RHODES UNIVERSITY, GRAHAMSTOWN, SOUTH AFRICA

STAFF INFORMATION

Professor Rui Werner Macedo Krause
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About:
I currently teach Organic and Medicinal Chemistry and some Nanomaterials Science. My interests are an eclectic mix of Medicinal Chemistry, Organic and Nanomaterials, and through these interests, I undertake research in Medicinal Chemistry, Drug Delivery and the application of Nanomaterials.

Teaching:
Courses for 2018 include

- Chemistry 1 – Organic Chemistry and Introduction to Biological Molecules
- Chemistry 2 – Fossil Fuels and Organic Chemistry
- Chemistry 3 - Advanced Organic and Retrosynthesis
- Honours
  - Chemical Aspects of Biosynthesis of Natural Products
  - Supramolecular Chemistry
  - Bio/Nano Interactions
  - Potholes and Pitfals - Lessons from Total Synthesis
- Masters – Coursework MSc in Nanoscience hosted at UWC
Many pharmaceutical products such as anti-cancer drugs suffer poor bio-distribution or poor kinetics in the body due to systemic issues such as low aqueous solubility or fast degradation. This means that they cannot be used efficiently in treatment. My group has applied a number of biomaterials such as alginate and chitosan as well as synthetic polymers like polylactic acid (PLA) to develop drug delivery systems. In addition, the use of inclusion complexes like cyclodextrins and nanotechnology (liposomes, carbon nanomaterials, gold nanoparticles) allows the possibility of directing the drugs more accurately to the site of action.

2) **Stimuli-Responsive Systems (SRS)**

Materials that respond to changes in their environment are useful in many areas from pollutant sensors to biomaterials for health. My group has used some of the expertise gained in drug delivery systems to build materials that respond to a range of changes in their environment such as changes in pH, changes in temperature, and changes in photon flux.

In the near future, our focus will also change to include materials that respond to other stimuli like enzyme gradients and magnetic fields.

We have been particularly interested in Phospholipid constructs such as liposomes and Solid-Lipid Nanoparticles.

The diseases of concern to us include Tuberculosis, Cancers, Malaria, Diabetes, and Sickle-Cell Anemia.

Many of these SR materials use large organic constructs like cyclodextrins, calixarenes and porphyrins, and some then have applications in medicinal chemistry and drug delivery.
3) Marine Medicinal Natural Products

Our focus here has shifted somewhat from Natural Products from African Plants, to Natural Products from Marine sources, particularly along the Algoa Bay coast. We still do quite a lot of work on terrestrial Natural Products, and have strong collaboration with researchers in Cameroon, which started via the late Professor Fomum.

Our marine Natural Products work is focused on alkaloids such as indoles and aminoquinones and is conducted in collaboration with Professor Dorrington, who holds a SARCHI Chair in Marine Natural Products Chemistry.

4) Nanomaterials for Renewable Energy

My group works closely with the UJ Centre for NanoScience, the Center of Excellence in Strong Materials (CoESM) and the Nanotechnology Innovation Centre (NIC) to construct renewable energy systems that are enhanced by nanomaterials.

Some of the work comes from our old research in water treatment systems that contain photoactive catalysts such as TiO$_2$ or ZnO to convert the pollutants to harmless nutrients using sunlight.

**News Interests:**

As if the above was not enough, some of these investigations prompt new interdisciplinary projects such as the use of natural pigments in solar-energy conversion, or the delivery of photoactive nanoparticles for photodynamic cancer therapy. I am always on the lookout for new collaborators so please feel free to come and chat or drop me a line.

**2018 Publications:**


2017 Publications:


Collaborators:

I have several national and international collaborators, some of whom are listed here.

- UJ CNS – Prof Derek Ndinteh (www.uj.ac.za/chemical)
- CoESM – Prof Neil Coville and Dr Zikhona Tetana (www.wits.ac.za/academic/ebe/4471/strongmaterials.html)
- NIC Water Platform – Prof Bhekie Mamba (www.nic.ac.za)
- CSIR / ANDI Nanomedicine Centre of Excellence- Dr H Swai (http://www.csir.co.za/msm/Encapsulation_and_Delivery/encap_delivery.html)
- National Centre for Nano-structured Materials (http://fs-noms.csir.co.za/)
- University of Cordoba – Argentina Biological Chemistry Centre CIQUIBIC – Prof Bruno Maggio (http://www.ciquibic.gov.ar)
- UNC Argentina Prof Alejandro Granados, Prof Rita Hoyos de Rossi, Dr Raquel Vico (http://www.fcq.unc.edu.ar/departamentos/dep_quimica_organica.php)
- University of Buenos Aires – Argentina – Nanomedicine Prof Alejandro Sosnik (http://www.ffyb.uba.ar)
- Indian Institute of Science – India – Prof Ashok Raichur (http://materials.iisc.ernet.in/~amr/Welcome.html), Prof S Sampath (http://ipc.iisc.ernet.in/sampath.html)
- University of Buea – Dr J Foba (ubuea.net)
- University of Yaounde 1 – Dr A Atchade and Prof J Mbafor (www.uy1.uninet.cm)
- UCLA – California NanoSystems Institute – Prof E Hoek (http://www1.cnsi.ucla.edu/institution/personnel?personnel_id=124316)
- UNISWA – Swaziland (http://www.uniswa.sz/academics/science/chemistry)