Why should the TCBR matter to you?

Because it is changing the world. Studying biomaterials is one of the most significant ways we can create a more sustainable future. Imagine using everyday products made from natural sources without the environmental complications of toxins. Imagine reducing our carbon footprint and creating a better world for future generations. The Trent Centre for Biomaterials Research is unique because of its interdisciplinary approach; chemists, physicists and social scientists come together to examine every factor of biomaterials, from their growth to their final use and implications. This is how the Trent Centre for Biomaterials Research is affecting a world of change.

Are you a highly motivated graduate student interested in biomaterials research, or a company focused on commercialization leadership in the new bioeconomy? Visit www.trentu.ca/tcbr

Our Lead Researchers in the Trent Centre for Biomaterials Research

World class professors, senior scientists, researchers and graduate students are led by **Dr. Suresh Narine**, Director of the Trent Centre for Biomaterials Research, Trent University Professor - Depts of Physics and Astronomy, and Chemistry; Ontario Research Chair in Green Chemistry and Engineering; and NSERC/GFO/ERS Senior Industrial Research Chair in Lipid Derived Biomaterials. Suresh Narine was named one of Canada's Top 40 Under 40 by *The Globe & Mail*.

Dr. Stephen Bocking, Professor and Chair, Environmental and Resource Science/Studies
- The roles of science in environmental policy and politics; environmental history and history of science

Dr. Neil Emery, VP Research and International, Professor, Biology
- Specialization in crop performance, particularly seed growth and development; hormonal effects on processes like fatty acid synthesis and oil deposition

Dr. Céline Guéguen, Canada Research Chair in Aquatic Sciences and Biogeochemistry, Assistant Professor, Chemistry
- Dynamics and characterization of dissolved organic matter in natural waters, cycling of trace metals in aquatic environments, role of nanoparticles in transport and bioavailability of trace metals in marine and fresh waters

Dr. Chris Metcalfe, Professor, Environmental and Resource Science/Studies, Director, Institute for Watershed Science, Senior Research Fellow, United Nations University
- The determination of the environmental fate and toxic effects of organic contaminants in the aquatic environment

Dr. Kathryn Norlock, Kenneth Mark Drain Chair in Ethics, Professor, Philosophy
- Environmental philosophy, ethics, socio-political issues, ethics of forgiveness, feminist philosophy

Dr. Raúl Ponce-Hernandez, Professor, Applied Modelling and Quantitative Methods, Professor, Environmental and Resource Sciences and Geography
- Earth observation systems and applied geospatial analysis, process-based modelling, climate change impacts and mitigation, carbon sequestration in biomass and soils, land resource assessment and land-use planning

Dr. Laura Summerfeldt, Registered Clinical Psychologist; Associate Professor, Psychology, Applications of Modelling and Quantitative Methods, Sustainability Studies Graduate Program
- Emotion regulation, cognition, decision making, situational and personality determinants of anxiety and anxiety-related behaviour

Dr. Andrew Vreugdenhil, Associate Professor of Chemistry, Director, Trent Centre for Materials Research
- Design, development and characterization of silane derived, sol-gel materials incorporating nanoparticle, hybrid and biohybrid research

Dr. Asaf Zohar, Professor and Chair of Business Administration, Director, Sustainability Studies graduate program
- Leadership in introducing sustainability to organizations, strategic analysis, creative problem solving, change management, systems thinking, and organizational learning

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TRENT CENTRE FOR BIOMATERIALS RESEARCH

Remaking the World's Materials Sustainably

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TRENT UNIVERSITY 50 1964–2014

Unique in North America, the Trent Centre for Biomaterials Research (TCBR) is on the cutting edge of research and technology development that will transform our world. Working to create a more sustainable future is at the heart of the work being conducted by the TCBR. Our focus on development, agricultural utilization and geographical, environmental and commercial impacts, sets Trent University's biomaterials approach apart. This is a research program where science meets social science and humanities, and where the creation and use of biomaterials is being examined within an ethical framework. One of only a handful of programs of its kind in the world, the TCBR is a leader in this life-changing realm of research.

What is the TCBR doing?

The TCBR's unique interdisciplinary nature examines the full spectrum of the biomaterials field from the crop seed to the development of biobased products and the implications of their use.

Agriculture

- Implementing seed modification for enhanced molecular profiles and functionalities
- Developing sound agronomic practices for modified crops
- Identifying transformed materials from crop residues, to produce forms of carbon with long-term residence time in the soil, in essence utilizing soil capacity for carbon sequestration

Organic Chemistry and Materials Science

- Utilizing unique chemical and physical techniques to turn natural oils into green chemicals, biomaterials and bioproducts
- Creating environmentally-friendly, waste-free reincarnations of materials and products currently manufactured from petrochemicals (lubricants, waxes and car bumpers, for example) and creating components for edible, cosmetic, agricultural and industrial uses

BIOMATERIAL / BIO-BASED MATERIALS:

Green, environmentally-friendly materials produced from photo-synthetically created carbon-carbon bonds in natural oilseed crops such as soy bean and canola.

Environmental Assessment

- Monitoring the total life cycle of natural oil-based materials – the energy associated with their lifespan, safe disposal of spent materials and the potential for toxic waste
- Developing techniques to make biomaterials without the use of toxins – this is our "Cradle to Cradle" approach; ensuring carbon released from biomaterials can be sequestered in successive crop cycles

Landscape and Geographical Analysis

- Assessing land use and maximizing sustainable land productivity in order to reduce our carbon footprint
- Investigating carbon sequestration options from sinks of both biomass and soil organic matter
- Assessing land suitability and crop productivity
- Determining the spatial variability of sources of raw biomaterials
- Monitoring landscape scale changes of all land cover, biomass and land productivity over time

Business Development and Human Factors

- Identifying, creating and integrating markets: developing an effective business strategy to create a demand for biomaterials
- Developing a transdisciplinary understanding of issues, barriers and key stakeholders in order to commercialize the need and use of biomaterials and create a more sustainable future.

Ethics

- Considering ethics in the production, utilization, implementation, commercialization and recycling of natural oil-based biomaterials
- Highlighting why biomaterials research is important and how it will impact all of us

Policy

- Developing policy tools that can help in understanding risks and ensuring safe use of biomaterials
- Encouraging informed decisions by society regarding biomaterials innovations

How is the TCBR doing this work?

Through funding from partners who share our vision of a more sustainable world, including Elevance Renewable Sciences Inc., Archer Daniels Midland, Pepsico, the Grain Farmers of Ontario, Ontario Ministry of Agriculture, Food and Rural Affairs, the Natural Sciences and Engineering Research Council (NSERC), Industry Canada, Ontario Centres of Excellence, and the Peterborough Innovation Cluster, led by Trent University.

State-Of-The-Art Laboratories

Fifteen-thousand square feet of laboratory space is spread over four distinct laboratory groups, each examining a particular consideration of biomaterials. This design, combined with Trent's remarkable facilities and equipment, positions the TCBR as a world-leader in the development and study of vegetable-oil based biomaterials.

TCBR Laboratory Groups:

Seed Modification Laboratories and Greenhouses provide high-throughput routine extraction and purification of trace-seed metabolites, including plant growth regulators. The Natural Resources DNA Profiling and Forensics Centre provides high throughput of gene expression analysis, the Aurora Greenhouse is a research-grade facility that can artificially reproduce any plant growth climate.

Chemical Conversion and Materials Science equipment provides second-to-none chemical modification, separation, and identification, along with a complete range of chemical and physical characterization of materials. TCBR facilities provide the ability to evaluate structure at length scales ranging from the molecular to the macroscale.

Fate Analysis and Environmental Chambers in the Trent University Water Quality Center and the Trent Microenvironment Laboratory allow the evaluation of materials under controlled atmosphere, soil and water environments. Analytical equipment allows measurement of chemical fragments from biodegradation and the complexation potential of products with heavy metals under changing environmental conditions.

Geographical Information Systems and Remote Sensing in the Applied Geomatics, Remote Sensing and Land Resources Laboratory and the Centre for Earth Observations and Geospatial Analysis (CEOSGA) provide instrumentation for satellite detection, geospatial analysis and mapping of land cover and biomass, mapping of vegetative sources and computer modeling of plant growth, yields and vegetative sources of biomaterials and monitoring of landscape and local-scale changes of biomass over time.