Tutorials in Life Sciences (Biology and Chemistry)

Bioethics

This tutorial provides an introduction to some key topics in bioethics, exploring a variety of different viewpoints and ethical frameworks. Some reference to medical law may be included, but with an awareness that students may come from very different jurisdictions, and that the law in some of these areas is evolving rapidly. The precise topics covered will depend on time and individual student requirements, but may include:

- Common ethical frameworks
- The beginning of life
- The end of life
- Research ethics
- Genetic ethics
- Artificial intelligence ethics
- Capacity
- Consent

Cell and Developmental Biology

This tutorial provides an introduction to cell and developmental biology. The precise topics covered will depend on time and individual student requirements, but may include:

- Cell and nuclear structure
- DNA replication, transcription, and translation
- Regulation of gene expression
- Mitosis and meiosis
- Cell growth and differentiation
- Early embryonic development
- Axis formation
- Patterning of limbs, structures, and organs
- Development of non-human animals
- Regeneration

Cellular Pathology

The aim of this tutorial is to give an introduction to some key themes in cellular pathology, with a particular focus on cancer. Depending on individual student requirements, the tutorial may be combined or overlap with Immunology or Infectious Disease. Topics covered may include:

- Genetic causes of cancer
- Infectious causes of cancer
- Modifiable/lifestyle risk factors and cancer

- Cancer and the immune system
- Cancer and the microbiome
- Cancer therapies
- Atherosclerosis
- Prion diseases

Ecology and Evolution

This tutorial provides an introduction to ecology and evolution. The precise topics covered will depend on time and individual student requirements, but may include:

- Biodiversity and biogeography
- Ecological systems
- Population biology
- The influence of humanity on ecology
- Conservation
- Evolutionary paradigms and theories
- Evolution
- Adaptation
- Natural selection
- Speciation

Human Physiology

This tutorial provides an introduction to human physiology. The precise topics covered will depend on time and individual student requirements, but may include:

- Cell physiology
- Cell signalling and communication
- Muscle physiology
- Neurophysiology: sensory systems
- Neurophysiology: special senses (e.g. vision, hearing, taste, olfaction)
- Neurophysiology: motor system
- Endocrine physiology
- Reproductive physiology
- Cardiovascular physiology
- Respiratory physiology
- Gastrointestinal physiology
- Renal physiology

Infectious Disease

The aim of this tutorial is to provide an introduction to infectious diseases. Depending on individual student requirements, the tutorial may be combined or overlap with Immunology or Cellular Pathology. Topics covered may include:

- Bacterial infections and antibiotics
- Viral infections and anti-viral agents
- Parasite infections
- Tuberculosis
- HIV
- Influenza
- Hepatitis viruses
- The influence of infectious agents on human evolution

Immunology

The aim of this tutorial is to give an introduction to the structure and function of the immune system. Depending on individual student requirements, the tutorial may be combined or overlap with Infectious Disease or Cellular Pathology. Topics covered may include:

- The innate immune system
- The adaptive immune system
- Immune regulation
- Autoimmunity

Molecular Spectroscopy

In this chemistry tutorial, students will study:

- Overview of molecular spectroscopy: principles, selection rules, techniques, and sample preparation
- Rotational and stark spectroscopy: accurate structure determination
- Infrared vibrational spectroscopy: anharmonicity and normal modes
- Infrared and Raman - rovibrational band structure
- Electronic and photo-ionization spectroscopy: electronic structure and the Franck-Condon principle
- Photochemistry: fates of excited states
- Ultrafast spectroscopy: following reactions in real time