

Grade 7 checklist

116 skills. Tick each one when you can do it. For grade 7 you need the skills for the grades below it too.

Cell biology

- ☐ **Compare sizes using orders of magnitude** Put both sizes in the same unit, divide, and write the ratio as a power of ten: 1000 times bigger is 3 orders of magnitude. (Eukaryotes and prokaryotes)
- ☐ **Estimate sizes of sub-cellular structures** Compare the structure with the whole cell, e.g. a nucleus a quarter of the width of a 20 μm cell is about 5 μm across. (Animal and plant cells)
- ☐ **Suggest adaptations of unfamiliar specialised cells** Use the same ideas (surface area, mitochondria, shape, missing structures) for a cell you have not studied. (Cell specialisation)
- ☐ **Suggest how a cell changes as it differentiates** It gains the sub-cellular structures its function needs, e.g. more mitochondria or ribosomes, and may change shape. (Cell differentiation)
- ☐ **Explain how electron microscopes improved understanding** Their much higher resolution revealed small sub-cellular structures, such as ribosomes, and the detail inside mitochondria and chloroplasts. (Microscopy)
- ☐ **Calculate bacterial numbers after a given time** Find the number of divisions, then multiply the starting number by 2 to the power of that number. (Culturing microorganisms)
- ☐ **Explain why the new cells are identical** The DNA is copied exactly, and one copy of every chromosome goes to each new cell. (Mitosis and the cell cycle)
- ☐ **Interpret data on dividing cells** e.g. use the percentage of cells in mitosis to estimate how long mitosis lasts. (Mitosis and the cell cycle)
- ☐ **Evaluate the use of stem cells** Weigh possible treatments against risks such as viral infection, and against ethical or religious objections, then give a conclusion. (Stem cells)
- ☐ **Explain why large organisms need exchange surfaces** Their small surface area to volume ratio and long diffusion distances mean diffusion through the body surface is too slow. (Diffusion)
- ☐ **Estimate cell concentration from a graph** Read the concentration where the line of best fit crosses 0% change in mass. (Osmosis)
- ☐ **Explain how oxygen affects active transport** Less oxygen means less aerobic respiration, so less energy is released and active transport slows. (Active transport)

Organisation

- ☐ **Explain why large organisms need organ systems** Large organisms have a small surface area to volume ratio, so they need specialised exchange organs and a transport system to supply every cell. (Principles of organisation)
- ☐ **Explain denaturing by high temperature or pH** The active site changes shape, so the substrate no longer fits and the rate of reaction falls. (The human digestive system)
- ☐ **Calculate rates from the amylase practical** Use the equation given, such as $\text{rate} = 1000 \div \text{time taken for the starch to be digested}$, and compare rates at each pH. (The human digestive system)

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- ☐ **Explain how alveoli are adapted for gas exchange** Millions of alveoli give a large surface area, with thin walls and a rich capillary network keeping a steep concentration gradient. (The heart and blood vessels)
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- ☐ **Explain why the left ventricle wall is thicker** It pumps blood at a higher pressure all round the body, while the right ventricle only pumps blood to the nearby lungs. (The heart and blood vessels)
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- ☐ **Apply blood functions to unfamiliar situations** For example, explain the effects of having too few platelets or too few red blood cells. (Blood)
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- ☐ **Evaluate drugs, devices and transplants** Weigh up how well and how quickly each works, risks, side effects, recovery, cost and the need for donors or lifelong drugs, then give a justified conclusion. (Coronary heart disease)
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- ☐ **Evaluate how representative a sample is** Large, random samples that include a range of people give data you can apply to the whole population. (Health issues)
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- ☐ **Explain why correlation does not prove causation** Another factor might explain the link, so a causal mechanism is needed before saying one factor causes a disease. (Lifestyle and non-communicable diseases)
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- ☐ **Explain how several factors combine to cause disease** Many diseases result from several risk factors interacting, e.g. smoking, poor diet and no exercise together raise heart disease risk. (Lifestyle and non-communicable diseases)
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- ☐ **Link cancer to the cell cycle** Changes to the genes that control cell division make cells divide by mitosis in an uncontrolled way. (Cancer)
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- ☐ **Explain how leaf structure suits photosynthesis** Link the thin, broad shape, transparent epidermis, chloroplast position, air spaces, stomata and veins to supplying light, carbon dioxide and water. (Plant tissues)
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- ☐ **Explain how guard cells control water loss** Guard cells become turgid to open the stomata and flaccid to close them, balancing gas exchange against water loss. (Plant organ system)
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- ☐ **Explain how water moves through the plant** Water evaporates from leaf cells and diffuses out through the stomata, and more water is drawn up the xylem to replace it. (Plant organ system)
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Infection and response

- ☐ **Interpret data on the spread of a disease** Describe trends in case numbers, calculate percentage changes and use the way the pathogen spreads to explain the pattern. (Communicable (infectious) diseases)
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- ☐ **Explain how HIV leads to AIDS** HIV attacks immune cells; when the immune system is badly damaged, the body cannot deal with other infections or cancers. (Viral diseases)
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- ☐ **Explain why infected leaves must be destroyed** Infected leaves, including fallen ones, still carry the fungus, which can spread to healthy leaves by water or wind. (Fungal diseases)
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- ☐ **Explain why controlling mosquitoes controls malaria** The protist's life cycle includes the mosquito, so it is normally passed between people only by mosquito bites. (Protist diseases)
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- ☐ **Explain why antibodies are specific** Each antibody fits only one antigen, so it binds to only one type of pathogen. (Human defence systems)
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- ☐ **Explain effects of damage to a defence** E.g. smoke stops cilia beating, so mucus and pathogens build up in the airways and infections are more likely. (Human defence systems)
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- ☐ **Interpret graphs of antibody concentration** After a second exposure, antibodies are made faster and in much larger amounts than after the first. (Vaccination)

- ☐ **Explain why antibiotic resistance is a concern** Resistant strains are not killed by the antibiotic, so infections become hard to treat and the strains can spread. (Antibiotics and painkillers)

- ☐ **Explain why double blind trials are used** Neither doctors nor patients know who has the drug, so their expectations cannot bias the results. (Discovery and development of drugs)

- ☐ **Explain why hybridoma cells are used** They can divide, like the tumour cell, and make the antibody, like the lymphocyte. (Producing monoclonal antibodies)

- ☐ **Explain why monoclonal antibodies are identical** They come from clones of a single hybridoma cell, so all the cells make the same antibody. (Producing monoclonal antibodies)

- ☐ **Explain how they are used to treat cancer** The antibody binds only to cancer cells, delivering a radioactive substance, toxic drug or chemical that stops cell division. (Uses of monoclonal antibodies)

- ☐ **Explain their use in research with dyes** An antibody attached to a fluorescent dye binds to a specific molecule, showing where it is in a cell or tissue. (Uses of monoclonal antibodies)

- ☐ **Explain how aphids damage plants** Aphids feed on sap from the phloem, removing sugars that the plant needs for growth. (Detection and identification of plant diseases)

- ☐ **Explain an unfamiliar defence in context** Decide what type of defence it is, then link it to fewer pathogens getting in or fewer animals eating the plant. (Plant defence responses)

Bioenergetics

- ☐ **Explain plant gas exchange in light and dark** Plant cells respire all the time, so a plant gives out carbon dioxide in the dark but takes it in overall when photosynthesis is faster than respiration. (Photosynthetic reaction)

- ☐ **Find the limiting factor on multi-factor graphs (HT)** Compare curves: if raising the second factor raises the curve, that factor was limiting the lower curve. (Rate of photosynthesis)

- ☐ **Use the inverse square law (HT)** Light intensity is proportional to $1 \div \text{distance}^2$, so doubling the distance gives a quarter of the light intensity. (Rate of photosynthesis)

- ☐ **Explain how nitrate shortage reduces growth** Less nitrate means fewer amino acids and less protein, so fewer new cells are made and the plant grows less. (Uses of glucose from photosynthesis)

- ☐ **Explain why anaerobic respiration transfers less energy** The oxidation of glucose is incomplete, so much of the energy stays in the lactic acid or ethanol. (Aerobic and anaerobic respiration)

- ☐ **Describe how lactic acid is removed (HT)** Blood carries lactic acid from the muscles to the liver, where it is converted back into glucose. (Response to exercise)

- ☐ **Define oxygen debt (HT)** The extra oxygen the body needs after exercise to react with the accumulated lactic acid and remove it from the cells. (Response to exercise)

- ☐ **Explain the importance of the small building blocks** Sugars, amino acids, fatty acids and glycerol are what large molecules are built from and broken down into, so they can be reused. (Metabolism)

Homeostasis and response

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- ☐ **Analyse and evaluate reaction time data** Calculate means, spot anomalies, judge conclusions and suggest control variables. (Structure and function)
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- ☐ **Evaluate the benefits and risks of brain procedures** Weigh possible benefits against risks such as damage to other areas, infection and uncertain results. (The brain)
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- ☐ **Interpret ray diagrams of eye defects** Show where light focuses and how a spectacle lens moves the focus onto the retina. (The eye)
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- ☐ **Evaluate treatments for defects of vision** Compare glasses, contact lenses, laser surgery and lens replacement for convenience, risk and cost. (The eye)
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- ☐ **Explain how vasoconstriction and shivering warm you** Less blood near the skin reduces energy transfer; shivering muscles respire, releasing energy. (Control of body temperature)
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- ☐ **Apply temperature control to new contexts** E.g. explain a runner's red skin and heavy sweating, or a swimmer's shivering. (Control of body temperature)
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- ☐ **Describe how glucagon raises blood glucose** Glucagon causes glycogen to be converted into glucose, which is released into the blood. (Control of blood glucose concentration)
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- ☐ **Explain how urea is formed** Excess amino acids are deaminated in the liver to form ammonia, which is converted to urea. (Maintaining water and nitrogen balance)
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- ☐ **Explain how ADH controls water balance** When the blood is too concentrated, the pituitary releases ADH, so the kidney tubules reabsorb more water. (Maintaining water and nitrogen balance)
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- ☐ **Explain how the four hormones interact** E.g. oestrogen inhibits FSH and stimulates LH; progesterone inhibits FSH and LH. (Hormones in human reproduction)
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- ☐ **Give the disadvantages of fertility treatment** It is emotionally and physically stressful, success rates are not high, and multiple births are risky. (Hormones to treat infertility)
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- ☐ **Explain how thyroxine levels are controlled** High thyroxine inhibits TSH release from the pituitary, so less thyroxine is released, and the reverse. (Negative feedback)
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- ☐ **Explain gravitropism in shoots and roots** Auxin collects on the lower side: it speeds up growth in shoots but slows it in roots. (Control and coordination)
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- ☐ **State the roles of gibberellins and ethene (HT)** Gibberellins initiate seed germination; ethene controls cell division and the ripening of fruit. (Control and coordination)
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- ☐ **Explain how selective weed killers increase yield** Auxin kills broad-leaved weeds but not narrow-leaved crops, so crops have less competition. (Use of plant hormones)
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- ☐ **Explain the advantages of controlled ripening** Unripe fruit is firm and less easily damaged in transport; ethene ripens it when needed. (Use of plant hormones)
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Inheritance, variation and evolution

- ☐ **Compare meiosis with mitosis** Compare the number of divisions, the number of cells made, the chromosome number and whether the cells are identical. (Meiosis)
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- ☐ **Explain why some organisms use both methods** Asexual reproduction to increase numbers quickly in good conditions; sexual reproduction to give variation for when conditions change. (Pros and cons of sexual and asexual reproduction)
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- ☐ **Discuss the importance of the human genome** Explain how each use could benefit people, especially in medicine. (DNA and the genome)
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- ☐ **Use complementary base pairing** A always pairs with T, and C always pairs with G, on the opposite strand. (DNA structure)
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- ☐ **Describe protein synthesis simply** On ribosomes, carrier molecules bring amino acids in the order set by a template; the chain then folds into a unique shape. (DNA structure)
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- ☐ **Construct a genetic cross to make predictions** From the information given, work out the genotypes and gametes, draw the Punnett square and give probabilities. (Genetic inheritance)
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- ☐ **Discuss the issues of embryo screening** Give economic, social and ethical arguments for and against, using the information provided. (Inherited disorders)
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- ☐ **Explain why the sperm determines sex** Eggs always carry X, so the sex depends on whether the sperm carries an X or a Y. (Sex determination)
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- ☐ **Use twin or clone data** Identical twins and clones have the same genes, so differences between them are caused by the environment. (Variation)
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- ☐ **Explain how a mutation can change a species** A rare new phenotype that suits an environmental change can spread relatively quickly by natural selection. (Variation)
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- ☐ **Compare selective breeding with natural selection** In selective breeding humans choose which individuals breed; in natural selection the environment decides which survive to breed. (Selective breeding)
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- ☐ **Evaluate the impact of selective breeding** Weigh benefits such as more food against inbreeding and reduced variation. (Selective breeding)
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- ☐ **Describe the main steps of genetic engineering** Enzymes isolate the gene, it is inserted into a vector, and the vector puts the gene into the required cells. (Genetic engineering)
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- ☐ **Describe adult cell cloning** Remove an egg's nucleus, insert an adult body cell nucleus, give an electric shock, then put the embryo into a womb. (Cloning)
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- ☐ **Describe Lamarck's theory** Changes that happen to an organism during its lifetime can be inherited. (Theory of evolution)
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- ☐ **Describe the steps that produce a new species** Isolation, genetic variation, different conditions, natural selection, and finally no fertile offspring between the populations. (Speciation)
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- ☐ **Explain Mendel's results using alleles** Use dominant and recessive alleles to explain why a characteristic disappears and then reappears in a 3 : 1 ratio. (The understanding of genetics)
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- ☐ **Explain how resistant bacteria show evolution** Bacteria reproduce so quickly that natural selection of resistant strains can be seen over a short time. (Evidence for evolution)
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- ☐ **Interpret an evolutionary tree** Organisms sharing the most recent common ancestor are the most closely related. (Fossils)
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- ☐ **Explain why variation reduces extinction risk** Some individuals are more likely to have characteristics that let them survive the change. (Extinction)
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- ☐ **Suggest causes from information given** Use clues in a description or data to name the factor and explain its effect. (Extinction)
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- ☐ **Explain why resistant strains spread** People are not immune to the new strain and there is no effective treatment. (Resistant bacteria)
- ☐ **Explain why new antibiotics won't solve it** Developing new antibiotics is costly and slow, so it is unlikely to keep up with new resistant strains. (Resistant bacteria)
- ☐ **Interpret evolutionary trees** Organisms that share the most recent common ancestor are the most closely related. (Classification of living organisms)
- ☐ **Explain how new evidence changed classification** Better microscopes revealed internal structures, and biochemistry revealed chemical differences, leading to new models. (Classification of living organisms)

Ecology

- ☐ **Predict knock-on effects of changes in food webs** Follow every arrow into and out of the changed species, give a reason for each effect and allow for other food sources. (Communities)
- ☐ **Explain knock-on effects through a community** Show how a change that affects plants then affects the animals that eat them or shelter in them. (Abiotic factors)
- ☐ **Explain how competition can make a species decline** If one species outcompetes another, the other's numbers can fall until too few are left to breed. (Biotic factors)
- ☐ **Explain adaptations using surface area to volume ratio** A large, compact body has a small surface area to volume ratio, so it loses heat more slowly. (Adaptations)
- ☐ **Explain predator-prey cycles from a graph** Prey rise first, giving predators more food; predators rise and eat more prey, so prey fall, then predators fall. (Levels of organisation)
- ☐ **Explain why the carbon and water cycles matter** They return carbon dioxide for photosynthesis and supply fresh water on land, so organisms can grow and survive. (How materials are cycled)
- ☐ **Describe the milk decay required practical** Time how long lipase takes to lower the pH of milk, shown by an indicator changing colour, at different temperatures. (Decomposition)
- ☐ **Explain why decay slows at high temperatures** Above the optimum temperature the decomposers' enzymes are denatured, so decay slows down. (Decomposition)
- ☐ **Explain a change in a species' distribution** Link the environmental change to survival and reproduction, e.g. warmer winters let a species survive further north. (Impact of environmental change)
- ☐ **Compare the stability of two ecosystems** Use the numbers of species to explain which is more likely to be badly affected by a change. (Biodiversity)
- ☐ **Explain how fertiliser run-off kills aquatic life** Algae grow, block light, plants die, decomposers respire and use up oxygen, so fish die. (Waste management)
- ☐ **Explain how using peat releases carbon dioxide** Burning peat, or its decay by microorganisms once it is exposed to oxygen, releases carbon dioxide. (Land use)
- ☐ **Evaluate a decision about land use** Weigh people's needs for homes, jobs and materials against the loss of habitats and biodiversity. (Land use)
- ☐ **Explain how cattle and rice fields add methane** Cattle release methane from digestion, and microorganisms in flooded rice fields release methane. (Deforestation)

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- ☐ **Evaluate clearing forest for crops or cattle** Weigh food, income and renewable fuel against habitat loss and the carbon dioxide released. (Deforestation)
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- ☐ **Explain how global warming reduces biodiversity** Species that cannot adapt or move to suitable areas quickly enough may become extinct. (Global warming)
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- ☐ **Explain conflicting pressures on maintaining biodiversity** Conservation costs money and uses land that people also need for food, homes, jobs and income. (Maintaining biodiversity)
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- ☐ **Identify trophic levels in a food web** An animal can be at more than one trophic level if it eats organisms from different levels. (Trophic levels)
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- ☐ **Read values from a pyramid using its scale** Measure bars, convert with the scale and compare trophic levels by calculation. (Pyramids of biomass)
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- ☐ **Explain why higher levels have fewer organisms** Less biomass is available at each higher level, so fewer organisms can be supported. (Transfer of biomass)
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- ☐ **Explain why food chains are short** After a few transfers too little biomass is left to support another trophic level. (Transfer of biomass)
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- ☐ **Explain why sustainable food production is needed** Food must be produced without using up resources or damaging the environment, so that everyone can be fed in future. (Factors affecting food security)
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- ☐ **Evaluate intensive farming, including ethical objections** Weigh cheap, efficient food production against animal welfare, disease spread and antibiotic use. (Farming techniques)
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- ☐ **Evaluate conservation methods using data** Use stock or catch data to judge whether a method is working, and consider other factors. (Sustainable fisheries)
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- ☐ **Explain advantages of culturing microorganisms for food** They grow quickly, can be grown all year in any climate, and need little land. (Role of biotechnology)
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- ☐ **Evaluate GM crops as a solution** Weigh more or better food against concerns about wild flowers, insects and long-term effects on health. (Role of biotechnology)
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