMENT OF INNOVATIVE NANOPARTICLES FOR CLINICAL APPLICATION

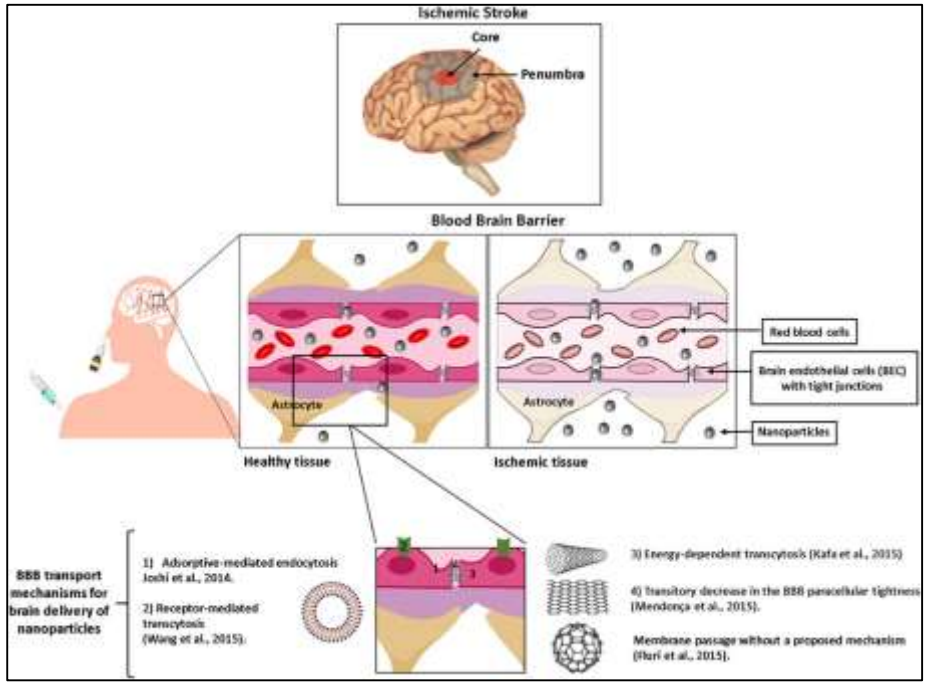
Lipid-based drug nanocarriers

PI: Frederic J. G. Frezard
frezard@ufmg.br
Partner: Université Paris XI, France
University College Cork, Ireland

One product
on the Brazilian market
for treatment
of androgenetic
alopecia

Nanoparticles for drug delivery to the central nervous system

PI: Andre Massensini
massensini@ufmg.br
Partner: University of Pittsburgh, USA.



Keywords: liposomes; lipid-based nanocarriers; hair growth; cosmeceutics; stroke

Closing Comments:

- ✓The multidisciplinary approach is the basis of all research groups on nanotechnology at UFMG.

- ✓Please contact the researchers for a more in depth information about partnerships and collaborative efforts.

- ✓For institutional contact please send emails to:

pg-internacional@prpg.ufmg.br

Thank you!!!!