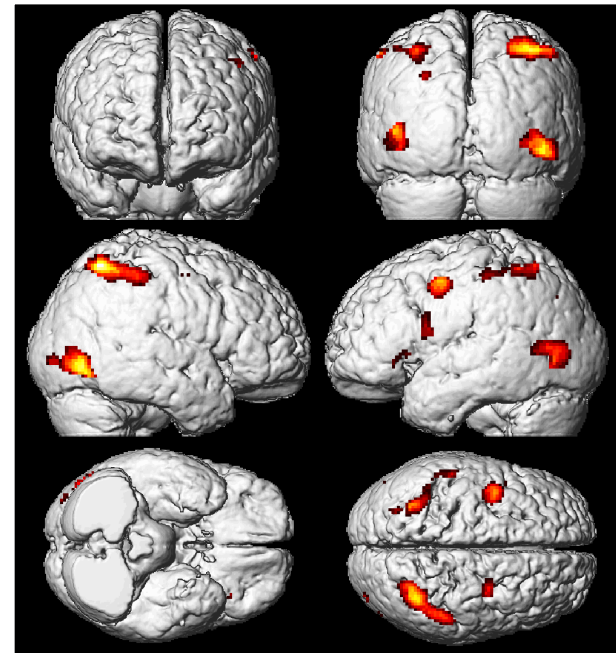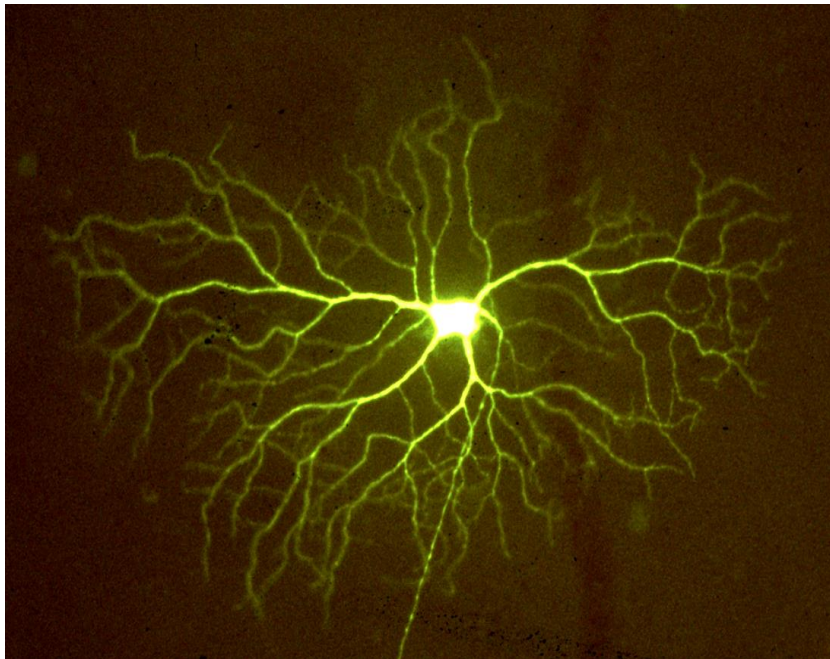# Imperial College London

BSc Neuroscience and Mental health

Course Director: Dr Magdalena Sastre
Course administrator: Ms Olive Thomas

Learning Outcomes:

1. Demonstrate an understanding of the role of **different cell types in the nervous system** and potential **therapeutic applications** such as stem cell therapy.
2. Demonstrate an understanding of the **disease mechanisms underlying neurodegenerative disorders** (such as Alzheimer's disease, Parkinson's disease, Multiple Sclerosis and Motor Neuron Disease) **and psychiatric conditions** (such as schizophrenia, bipolar disorder and autism), based on a multidisciplinary approach (genetics, neuropathology, cell biology and imaging).
3. Appraise **current therapies** and novel experimental approaches for treatment of neurological and neuropsychiatric disorders.
4. Demonstrate an understanding of the **basis for both Substance misuse and addiction** and behavioural addictions such as problem gambling and be familiar with different therapeutic approaches used in addiction such as pharmacological interventions and cognitive behavioural therapy
5. Demonstrate an understanding of the **psychopathology of affective disorders** and current models of underlying mechanisms (molecular, cognitive, psychological).
6. Demonstrate an understanding of the **psychopathology of mood instability and self-harm behaviour** within a lifespan perspective, and be familiar with public health implications, current challenges in detection, measurement and available interventions

The course is made up of:

Module 1: Three taught courses/blocks
(3 X 3 weeks, each followed by a consolidation week)
Module leaders: Amin Hajitou, Dasha Nichols

Module 2: Self directed learning
Group literature review
Clinical case report (4 weeks)
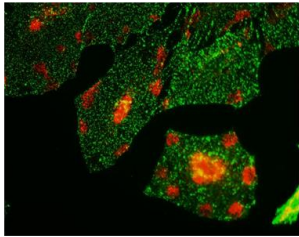Module leaders: Simone Di Giovanni and Marco Brancaccio

Module 3: Research Project
(15 weeks)
Types of projects: clinical/lab based/systematic review
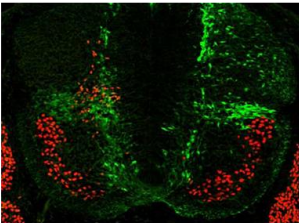Module leader: Sam Barnes

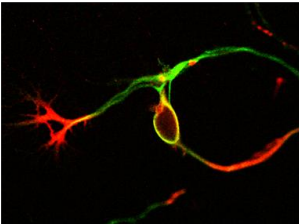# MODULE 1, Block 1: Cellular & Developmental Neurobiology

Cells

e.g. Neuron-glia inter-relationships & cell
      biology in health & disease
      Cell/tissue culture & visualisation
      When good cells go bad - cancer

Rat astrocytes in culture

Nervous system development

e.g. Neural tube - Neurogenesis - Disorders
      Neuronal migration - Axon guidance
      Cerebellar development & circuitry
      Synapse remodelling

Computational Neuroscience

Regeneration

e.g. The problem of CNS regeneration
      Regeneration strategies
      Therapeutic use of stem & other cells
      Brain Tumours

Cortical neuron regenerating an axon

Axonal damage diseases

Traumatic brain injury
Spinal cord injury
Multiple sclerosis

Preparation for ICA-1

- "Story of a paper" insight into research
- Guidance on how to interpret, write articles & research papers
- Journal club presentations

ICA1: Written assessment:
Commentary on a research article; 1000 words max

MODULE 1, Block 2: <u>Neurological diseases of the Central Nervous System</u>
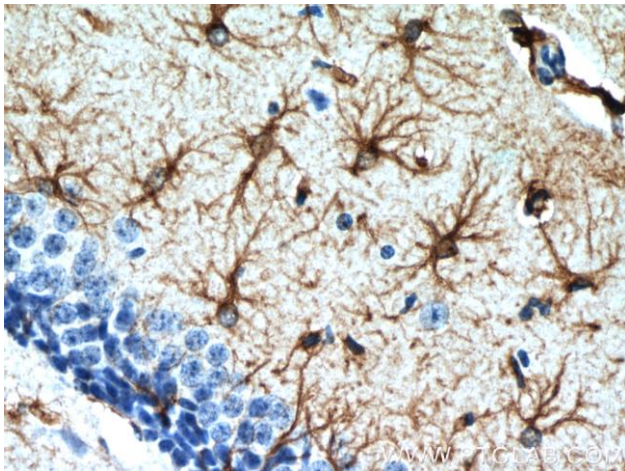
Clinical presentation, underlying pathology, genetics, experimental models and treatment of

- Stroke
- Parkinson's disease
- Motor neuron disease
- Epilepsy
- Neurodegenerative dementias
- Huntington's disease
- Prion disease
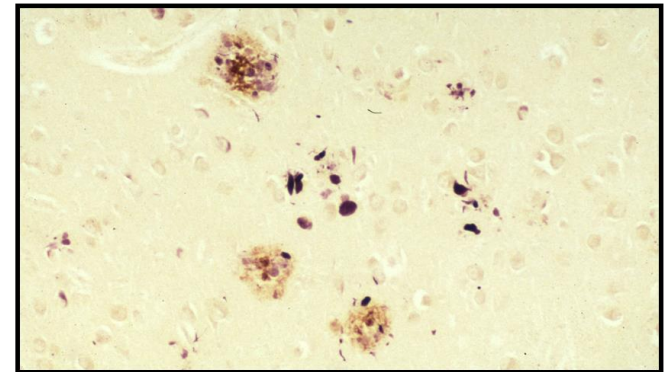
Alzheimer's Disease: amyloid deposits

Laboratory practical: Neuropathology

Integrating clinical presentation with aetiology and pathology
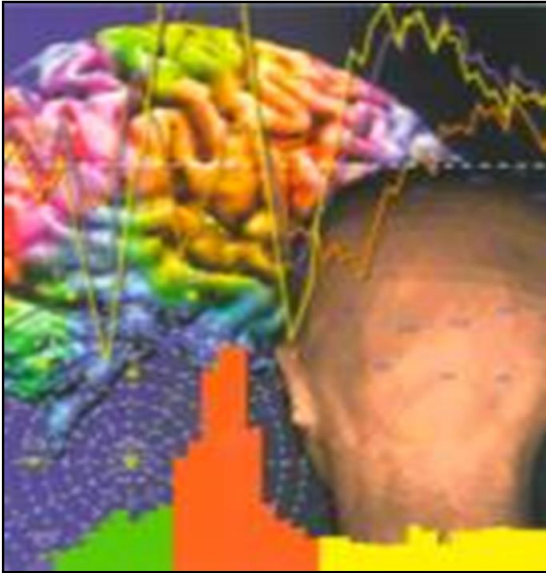
ICA-2: Data analysis
- 1500 words results compendium
- Scientific abstract
- Lay abstract

MODULE 1, Block 3:
Neurodevelopment, Mental Health, and Mental Illness

The biological and Psychosocial basis of:

- Autism
- ADHD
- Depression
- Bipolar Disorder
- Schizophrenia
- Drug and alcohol misuse and addictions
- Personality disorder

A comprehensive introduction to the aetiology and treatment of psychosis, substance misuse and personality disorder

ICA-3: Oral presentation

Powerpoint presentation of a study design

TREATMENT PHASES IN DEPRESSION

No depression

Severity — Symptoms — Response

Syndrome

Treatment Phases — Acute — Continuation — Maintenance

Time
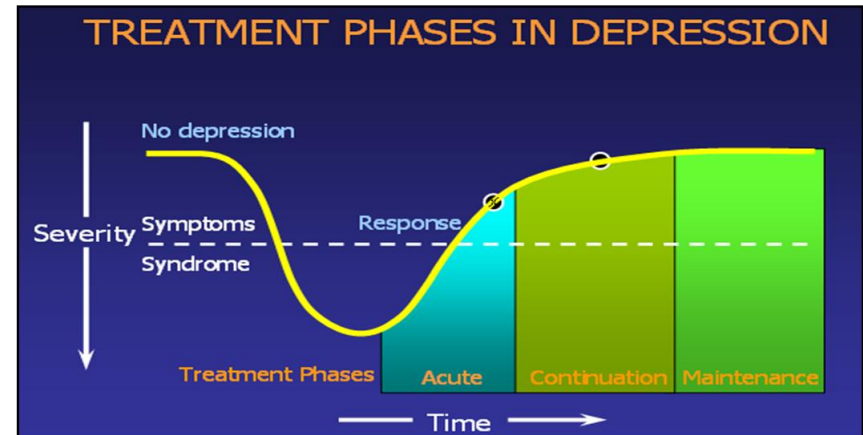
Module 2: self-direct learning, involving a literature review and a clinical case study (Science in Context)

Module Leaders; <u>Prof. Simone Di Giovanni and Dr Marco Brancaccio</u>

The literature review will consist of 3500 words (abstract 350 words) on a neurological or psychiatric disease and will be done in groups. Then, the students will review another group's review and provide a peer review referees report.

The clinical case study will consist of a virtual clinical or psychiatric case and the students need to provide answer for some of the questions raised in the case. The students need to write a report of £1500 words.

Module 3: THE RESEARCH PROJECT

Module Leaders: Dr Sam Barnes and Dr Magdalena Sastre

The projects can be either lab-based or clinical

CLINICAL/NEUROPATHOLOGICAL PROJECTS

- Therapeutic potential of anti-inflammatory drugs in stroke
- The role of glucose and BP in acute stroke thrombolysis
- Damage to the brain-CSF barrier in multiple sclerosis.
- Diagnostic Accuracy of CSF and Plasma Amyloid beta in people with dementia
- Neuroprotection in Parkinson's disease (PD).
- New genes for motor neurone disease: pathogenic mechanisms.
- Neuroprotective effects of molecular chaperones

THE RESEARCH PROJECT

CELL/MOLECULAR NEUROSCIENCE PROJECTS

- Molecular targets of anti-inflammatory drugs in chronic pain
- The neuroprotective role of foetal neural stem cells in the damaged central nervous system
- TRAIL-mediated apoptosis in response to Hypoxic-Ischaemic challenge in immature neurons
- CITED2-dependent control of axonal regeneration
- Metabolomic profiling of ASS-ve and ASS+ve Glioblastoma identifies novel therapeutic strategies
- Investigating the role of astrocytes in Alzheimer's disease.
- Investigation of tau aggregates in tau transgenic mice

COGNITIVE NEUROSCIENCE/COMPUTATIONAL NEUROSCIENCE

- Music effects on memory function
- Learning without seeing
- Treatment Effects on Attentional Networks in Alzheimer's Disease
- Investigating the effect of Parietal Lobe Damage on Allocentric Spatial Memory
- Does cognitive load compromise static and dynamic aspects of balance in healthy participants and traumatic brain injury patients?
- Psychometric analysis of cognitive performance in adults – factor structure, and relationship to age, education and sociodemographic factors.
- Exploring intrinsic connectivity networks in a large-scale computational model of neural dynamics

THE RESEARCH PROJECT

AETIOLOGY AND TREATMENT OF ADDICTION

- Role of opioid peptides and GABA in addiction
- Dopaminergic pathways in reward systems and addictive behaviours
- Neuroinflammation and alcohol misuse
- Does smoking cannabis cause schizophrenia
- Peer Advocacy in drug and alcohol treatment services
- Public attitudes to reducing alcohol misuse through changing the price of alcoholic drinks
- Treatment of Opiate addiction – what works, what are the challenges?
- Alcohol histories in a cohort of dementia patients.

THE RESEARCH PROJECT

MENTAL HEALTH/PSYCHIATRY RESEARCH

- Assessing mental health of adolescent asylum seekers
- The mental health impact of critical illness
- Arts therapies for people with severe mental illness
- Self expression among people with psychosis
- Therapy for personality disorders: Why do some patients get better while others get worse?
- Can we measure mood swings in adolescents?
- Personality and risk assessment
- Comorbidity and pharmacological treatment in high security hospital personality disorder services
- Early intervention in psychosis

Reflections on SOLE results for modules 1 and 2

- Content is interesting, engaging and for the most part lecturers have been experts in their fields. Good range of topics
- Well organized
- The course leaders and coordinators were very supportive
- Plenty of opportunity to ask questions and participate, Regular Q&A sessions
- Lots of practice for ICA and group work
- Good amount of interactivity
- Quick responses to queries/ problems
- coffee mornings and quizzes were nice
- Considering changing the order of the assessments (Module 1)
- More support for the science in context (Module 2)
- Giving more time for completing the assessments of Module 2