

The Pod

The original Centre of the Cell experience! Visit our 16-cell-embryo-shaped Pod, suspended over the laboratories of the Blizard Institute. Once inside, you will learn about the amazing world of cells, the human body and the latest medical research. You can try your hand at virtual experiments, heal extensive virtual burns and have your cells counted. You also get to see real body parts and diagnose cancer using high-power microscopes.

Running time: 90 minutes

Maximum group size: 40
(including accompanying adults)

Suitable for key stages 2 – 5



Running order

1. Introduction: What are cells? (Film)
2. Cell interactive games
3. Why do scientists study cells? (Film)
4. Medical Research interactive games
5. End: Careers in science and healthcare (Film)

Please find the curriculum links listed below. Please note that some of these topics are covered in more depth than others during the one hour in the Pod itself. Students are free to ask questions about any topic at any time.

Key stage 2 Science curriculum links

Working scientifically

Year 5 and 6

- identifying scientific evidence that has been used to support or refute ideas or arguments

Animals, including humans

Year 3

- identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat
- identify that humans and some other animals have skeletons and muscles for support, protection and movement

Year 4

- describe the simple functions of the basic parts of the digestive system in humans
- identify the different types of teeth in humans and their simple functions

Year 5

- describe the changes as humans develop to old age

Year 6

- identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood
- recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function
- describe the ways in which nutrients and water are transported within animals, including humans

Living things and their habitats:

Year 4

- recognise that living things can be grouped in a variety of ways

Year 6

- describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals

Evolution and inheritance

Year 6

- recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents

Key stage 3 Science curriculum links

Working scientifically

- understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas

Structure and function of living organisms

Cells and organisation

- cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope
- the functions of the cell membrane, cytoplasm, nucleus, mitochondria
- the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms.

Nutrition and digestion

- content of a healthy human diet (from February 2016)
- the tissues and organs of the human digestive system
- the importance of bacteria in the human digestive system (from February 2016)

Reproduction

- reproduction in humans (as an example of a mammal), including gametes, fertilisation, gestation and birth

Genetics and evolution

Inheritance, chromosomes, DNA and genes

- heredity as the process by which genetic information is transmitted from one generation to the next
- the variation between species and between individuals of the same species means some organisms compete more successfully (from February 2016)

Key stage 4 Science curriculum links

Working scientifically

- the ways in which scientific methods and theories develop over time
- appreciating the power and limitations of science and considering ethical issues which may arise
- explaining everyday and technological applications of science; evaluating associated personal, social, economic and environmental implications; and making decisions based on the evaluation of evidence and arguments
- evaluating risks both in practical science and the wider societal context, including perception of risk

Cell biology

- cells as the basic structural unit of all organisms; adaptations of cells related to their functions; the main sub-cellular structures of eukaryotic and prokaryotic cells
- stem cells in animals

Health, disease and the development of medicines

- the relationship between health and disease
- communicable diseases humans
- non-communicable diseases
- bacteria, viruses and fungi as pathogens in animals
- body defences against pathogens and the role of the immune system against disease
- reducing and preventing the spread of infectious diseases in animals
- the process of discovery and development of new medicines
- the impact of lifestyle factors on the incidence of non-communicable diseases

Evolution, inheritance and variation

- the genome as the entire genetic material of an organism (from February 2016)
- how the genome, and its interaction with the environment, influence the development of the phenotype of an organism (from February 2016)
- the potential impact of genomics on medicine
- most phenotypic features being the result of multiple, rather than single, genes (from February 2016)
- single gene inheritance and single gene crosses with dominant and recessive phenotypes
- genetic variation in populations of a species (from February 2016)
- the uses of modern biotechnology including gene technology; some of the practical and ethical considerations of modern biotechnology

Key stage 5 Science curriculum links

AQA AS / A level Biology

3.2 Cells

3.2.1.1 Structure of eukaryotic cells

The structure of eukaryotic cells, restricted to the structure and function of:

- cell-surface membrane
- nucleus (containing chromosomes, consisting of protein-bound, linear DNA, and one or more nucleoli)
- mitochondria
- Golgi apparatus and Golgi vesicles
- lysosomes (a type of Golgi vesicle that releases lysozymes)
- ribosomes
- rough endoplasmic reticulum and smooth endoplasmic reticulum

In complex multicellular organisms, eukaryotic cells become specialised for specific functions. Specialised cells are organised into tissues, tissues into organs and organs into systems.

3.2.2 All cells arise from other cells

Within multicellular organisms, not all cells retain the ability to divide.

Eukaryotic cells that do retain the ability to divide show a cell cycle.

- DNA replication occurs during the interphase of the cell cycle.
- Mitosis is the part of the cell cycle in which a eukaryotic cell divides to produce two daughter cells, each with the identical copies of DNA produced by the parent cell during DNA replication.

The behaviour of chromosomes during interphase, prophase, metaphase, anaphase and telophase of mitosis. The role of spindle fibres attached to centromeres in the separation of chromatids.

Division of the cytoplasm (cytokinesis) usually occurs, producing two new cells.

Mitosis is a controlled process. Uncontrolled cell division can lead to the formation of tumours and of cancers. Many cancer treatments are directed at controlling the rate of cell division.

3.6 Organisms respond to changes in their internal and external environments

3.6.4 Homeostasis is the maintenance of a stable internal environment

Homeostasis in mammals involves physiological control systems that maintain the internal environment within restricted limits.

The importance of maintaining a stable core temperature and stable blood pH in relation to enzyme activity.

The importance of maintaining a stable blood glucose concentration in terms of availability of respiratory substrate and of the water potential of blood.

3.7 Genetics, populations, evolution and ecosystems

3.7.1 Inheritance

The genotype is the genetic constitution of an organism.

The phenotype is the expression of this genetic constitution and its interaction with the environment.

There may be many alleles of a single gene.

3.8.3 Using genome projects (from February 2016)

Sequencing projects have read the genomes of a wide range of organisms, including humans.

This may have many applications, including the identification of potential antigens for use in vaccine production.

Edexcel AS / A level Biology

Unit 1: Lifestyle, Transport, Genes and Health

1.3 Topic 1: Lifestyle, health and risk

Explain why many animals have a heart and circulation (mass transport to overcome limitations of diffusion in meeting the requirements of organisms)

Describe the factors that increase the risk of CVD (genetic, diet, age, gender, high blood pressure, smoking and inactivity)

Discuss how people use scientific knowledge about the effects of diet (including obesity indicators), exercise and smoking to reduce their risk of coronary heart disease

1.4 Topic 2: Genes and health (from February 2016)

Describe a gene as being a sequence of bases on a DNA molecule coding for a sequence of amino acids in a polypeptide chain (from February 2016)

Explain how errors in DNA replication can give rise to mutations (from February 2016)

Explain the uses of genetic screening: identification of carriers, preimplantation genetic diagnosis and prenatal testing (amniocentesis and chorionic villus sampling) and discuss the implications of prenatal genetic screening

Identify and discuss the social and ethical issues related to genetic screening from a range of ethical viewpoints

Unit 2: Development, Plants and the Environment

2.3 Topic 3: The voice of the genome

Describe the ultrastructure of an animal (eukaryotic) cell (nucleus, nucleolus, ribosomes, rough and smooth endoplasmic reticulum, mitochondria, centrioles, lysosomes, and Golgi apparatus) and recognise these organelles from EM images. Explain the role of the rough endoplasmic reticulum (rER) and the Golgi apparatus in protein transport within cells and including its role in formation of extracellular enzymes.

Describe how the cells of multicellular organisms can be organised into tissues, tissues into organs and organs into systems.

Explain the role of mitosis and the cell cycle for growth and asexual reproduction.

Describe the stages of mitosis

Explain how mammalian gametes are specialised for their functions

Unit 4: The Natural Environment and Species Survival

3.4 Topic 6: Infection, immunity and forensics

Describe the major routes pathogens may take when entering the body and explain the role of barriers in protecting the body from infection, including the roles of skin, stomach acid, gut and skin flora

Unit 5: Energy, Exercise and Coordination

4.3 Topic 7: Run for your life

Explain how medical technology, including the use of keyhole surgery and prostheses, is enabling those with injuries and disabilities to participate in sports, eg cruciate ligaments repair using keyhole surgery and knee joint replacement using prosthetics

4.4 Topic 8: Grey matter

Discuss the moral and ethical issues relating to the use of animals in medical research from two ethical standpoints

OCR AS / A level Biology A

Module 2: Foundations in biology

2.1 Foundations in biology

2.1.1 Cell structure

The ultrastructure of eukaryotic cells and the functions of the different cellular components

2.1.6 Cell division, cell diversity and cellular organisation

The cell cycle

The main stages of mitosis

How cells of multicellular organisms are specialised for particular functions

The organisation of cells into tissues, organs and organ systems

The features and differentiation of stem cells

The potential uses of stem cells in research and medicine

Module 4: Biodiversity, evolution and disease

4.1 Communicable diseases, disease prevention and the immune system

4.1.1 Communicable diseases, disease prevention and the immune system

The different types of pathogen that can cause communicable diseases in plants and animals

The principles of vaccination and the role of vaccination programmes in the prevention of epidemics

The benefits and risks of using antibiotics to manage bacterial infection

Module 5: Communication, homeostasis and energy

5.1 Communication and homeostasis

5.1.1 Communication and homeostasis

The need for communication systems in multicellular organisms

5.2 Energy for biological processes

5.2.2 Respiration

The need for cellular respiration

The structure of the mitochondrion

Module 6: Genetics, evolution and ecosystems

6.1 Genetics and evolution

6.1.2 Patterns of inheritance

The contribution of both environmental and genetic factors to phenotypic variation

The principles of artificial selection and its uses

The ethical considerations surrounding the use of artificial selection

6.1.3 Manipulating genomes

How gene sequencing has allowed for genome-wide comparisons between individuals and between species (from February 2016)

6.2 Cloning and biotechnology

6.2.1 Cloning and biotechnology

How artificial clones in animals can be produced by artificial embryo twinning or by enucleation and somatic cell nuclear transfer (SCNT)

The arguments for and against artificial cloning in animals

OCR AS / A level Biology B

Module 2: Cells, chemicals for life, transport and gas exchange

2.1 Cells and chemicals for life

2.1.1 Cells and microscopy

The importance of microscopy in the development of the cell theory as a unifying concept in biology and the investigation of cell structure

Module 3: Cell division, development and disease control

3.1 Cell division and development

3.1.1 The developing cell: cell division and cell differentiation

The cell cycle

The changes that take place in the nuclei and cells of animals and plants during mitosis

The microscopic appearance of cells undergoing mitosis

Current applications and uses of stem cells

3.2 Pathogens, immunity and disease control

3.2.1 Pathogenic microorganisms

How pathogens (including bacteria, viruses and fungi) cause communicable disease

The causes, means of transmission, symptoms and the principal treatment of tuberculosis (TB)

The social, ethical, economic and biological factors involved in the attempts to control and prevent diseases in the context of TB

3.2.3 Controlling communicable diseases

The use of antibiotics in the treatment of communicable disease

How the misuse of antibiotics can lead to the evolution of resistant strains of bacteria

3.3 Non-communicable diseases

3.3.1 The cellular basis of cancer and treatment

The factors that may increase the risk of developing non-communicable diseases

The cellular basis of cancer

The methods used to detect cancers

The methods used to treat patients with cancer