

Integration of body systems What is system integration?	Integration of body systems Emergent property (with the IB example)
Integration of body systems Name three ways organs are integrated in animals.	Integration of body systems What two roles of the brain make it the central integration organ?
Integration of body systems Conscious vs unconscious processes	Integration of body systems Sensory neuron vs motor neuron
Integration of body systems What does a transverse section of a nerve show?	Integration of body systems Pain reflex arc, in order

A property of the whole that its parts lack, arising from integration. A cheetah is an effective predator through integration of its body systems.

Coordination of the component parts of a system so that they collectively perform an overall function. It is a necessary process in living systems.

Processing information combined from several inputs, and learning and memory.

Nervous signalling, hormonal (endocrine) signalling, and transport of materials and energy by the blood.

Sensory: carries messages from receptor cells to the CNS. Motor: carries output from the CNS (cerebral hemispheres) to muscles, stimulating contraction.

Conscious: aware and voluntary, coordinated by cerebral hemispheres.
Unconscious: no awareness or decision (eg reflexes), can be coordinated by the spinal cord.

Free nerve ending in hand → sensory neuron → interneuron in spinal cord grey matter → motor neuron → skeletal muscle contracts.

A protective sheath around bundles of nerve fibres of both sensory and motor neurons, some myelinated and some unmyelinated.

Integration of body systems

What is the effector in a pain reflex arc?

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Role of the cerebellum

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Melatonin: source and pattern

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Four effects of epinephrine

Integration of body systems

How do the hypothalamus and pituitary control the endocrine system?

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Baroreceptors: what and where?

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How does the medulla change heart rate?

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Why does blood pH fall during exercise?

Coordinates skeletal muscle contraction and balance, giving smooth, accurate movement and posture.

A skeletal muscle, which contracts to withdraw the body part.

Increased heart rate and stroke volume; blood diverted to skeletal muscles; airways widen and ventilation increases; liver glycogen broken down to glucose.

Secreted by the pineal gland; rises in the evening darkness, high at night, low in daylight. Helps set the sleep-wake cycle.

Monitor blood pressure; located in the walls of the aortic arch and carotid arteries.

The hypothalamus receives nervous and blood-borne information and signals the pituitary, which secretes hormones that regulate other endocrine glands.

More CO₂ from respiration forms carbonic acid, which releases H⁺ ions.

Impulses along the sympathetic nerve increase heart rate and stroke volume; impulses along the vagus nerve decrease heart rate.

Integration of body systems Effectors in ventilation control	Integration of body systems Which parts of gut movement are voluntary?
Integration of body systems Enteric nervous system (ENS)	Defence against disease Pathogen
Defence against disease Which group of organisms is not known to cause disease in humans?	Defence against disease How is skin a physical and a chemical barrier?
Defence against disease How do mucous membranes defend the body?	Defence against disease Blood clotting, in order

Initiation of swallowing and egestion of faeces, controlled by the CNS. Peristalsis in between is involuntary.

The diaphragm and intercostal muscles, signalled by the medulla after chemoreceptors in the brainstem detect a fall in pH.

A disease-causing organism; the term is typically reserved for viruses, bacteria, fungi and protists.

Network of neurons in the gut wall that controls peristalsis involuntarily, coordinating passage of material through the gut.

Physical: tough outer layer of dead keratinized cells. Chemical: acidic secretions with antimicrobial chemicals that inhibit bacteria and fungi.

Archaea.

Platelets release clotting factors → cascade → thrombin → fibrinogen converted to fibrin → fibrin mesh traps erythrocytes → clot.

Sticky mucus traps pathogens; in airways, cilia sweep it away; lysozyme in mucus digests bacterial cell walls.

Defence against disease

Innate vs adaptive immune system

Defence against disease

How do phagocytes control infection?

Defence against disease

Where are lymphocytes found?

Defence against disease

Antigen

Defence against disease

Why can a blood transfusion trigger antibody production?

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What two things activate a B-cell?

Defence against disease

Plasma cells

Defence against disease

Immunity

Amoeboid movement from blood to infection site, recognize pathogens, engulf them by endocytosis, digest them with lysosome enzymes.

Innate: broad categories of pathogen, unchanged through life. Adaptive: specific to particular pathogens, builds memory so responses improve.

A recognition molecule that triggers antibody production; usually a glycoprotein or other protein on the outer surface of a pathogen.

Circulating in the blood and contained in lymph nodes.

Direct interaction with its specific antigen, and contact with a helper T-cell activated by the same antigen.

Antigens on donated erythrocytes from a different blood group are recognized as foreign and stimulate antibody production.

The ability to eliminate an infectious disease from the body, due to long-term survival of memory cells that make the specific antibodies.

Antibody-secreting cells formed when activated B-cells divide by mitosis; a clone all making the same antibody.

Defence against disease

What do vaccines contain?

Defence against disease

Herd immunity

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Four ways HIV is transmitted

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Why does HIV infection lead to AIDS?

Defence against disease

Why do antibiotics not harm human cells?

Defence against disease

How does antibiotic resistance spread?

Defence against disease

How can careful use slow multiresistant bacteria?

Defence against disease

Zoonosis (with IB examples)

When a sufficient percentage of a population is immune, transmission is greatly impeded, preventing epidemics and protecting non-immune people.

Antigens, or nucleic acids (DNA or RNA) with sequences coding for antigens. They stimulate immunity without causing the disease.

HIV kills helper T-cells, so fewer B-cells are activated and fewer antibodies made; opportunistic infections cannot be fought.

Unprotected sex; sharing needles; unscreened blood transfusions; mother to baby via placenta, childbirth or breast milk.

Mutation or plasmid gives resistance; antibiotic kills susceptible bacteria; resistant ones survive and reproduce: natural selection.

They block processes found in bacteria but not eukaryotic cells, eg cell wall synthesis or protein synthesis by 70S ribosomes.

An infectious disease that can transfer from other species to humans, eg tuberculosis, rabies, Japanese encephalitis, COVID-19.

Prescribe only for bacterial infections, complete the course, limit use in livestock, and maintain hospital hygiene.

Defence against disease

How are rabies and Japanese encephalitis transmitted?

Defence against disease

Percentage change vs percentage difference

Change: $(\text{final} - \text{initial}) \div \text{initial} \times 100$, one quantity over time, with a sign. Difference: $|A - B| \div \text{mean of A and B} \times 100$, two values with no starting point.

Rabies: bite from an infected mammal (virus in saliva). Japanese encephalitis: bite of a mosquito that fed on infected pigs or birds.