



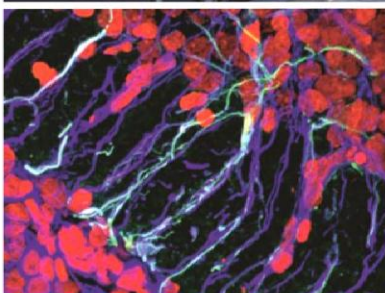
ucc

Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland



Research in the Department of Anatomy and Neuroscience University College Cork

www.ucc.ie/en/anatomy



Department of Anatomy and Neuroscience

This is a landmark time in the Department's history as it is in the process of moving to its new teaching and research facilities in the Western Gateway Building. The new state of the art facility offers huge potential for further development of teaching and research in the Department.

To reflect its role in Anatomy and neuroscience education and training the Department has recently changed its name to the Department of Anatomy and Neuroscience. New research facilities are also coming online in the Western Gateway Building which coupled with the development of the 'Neuroscience Hub' in the same building (expected to open in early 2013) ensure that the Department is able to make significant research advances in the



Neurosciences. The mysteries of how the brain develops, functions and malfunctions are among the most challenging and fascinating in modern medicine where new techniques at the molecular and cellular level are opening up exciting avenues for scientific pursuit.

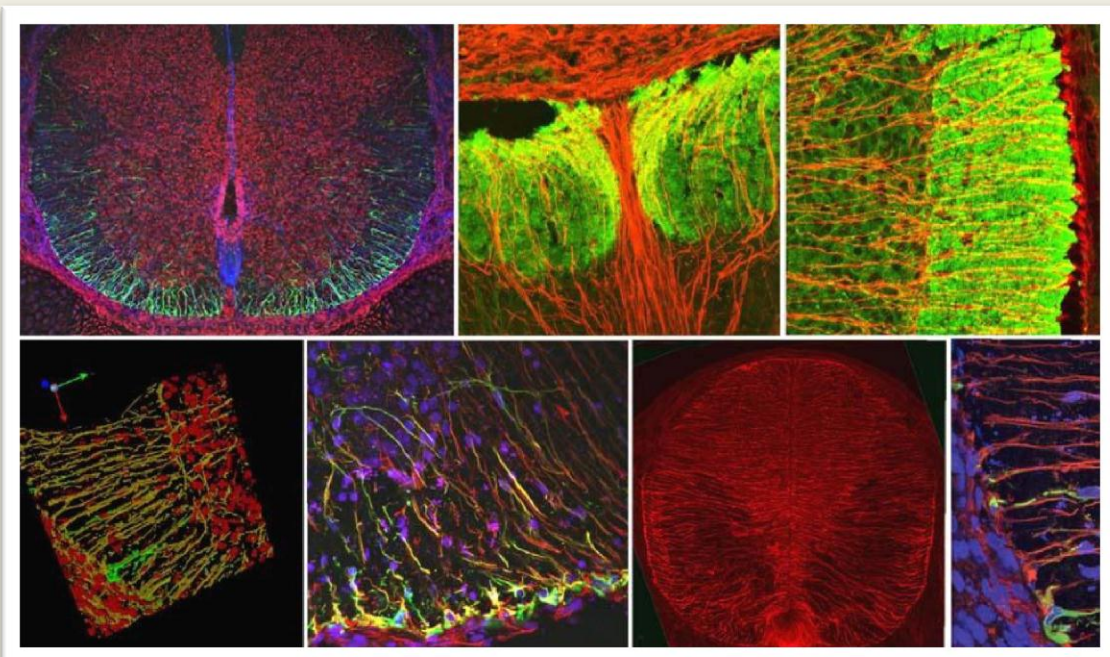
The new teaching and research facilities ensure that the Department is excellently poised to keep abreast with such changes. Thus the teaching mission of the Department is to enable high-quality innovative teaching and assessment of anatomy & neuroscience at both undergraduate and postgraduate level within a context that is clinically meaningful and related to the competencies required by Health Professionals and research and industry-based scientists.

From a research perspective the Department of Anatomy & Neuroscience at UCC has a long-standing focus on neuroscience research and our goal is to continue to develop an internationally recognised research unit in the neurosciences to advance knowledge, and to educate both students and society of the mechanisms and potential treatments for brain disorders.

Research in Anatomy & Neuroscience

The **research program** consists of coherently linked projects in the fields of development, degeneration and regeneration. It ranges from fundamental studies to the development of strategies for neuroprotection, neuroregeneration and restoration of function of damaged tissue in neuroinflammatory disorders. Most of the experimental programme is multidisciplinary, within and outside the group. The experimental programme encompasses genetic, molecular, cellular, tissue, system and behavioral levels. The range of techniques and expertise available is broad and is particularly strong in relation to post-genomic and cellular studies, whereby molecular events are analysed and are located with high precision in cells and tissues, in order to understand the complex interplay of events.

Neuroscience Research Thematic Programme



1. Neural circuitry underlying stress-related disorders
2. Neurogastroenterology
3. Developmental Neuroscience and Regeneration
4. Neurodegeneration
5. Neuroprotection and Therapeutics
6. Neuroinflammation

All of these areas are being energetically developed over the forthcoming 5 years, specifically as defined below.

Neural circuitry underlying stress-related disorders

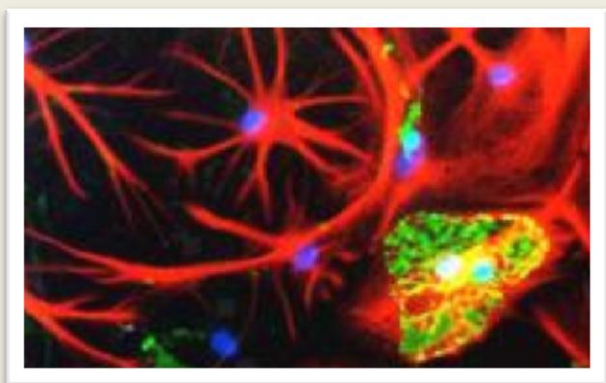
John Cryan, Olivia O'Leary,
Siobhain O'Mahony

- ✓ Neurobiological basis of stress-related neuropsychiatric disorders including depression, anxiety and drug dependence.
- ✓ Understanding the interaction between brain and gut and how it applies to stress and immune-related disorders, including irritable bowel syndrome, obesity and sepsis.
- ✓ The impact of early life stress on the developing gastrointestinal microbiota
- ✓ Applying novel approaches to facilitate drug/siRNA delivery to the brain in vivo.

Neurogastroenterology

John Cryan, Siobhain O'Mahony

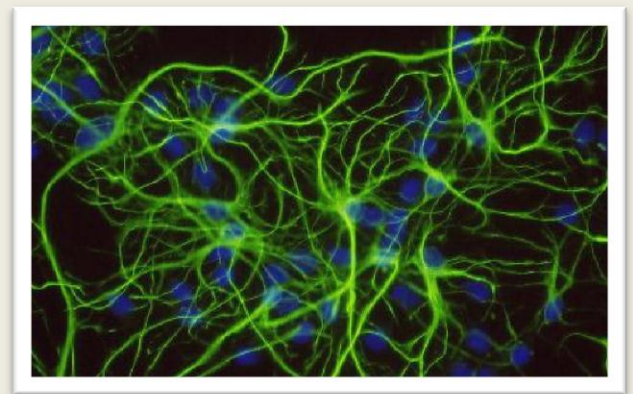
- ✓ Understanding the interaction between brain and gut and how it applies to stress and immune-related disorders, including irritable bowel syndrome, visceral pain, obesity and sepsis.
- ✓ Investigation of dysfunctional communication within the brain gut axis in the emergence of functional bowel disorders
- ✓ Examination of GPCRs in the development of visceral hypersensitivity particularly within the lumbar-sacral spinal cord
- ✓ The role of the gut bacteria in anti-psychotic associated obesity.



Developmental Neuroscience and Regeneration

Kieran McDermott, Ger O'Keeffe, Yvonne Nolan,
Aideen Sullivan, Olivia O'Leary, André Toulouse

- ✓ Investigation of glial-neuronal interactions in the developing nervous system.
- ✓ Elucidation of spinal cord radial glial cell development and determination of the lineage relationships among different types of neuroepithelial cells in the spinal cord.
- ✓ Gene expression profiling in neuroepithelial stem and progenitor cells during development and in the adult CNS to elucidate mechanisms underlying fate decisions, differentiation and phenotypic diversity.

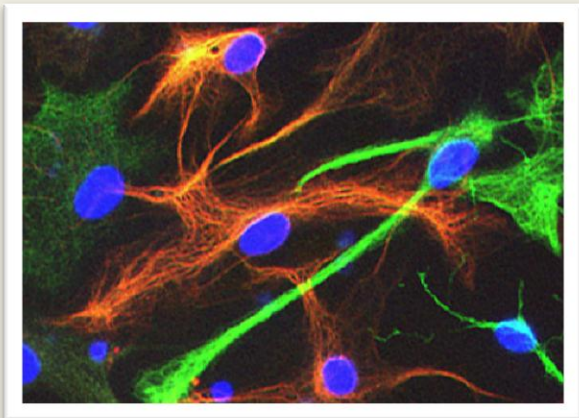


- ✓ Spatial and temporal patterns of oligodendroglialogenesis and myelination in vivo.
- ✓ "Developmental windows" – studying the molecular architecture of critical periods of development affecting the formation of the nervous system.
- ✓ Transcription factor networks controlling axonal growth.
- ✓ Examination of the development of midbrain dopaminergic neurons, including gene expression profiling using microarray technology and studies on phenotypic changes which occur during specification, maturation and differentiation of these neurons.
- ✓ Investigation of the effect of inflammation on neurogenesis in the embryonic and adult hippocampus.
- ✓ Elucidation of the migration patterns of newly generated astrocytes and oligodendrocytes

Neurodegeneration

Aideen Sullivan, Yvonne Nolan, André Toulouse,
Ger O'Keefe, Kieran McDermott

- ✓ Astroglial heterogeneity and role of astroglial in neuron's degeneration.
- ✓ Development of in vivo and in vitro models of cyclopamine-mediated models of oligodendrocyte depletion and demyelination
- ✓ Study of mechanisms of cytotoxicity in spinocerebellar ataxias and Huntington's Disease.
- ✓ Mechanisms of neuronal cell death in Parkinson's Disease.
- ✓ Role of activated microglia and pro-inflammatory cytokines in degeneration of midbrain dopaminergic neurons pertinent to Parkinson's disease.

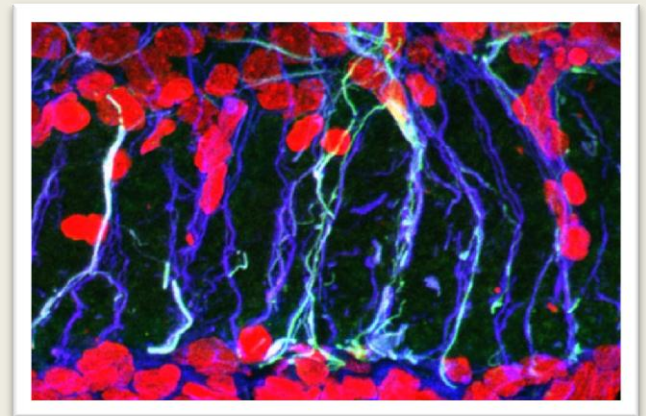


- ✓ Identification of inflammation-induced intracellular signaling cascades mediating the death or survival of midbrain dopaminergic neurons and hippocampal precursor cells.
- ✓ Reorganization of dynastic circuitries and selective loss of neurons in the amygdala in human temporal lobe epilepsy (TLE) and experimental epilepsy

Neuroinflammation

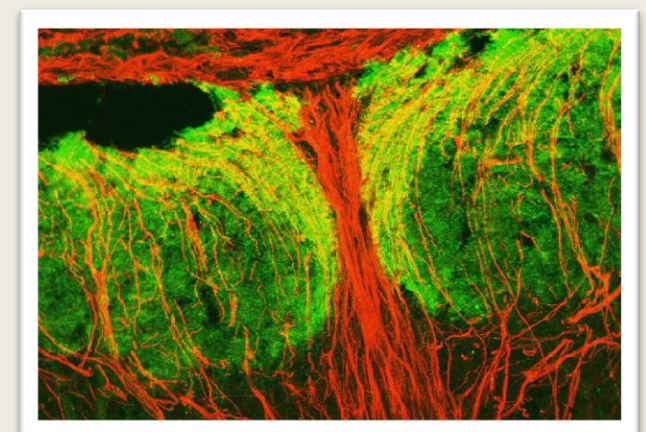
Yvonne Nolan, Siobhain O'Mahony,
John Cryan, Ger O'Keeffe

- ✓ Deciphering the role of inflammation in the
- ✓ Degeneration of dopaminergic neurons pertinent to Parkinson's Disease
- ✓ Regulation of dopaminergic neural stem cell fate
- ✓ Impairment of embryonic and adult hippocampal neurogenesis
- ✓ Visceral hypersensitivity associated with post-infectious irritable bowel syndrome.
- ✓ Inflammation as a "normal" neurodevelopment process.
- ✓ Consequences of maternal immune activation on foetal brain development



Neuroprotection and Therapeutics

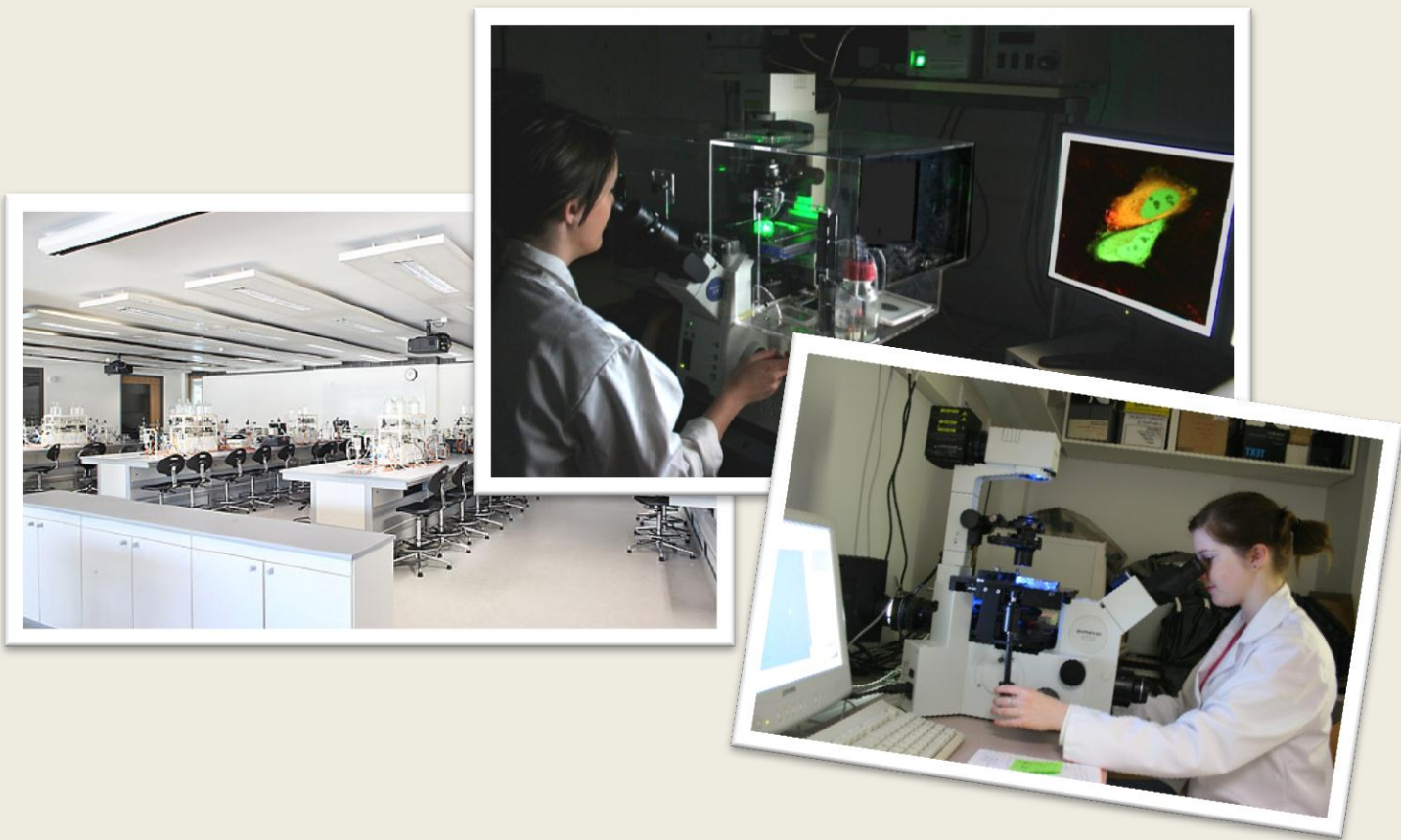
Aideen Sullivan, Yvonne Nolan, André Toulouse,
Ger O'Keeffe



- ✓ Neuroprotective and immunomodulatory therapies for Parkinson's disease
- ✓ Genetic manipulation of embryonic stem cells for Parkinson's disease

Research Facilities

The Department of Anatomy and Neuroscience is fully equipped with state of the art research laboratories and equipment. Its research labs are located in the Biosciences Institute and the Western Gateway Building and are equipped with the latest facilities and equipment for cell culture, molecular biology and behavioural testing. It also houses the BioSciences Imaging Centre which is equipped for a variety of light and electron microscopic applications, including TEM, SEM, laser scanning confocal and two-photon imaging.



These are supported by high performance computing and image analysis workstations. The Department offers a training and booking service on its microscopy instruments, and welcomes researchers from other departments within the University and from external users in Industry etc. For further information follow this link to the [Imaging Centre](#).

Research Staff





John F. Cryan is Professor & Chair, Dept. of Anatomy & Neuroscience, University College Cork. He received a B.Sc. (Hons) and PhD from the National University of Ireland, Galway, Ireland. He was a visiting fellow at the Dept Psychiatry, University of Melbourne, Australia (1997-1998), which was followed by postdoctoral stints at the University of Pennsylvania, Philadelphia, USA and The Scripps Research Institute, La Jolla, California. He spent four years at the Novartis Institutes for BioMedical Research in Basel Switzerland, as a LabHead, Behavioural Pharmacology prior to joining UCC in 2005 where he

was a Senior Lecturer in Pharmacology in the School of Pharmacy and in the Dept. Pharmacology & Therapeutics UCC. Currently he is also a Principal Investigator in the Alimentary Pharmabiotic Centre and Food Health Ireland

Dr. Cryan has an H-Index of 35 having published over 130 peer-reviewed articles and book chapters including articles in high-impact journals such as PNAS, Neuron, Nature Reviews Drug Discovery, Molecular Psychiatry, Biological Psychiatry, Progress in Neurobiology, Gastroenterology, Gut and Journal of Neuroscience. He has been commissioned to co-edit books on "Behavioural Neurogenetics" (Springer Press, 2011) and on "Depression: From Psychopathology to Pharmacotherapy" (Karger Press, 2010).

Dr. Cryan has given over 40 Invited Lectures at various Institutions worldwide, and more than 30 Invited Oral/Plenary presentations at International Conferences. Dr. Cryan is an Editor of both British Journal of Pharmacology and Neuropharmacology. He is Advisory Editor of Psychopharmacology; on the Board of Reviewing Editors of Brain Research; an Associate Editor of Frontiers in Behavioural Neuroscience; an Associate Editor of Frontiers in Psychopharmacology; an Associate Editor of Frontiers in Gastrointestinal Pharmacology; an Editorial Board Member of Behavioural Pharmacology and has acted as Guest Editor of both Neuroscience and Biobehavioral Reviews and International Journal of Neuropsychopharmacology. He is an adhoc reviewer for 72 different journals including Science, PNAS, J.Neurosci, Mol. Psychiatry, Arch Gen Psych, TiPS, Nature Methods and PLOS Biology. He organised a highly successful Conference for the European Behavioural Pharmacology Society in Cork in 2008 "From Mouse to Man: Behavioural Genetics and its Relevance to Psychiatric Disorders".and is on the Programme Committee for the 24th Congress of the European College of Neuropsychopharmacology, Paris, France, September, 2011. He is co-organiser of the 21st Neuropharmacology Conference in Washington DC in November 2011 on the topic of Anxiety and Depression.

Dr. Cryan is a member of the International Union on Pharmacology (IUPHAR) Committee on GABAB receptors. He is a member of the Full Committee of the European Behavioural Pharmacology Society and served as its Meeting Secretary and Executive Committee Member from 2007-2009. Dr Cryan has been honoured with the European College of Neuropsychopharmacology (ECNP) Fellowship Award, the Wyeth Psychopharmacology Award from British Association of Psychopharmacology and the Young Scientist Award from the European Behavioural Pharmacology Society.

He is currently External Examiner for University Birmingham, BMed Sci Degree and Galway-Mayo Institute of Technology, BSc (Hons) Degree in Applied Biology and Biopharmaceutical Sci. He has been an invited PhD thesis examiner at University of Bordeaux, France; Trinity College Dublin; Katholieke Universiteit Leuven, Belgium; University Oxford, UK; University of Utrecht, The Netherlands; Univ Tartu, Estonia and Kings College London.



Kieran McDermott received a BSc (Hons) in Zoology from University College Cork in 1984. He obtained an MSc in Experimental Pathology and Toxicology (1985) and a PhD in Developmental Neurobiology (1990) from the University of London. Postdoctoral work in developmental neurobiology, funded by a Wellcome Trust Travelling Fellowship, and experimental neuropathology was subsequently undertaken at the Department of Anatomy and Cell

Biology, Emory University, Atlanta, USA and the

Department of Clinical Veterinary Medicine, Cambridge, UK. In 1992 he was appointed Lecturer in the Department of Anatomy at University College, Cork. After taking up that appointment he played a key role in setting up the BSc (Hons) in Neuroscience at UCC, the first such degree in Ireland. In 2003 he was promoted to Senior Lecturer and his teaching is mainly in medical, dental, neuroscience and postgraduate programmes. He served as Head of Department of Anatomy on a number of occasions, most recently from February 2010 until July 2011. His research interests include the developmental origins and lineage determinants of neural cell types, including neural stem cells and the pathophysiology of neurodegenerative diseases such as Parkinson's disease and multiple sclerosis and has received research funding from SFI, HRB, Wellcome, PRTL, IRCSET, the Anatomical Society and the Multiple Sclerosis Society. He has been a Principal Investigator in the UCC's Biosciences Institute since 2002 and Director of the BioSciences Imaging Centre since 2007. He has served on the Neuroscience and Postdoctoral Fellowship committees of the Health Research Board of Ireland and undertakes international grant evaluations for the EU, INTAS and AOSpine among others. He has been an external examiner for the Universities of London, Portsmouth and Cambridge and is a reviewer for numerous neuroscience and developmental neurobiology journals. In 2003, he, jointly, won the Olympus-GIT Verlag International Microscopy Award and, in 2006, became the first elected President of Neuroscience Ireland, Ireland's new national neuroscience association.



Yvonne Nolan graduated from NUI, Galway with a BSc (Hons) in Biochemistry (1996), and a PhD in Neuropharmacology (1999). She was a visiting fellow at McGill University Montreal, Canada (1998) and worked as a postdoctoral researcher in the Physiology department with Prof. Marina Lynch, Trinity College, Dublin (1999 – 2003) where her research focused on age- and inflammatory related deterioration in neuronal function. In 2003 she was appointed as Lecturer in the Department of Anatomy and Neuroscience, UCC and in 2011 she

was promoted to Senior Lecturer. In 2006 she was awarded a Postgraduate Certificate in Teaching and Learning in Higher Education (UCC), and in 2008 she received a National Academy award for the Integration of Research and Teaching and Learning. Yvonne is currently involved in teaching and co-ordinating anatomy and neuroscience modules for Occupational Therapy, Speech and Language Therapy and Neuroscience students.

Dr. Nolan's research focuses on how neuroinflammation affects neurogenesis (the birth of new neurons) during development and in the adult brain, as well as its contribution to the degeneration of neurons in Parkinson's disease. She leads an active research group of MSc and PhD students, and her research has been funded by Science Foundation Ireland, the Irish Research Council for Science Engineering and Technology, Vasogen Inc., Canada, and Marigot Limited, Ireland. She has served as an expert reviewer for the EU FP7 programme for research. She is a member of the School of Medicine Postgraduate Affairs committee, Chair of the Departmental Graduate Studies committee and is the UCC representative on the Neuroscience Ireland committee.



Siobhain O' Mahony graduated with a B.Sc. (Hons) in Neuroscience from University College Cork. She then went on to complete a Masters in Neuropharmacology in the National University of Ireland, Galway. Siobhain spent one year in the Department of Psychiatry and Neuropsychology in the University of Maastricht, the Netherlands, which was funded by a Marie Curie Fellowship. Siobhain obtained a Ph.D. from the department of Psychiatry, UCC and continued her research on early life stress during a post-doctoral post in the Alimentary

Pharmabiotic Centre, UCC. She then took up a post with GlaxoSmithKline in Cork validating lead compounds targeting visceral pain in irritable bowel syndrome.

In 2008 Siobhain was appointed as Lecturer in the Department of Anatomy at UCC. She is involved in teaching the B.Sc. in Neuroscience and anatomy to the Graduate Medical Entry students. Her research group is in the Biosciences Institute and is focused on the involvement of early life stress in the development of visceral pain in adulthood



Aideen Sullivan leads an active research group, based in the Biosciences Institute at University College, Cork. Her research is focused on novel approaches to the treatment of Parkinson's disease, in particular neuroprotective therapies, which have the potential to slow or even reverse the progression of this disease. Her research programme is funded by the Health Research Board and the Irish Research Council for Science Engineering and Technology.

Dr Sullivan graduated from University College Dublin in 1992 with a BSc (Hons) in Pharmacology. She obtained a PhD in Neuropharmacology from the University of Cambridge, UK, in 1995. She worked in the Imperial College School of Medicine, London, as a post-doctoral researcher from 1995-1998, on a project funded by the Parkinson's Disease Society. In 1998, she was appointed as Lecturer in the Department of Anatomy at UCC and was promoted to Senior Lecturer in 2006. She was involved in establishing the BSc (Hons) in Neuroscience at UCC- the first Neuroscience degree in Ireland - and she has been active in teaching and co-ordinating this degree course since her appointment to UCC. In 2006, she was awarded a Postgraduate Certificate in Teaching and Learning in Higher Education from UCC. She practices research-led teaching and encourages capable students to pursue research careers. She provides mentoring to undergraduate and postgraduate students and to colleagues. In 2001, she attained a FETAC cert (awarded Distinction) in Peer-mentoring.

Dr Sullivan is active in promoting Neuroscience and stem cell research in Ireland. As a member of the Cork Neuroscience Group committee, she is presently organising a series of public awareness talks in UCC about current research and treatments for neurological diseases. She visits PD patient and carer groups, and clinicians and nurses who work with PD patients, to speak about her research, or recent advances in the research field. She is a member of Neuroscience Ireland, FENS (Federation of European Neurosciences), NECTAR (Network of European CNS Transplantation and Restoration), the Anatomical Society of Great Britain and Ireland, and the Irish Network of Neuronal Stem Cell Investigators



Olivia O'Leary is a lecturer in the Department of Anatomy and Neuroscience, University College Cork. Olivia graduated with a BSc in Biotechnology, NUI, Galway, followed by an MSc in Neuropharmacology at the same institution. She was a visiting scholar for over three years at the University of Pennsylvania, Philadelphia, USA, where she conducted her PhD research in behavioural neuropharmacology. This was followed by postdoctoral research at the Neuroscience Centre at the University of Helsinki

where her research was focused on the role of neuronal plasticity in pathophysiology and treatment of psychiatric disorders. In 2008, Olivia was awarded a prestigious Career Development Award from the Health Research Board to conduct her research at the School of Pharmacy, University College Cork, where she was appointed as lecturer in 2011. Olivia then joined the Department of Anatomy and Neuroscience as a lecturer in 2012.

Olivia's main research interest is in the neurobiology and treatment of stress-related psychiatric disorders with a particular focus on depression. Her research has been published in high-impact journals including PNAS and Science. In addition, Olivia has been the recipient of several awards from international professional societies including The Rafaelsen Young Investigator Award from the International College of Neuropsychopharmacology (2011) and the Fellowship Award from the European College of Neuropsychopharmacology (2010), as well the career development award from the Health Research Board Ireland (2008-2011). In addition to her teaching and research activities, Olivia is also an expert reviewer for 20 different international journals.



Gerard O'Keeffe graduated with a BSc degree (1st Hons) in Neuroscience from University College Cork (UCC) in 2000. Subsequently he undertook a PhD in the Department of Anatomy in UCC in Developmental Neurobiology, where he studied the roles of members of the TGF-beta superfamily in regulating the development of midbrain dopaminergic neurons. During his PhD, Dr. O'Keeffe spent 4 months in the Karolinska Institute in Stockholm, Sweden on an Enterprise Ireland-funded International Collaboration

grant developing his research. In 2004, after graduating from his PhD, Dr. O'Keeffe moved to Cardiff University where he worked in the laboratories of Prof. Alun Davies. Here he

expanded his research interest in neural development, by looking at the roles of members of the TNF superfamily of receptors, and the molecular mechanisms mediating their effects on neuronal survival and growth in the developing CNS and PNS. He was awarded a Leverhulme Trust Research Fellowship in 2008, but instead he returned to UCC in September 2008 when he was appointed as Lecturer and Principal Investigator in the Department of Anatomy. He is currently involved in teaching Anatomy and Neuroscience on the new graduate entry medical course, as well as undergraduate science students. His research is based in the laboratories of the Department of Anatomy in the state-of-the-art Biosciences Institute in UCC



André Toulouse received a B.Sc. degree in Biology from Université Laval (Québec, Canada) in 1991. He then developed his expertise in cellular and molecular biology by completing a M.Sc. (1993) and a Ph.D. (1998) in Molecular Biology at Université de Montréal (Montréal, Canada). His interest in Neuroscience led him to undertake post-doctoral work with Dr Guy Rouleau in the Centre for Research in Neuroscience at McGill University (Montréal, Canada) where he also worked as a research associate in the

Neurogenetics Laboratory. His research areas included pharmacogenetic studies of schizophrenia, gene cloning and the study of molecular mechanisms of neurodegeneration. In 2003, he moved to University College Cork to undertake a post-doctoral fellowship on the molecular biology of neurotrophic factors in the laboratory of Dr Aideen Sullivan in the Biosciences Institute. His research interests are now focused around two themes: the mechanisms of neurodegeneration in polyglutamine disorders and the genetic manipulation of embryonic stem cells. He was appointed College Lecturer in Clinical Anatomy in September 2005 and is involved in teaching Developmental Biology, Anatomy and Neuroscience to UCC students.