WESTERN SYDNEY
UNIVERSITY

Hawkesbury Institute
for the Environment

RESEARCH CAPABILITY

Advances in Genomics & Molecular Biology

Using genomics and molecular biology to address climate change and other environmental challenges

Acknowledgement

Western Sydney University acknowledges the peoples of the Darug, Tharawal, Eora and Wiradjuri nations. We acknowledge that the teaching, learning and research undertaken across our campuses continues the teaching, learning and research that has occurred on these lands for tens of thousands of years.

Researchers

To contact HIE Soil Biology and Genomics Theme scientists, please go to:
www.westernsydney.edu.au/hie/research/soil_biology_and_genomics

Published by

Hawkesbury Institute for the Environment

www.westernsydney.edu.au

Deciphering molecular pathways underlying climate stressors

Genomic and molecular biology research has the capability to expand our understanding of the structure, function and evolution of the molecules essential for all life on Earth.

Next generation sequencing technologies combined with bioinformatic tools allow us to decipher key molecular pathways underlying stress responses and functional changes due to altered environmental conditions.

These approaches also help us to understand the genetic factors that contribute significantly to resilience and responses to stress.

Bioinformatics

At the Hawkesbury Institute for the Environment, we use genomic, bioinformatics, and molecular biology techniques to explore response and resistance pathways against climate change stressors. Our main subjects of study are plants, soils, and insects.

With climate change factors continuously challenging the survival of species, understanding the mechanisms that allow organisms to thrive, adapt, and evolve will inform environmental conservation efforts and the future of sustainable agriculture.

- **Bioinformatics**
- **Genomics**
- **Computer science**
- **Information engineering**
- **Mathematics**
- **Statistics**

Our researchers use state-of-the-art bioinformatics and high performance computing suitable for 'big data' applications to reveal complex networks of molecular interactions occurring within and between organisms.

Plants

Our researchers study how changes in the environment influence regulatory mechanisms and metabolite accumulation in plants, thus promoting memory forming processes, cellular acclimation and reproduction, and plant adaptation to change.

How altered environmental conditions change the accumulation of metabolites in the rhizosphere (zone of soil surrounding the roots).

The role of RNA structural switches (riboswitches) influencing the nature of gene expression or protein levels.

Regulatory mechanisms controlling mechanical touch induced gene expression in plants.

Links between Rubisco catalysis, CO_2 concentration mechanism and resource use efficiency in plants.

High-throughput sample preparation robotics to enable emerging large-scale plant genomics, metabolomics, and proteomics research.

Genotypic and chemotypic diversity of *Eucalyptus moluccana* and its role in psyllid caused dieback.

We focus on developing new solutions to improve plant performance and improve agricultural sustainability, from model plants to crops and native forest species.

Soils

Processes underlying assembly of microbial communities, and mechanisms generating soil microbial biodiversity and their response to various stressors.

Metagenomic approaches to isolate novel genes and enzymes with future bioremedial and therapeutic uses.

Soil quality and ecosystem health assessments.

Microbial genes controlling greenhouse gas emissions.

Molecular and genetic basis for symbiosis between *Eucalyptus* and beneficial and pathogenic fungi.

NGS-based molecular approaches to study biogeographic patterns of soil microorganisms.

Insects

Population and ecological genetics of arthropods: insect adaptations and applications to pest management.

Insect virus evolution, transmission, and effects via molecular and bioinformatic techniques.

Genomic approaches to multitrophic insect community ecology and evolution.

Using gene expression to dissect molecular basis of adaptive traits in moths, butterflies, flies.

Studies and applications of insect-microbe interactions relevant to insect population dynamics, plant health and pest management.

WESTERN SYDNEY
UNIVERSITY

Hawkesbury Institute
for the Environment

We invite researchers and investors to explore future opportunities to work with the **Hawkesbury Institute for the Environment.**

Hawkesbury Institute for the Environment
Senior Advisor (Research Strategy and Partnerships)
Dr Nisha Rakhesh
Telephone: (02) 4570 1310
Email: n.rakhesh@westernsydney.edu.au

Hawkesbury Institute for the Environment
Western Sydney University, Locked Bag 1797, Penrith NSW 2751 Australia
Bourke Street, Richmond NSW 2753 Australia. Phone: +61 2 4570 1125 Email: hieinfo@lists.westernsydney.edu.au

westernsydney.edu.au/hawkesburyinstitute