



Trent Centre for the Study of Biomaterials

Suresh Narine

**Ontario Research Chair in Green Chemistry and
Engineering**

Departments of Physics & Astronomy and Chemistry

Trent University

www.trentu.ca/biomaterials

T R E N T
B I O M A T E R I A L S
R E S E A R C H
P R O G R A M



Trent Centre for the Study of Biomaterials

- Application for approval to be submitted to the Trent Senate in May, 2010
- Built around the current Trent Biomaterials Research Program – focus is on LIPIDS (Soybeans, Canola, flax,..)
- Anticipates a critical mass of scientists working at specific nodes along the vertical chain from production to utilization.
- Will focus on specific areas – active collaboration with Ontario, Canadian and International scientists will form an essential part of the strategy to have a transformative approach.



Active Areas of Research

- Focus is on six nodes (7 Professors):
 - Modification of oilseed genetics so as to produce tailored molecules (Prof. Neil Emery)
 - Conversion technologies (Prof. Andrew Vreugdenhil, Prof. Suresh Narine, New CRC Tier II in Physics of Biomaterials)
 - Fate Analysis of Biomaterials (Prof. Chris Metcalfe).
 - GIS Mapping of Resources – land, water, labour, transportation, processing (Prof. Raul Ponce-Hernandez).
 - Sustainability of Commercialization Opportunities (Prof. Assaf Zohar).



Modification of Primary Feedstock

- Led by Professor Neil Emery (Department of Biology)
 - Plant physiological and molecular development
 - Physiological ecology
 - Hormone signalling, water uptake and use, seed development, branching
 - *This is an area where we will be seeking to enhance significantly with collaboration.*



Conversion Technologies

- Prof. Andrew Vreugdenhil (Department of Chemistry)
 - Materials for applications in sensors, coatings and interface modification.
 - Sol-gel chemistry is used to develop materials with finely tuned physical properties including surface area, pore sizes, index of refraction, surface chemistry and chemical durability.
 - These materials are then modified with additives to provide specialized chemical and physical capabilities. These include metals for conductivity, ligands for metal chelation and inorganic solids for improved mechanical properties.



Conversion Technologies

- New CRC Tier II Chair in Physics of Biomaterials
 - Currently being interviewed for.....



Conversion Technologies

- Prof. Suresh Narine (Director, Trent Biomaterials Research Program, Depts. of Physics & Astronomy and Chemistry.)
 - Multidisciplinary approach to the development of new and functional, environmentally-responsible materials from renewable, sustainable agricultural feedstock (Lipids), utilizing the following:
 - Synthetic Organic Chemistry
 - Microbial and Enzymatic Modification
 - Materials Chemistry and Physics
 - Polymer Physics



Conversion Technologies

- Dr. Narine's research continued.....
- Photo-synthetically created carbon-carbon bonds (in lipids) manipulated to produce green, environmentally-friendly products, including:
 - Healthy, functional foods and food matrices
 - Functional, toxin-free polymers
 - Functional waxes and greases
 - Lubricants with specialized functionalities
 - Cosmetics
 - Fuels

In addition to existing facilities, Trent is building a 5000 sq. ft. Facility for the Trent Biomaterials Research Program, led by Dr. Narine (50% completed)



Conversion Technologies

- Ontario Collaborators:
 - Prof. Mohini Sain, University of Toronto
 - Profs. A. Mohanty and M. Misra, University of Guelph
 - Prof. A. Marangoni, University of Guelph
 - Prof. Lenardo Simon, University of Waterloo
 - Others...



Fate Analysis of Biomaterials

- Led by Dr. Chris Metcalfe (Environmental and Resource Studies)
 - Fate analysis of biomaterials in aquatic, terrestrial and atmospheric environments.
 - Utilises novel, micro-environmental chambers and wind tunnels to study biodegradability and environmental fate.
 - Uses the world-class Worsfold Water Quality Centre Facilities.
 - Will also focus on carbon accounting and Life Cycle Assessment Models (in collaboration with Prof. M. Patel, Utrecht, NL).



GIS Mapping of resources

- Led by Prof. Raul Ponce-Hernandez (Environmental and Resource Studies)
 - GIS/RS research and applications to spatial modelling and process-based modelling of natural and anthropogenic phenomena (i.e. land suitability, land degradation, contaminants, terrestrial carbon cycle and other soil fertility elements, biodiversity, desertification).
 - Design of GIS/modelling-based methods for land-use planning, ecological and economic zoning and watershed management planning.
 - Applications to agriculture and forestry, environmental assessment and natural resources planning.



Sustainability of Commercialization Opportunities

- Led by Dr. Asaf Zohar (Department of Business Administration)
 - Feasibility of sustainable business models for commercialization of biomaterial opportunities
 - Will incorporate Life Cycle Assessment models



Funding and Research Partners

- NSERC
- Trent University
- Elevance Renewable Sciences
- Ontario Soybean Growers
- Ontario Ministry of Agriculture Food and Rural Affairs
- Industry Canada
- Greater Peterborough and Area Innovation Cluster