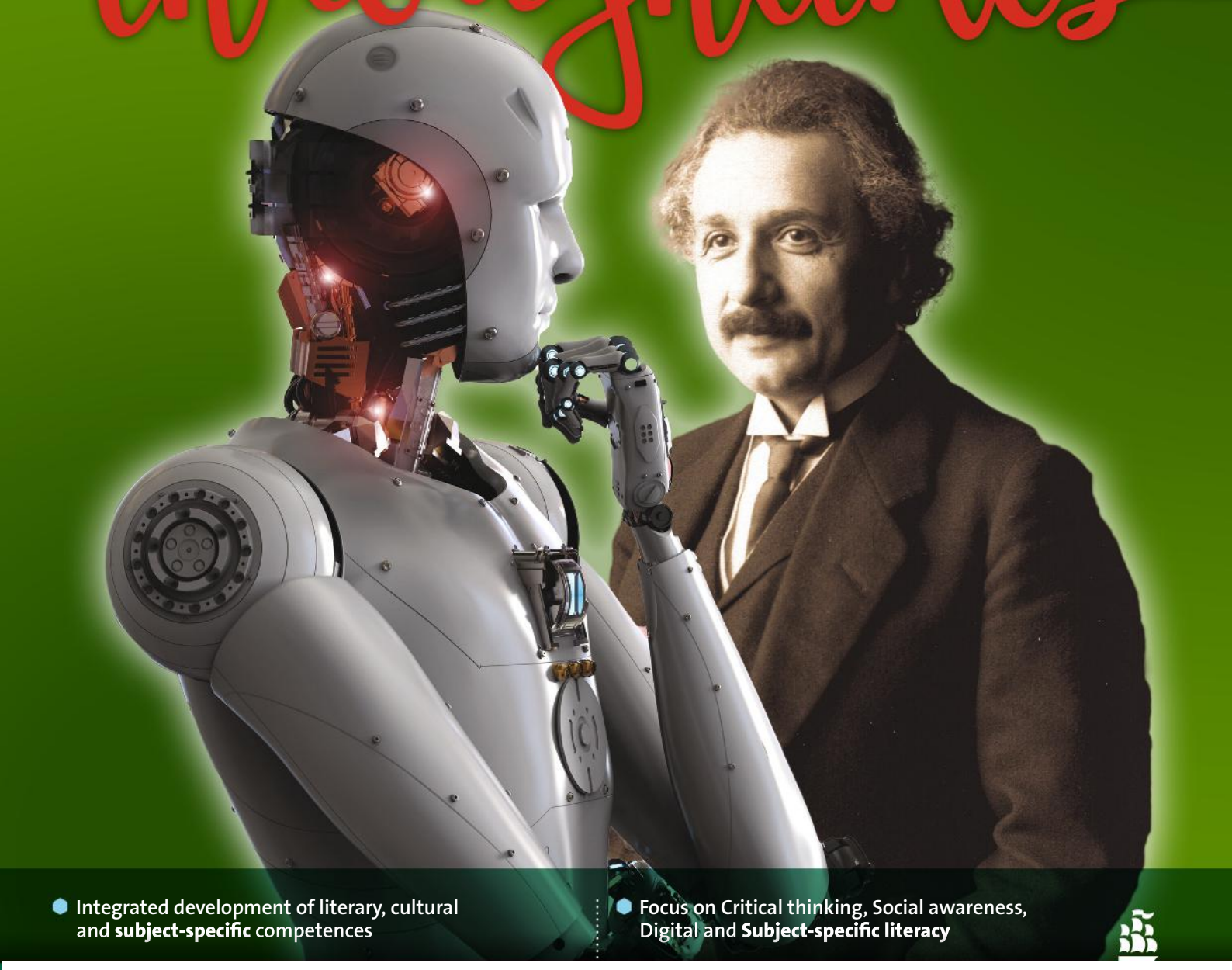
MAURO SPICCI | TIMOTHY ALAN SHAW

AMAZING MINDS

SCIENTIFIC throughlines



- Integrated development of literary, cultural and **subject-specific** competences
- Focus on Critical thinking, Social awareness, Digital and **Subject-specific literacy**

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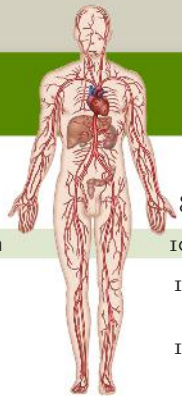


1 Exploring the human body

2 Exploring the universe

3 Exploring the relationship between man and technology

3

Exploring the relationship between man and technology

"Technology has exceeded our humanity"

TACKLING THE TOPIC

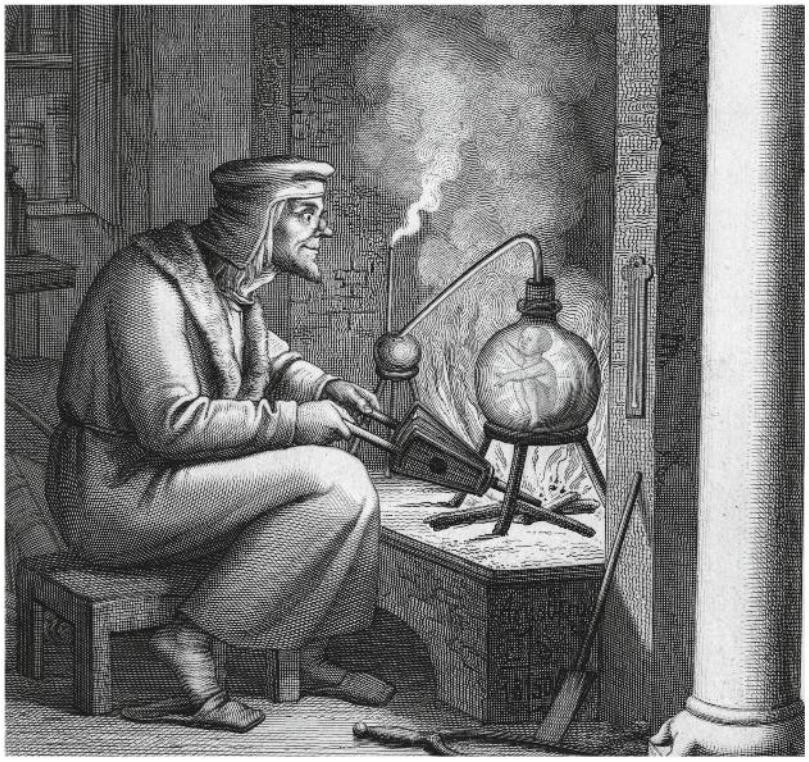
These pictures represent two examples of man-robot relationship. The picture on the left shows a scientist admiring a new robot in the 1950s. The picture on the right shows Sophie, the most sophisticated example of humanoid robot ever created, with her creator. Sophie is a 'sentient robot', a robot that can feel human feelings, laugh and cry.

Answer the following questions.

1. Which of the two robots is more 'human'? Why?
2. If you did not know, could you tell that Sophie is a robot? Why/Why not?
3. What do you think robots will be like in 2050?
4. Do you think in the future robots will threaten human beings?

The Mystery of Life

CLIL



▲ Engraving depicting alchemist with crucible from Goethe's *Faust*. 'Homunculus' appears in the crucible.

From the very dawn of civilisation humankind has always been fascinated by the mystery of life itself. This interest has been expressed through the creation myths of all religions, philosophy, art and through literature, including notably Mary Shelley's *Frankenstein* of 1818, the prototype of the science fiction genre which has enjoyed lasting popularity. Since the mid-19th century scientific speculation and research have made immense progress in aspects of the creation and manipulation of both plant and animal life through the study of genetics as well as in the creation of artificial imitations of human characteristics through robotics and artificial intelligence.

Genetics and Cloning – Recreating Life

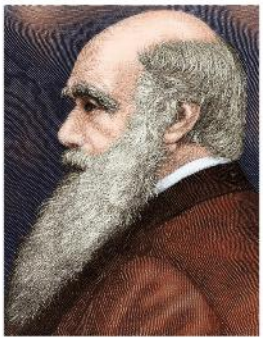
Evolution and inheritance. Genetics is the science that studies **heredity** and variation. Heredity can be defined as the process by which genetic information and physical traits are transferred from parents to their **offspring**, and the '**gene**' is the basic unit of heredity, a DNA molecule containing the genetic information of a biological organism.

In the 18th century plant breeders learnt how to develop strong varieties of many important plants, realising that when some varieties of plants were crossed certain dominant features present in one parent tended to appear in offspring. Similar traits among relatives were of course familiar too, but it was only in the 19th century that this question was studied scientifically.

In 1859 **Charles Darwin** proposed his famous '**theory of evolution**', describing how organisms change slowly through time. Darwin also introduced the idea of natural selection, often referred to as the 'survival of the fittest': organisms with more favourable characteristics are more likely to survive in specific environments and to reproduce.

At about the same time an Austrian monk, **Gregor Mendel**, was experimenting on inheritance and genetics in pea plants. Mendel discovered how traits are passed from one generation to the next. He described the unit of heredity as a particle that does not change and is passed on to offspring.

Chromosomes and DNA. In the 1890s the Dutch botanist Hugo de Vries experimented with a variety of plant species and in 1897 published a paper stating that each inherited trait was governed by two discrete particles of information, one from each parent, and that these particles were passed on intact to the next generation. His independent research confirmed much of Mendel's previous work, though no credit was given to the Austrian monk.

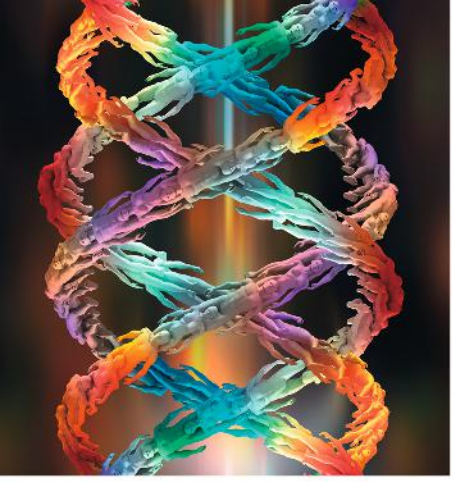


Charles Darwin

Charles Darwin, English naturalist, geologist and biologist (1809-1882), is the father of the theory of biological evolution and author of *On the Origin of Species* (1859).

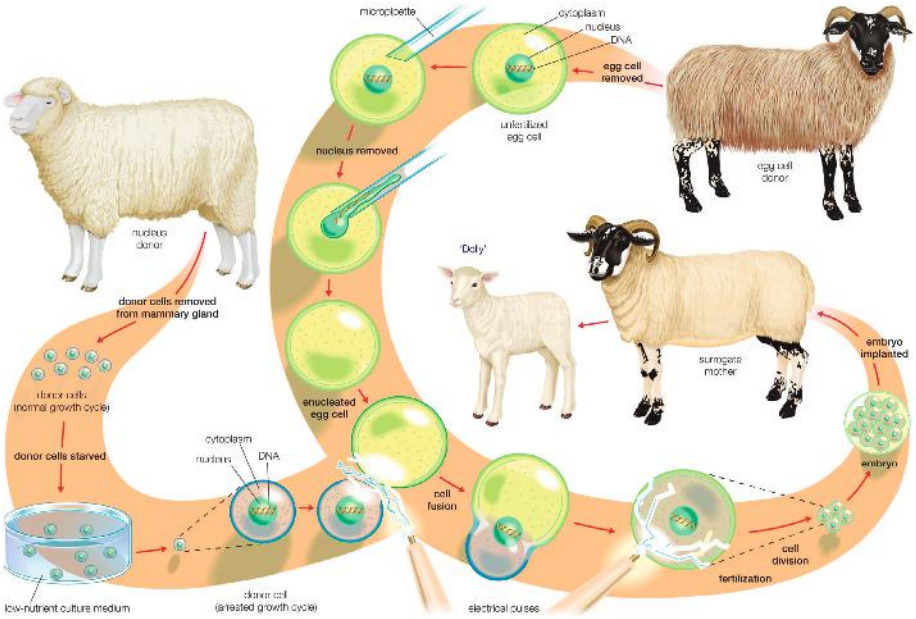
CHAPTER 5

- Why do you think Darwin's theory was considered controversial in his own day?



▲ The double helix structure of a DNA molecule.

In 1910, Thomas Hunt Morgan proved that genes reside on specific **chromosomes** and then found that they occupy specific locations on the chromosome. In an experiment in 1928 he demonstrated that genes could be transferred from one organism to another. Morgan injected a mouse with a deadly strain of bacteria; the genetic information of this deadly strain of bacteria was transferred to a safe strain of the same bacteria in the mouse and the mouse died.
Decades later it was discovered that the genetic material is made of DNA (deoxyribonucleic acid). In 1944, three Canadian and American researchers, **Oswald Avery**, **Maclyn McCarty** and **Colin MacLeod**, demonstrated that DNA holds the gene's information and in 1953 Cambridge University scientists **James D. Watson** and **Francis H.C. Crick** demonstrated the molecular structure of DNA, creating the three-dimensional and double-helical model of DNA which prepared the way for studies in cell biology and biotechnology.



▲ Dolly: the cloning of a sheep.

Cloning. Cloning describes a number of different processes that can be used to produce genetically identical copies of a biological organism. The copied material which is identical to the original is called a **clone**.
Scientists have succeeded in cloning a range of biological entities, including genes, cells, tissues and even entire organisms such as a sheep.
Clones can occur naturally. Some plants and single-cell organisms like bacteria produce identical offspring through asexual reproduction. Natural clones in humans and other mammals are known as **twins**. Twins occur when a fertilised egg splits and creates two or more embryos with identical DNA.
Artificial cloning can be divided into three types:

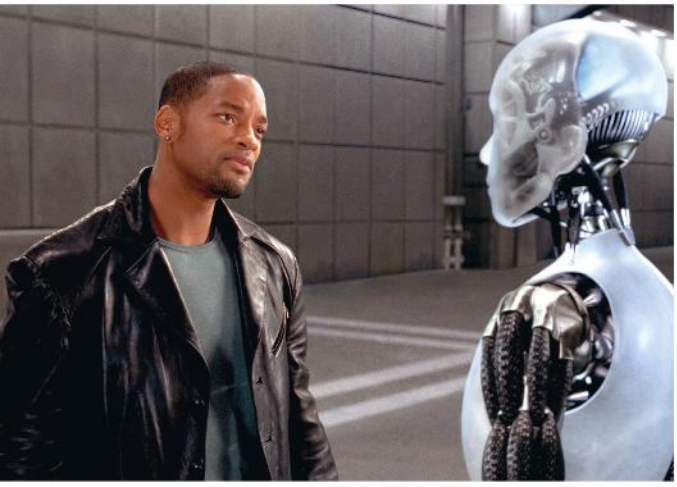
- **gene cloning**, which produces copies of genes or segments of DNA;
- **reproductive cloning**, which produces copies of whole animals;
- **therapeutic cloning**, which produces embryonic cells for experiments and to attempt to create tissues to replace injured or diseased tissues.

The most famous example of reproductive cloning is certainly represented by **Dolly** the sheep, the first mammal cloned from an adult cell, in 1996.
Reproductive cloning of animals can be used to produce animals to be used to test drug responses. Its main advantage is that their reactions to drugs are uniform because they share the same genetic material. This form of cloning is still inefficient: cloned animals are not as healthy as animals born through sexual reproduction and do not live so long.
While gene cloning is generally accepted and regularly used in laboratories today, reproductive and therapeutic cloning raise ethical issues, especially when applied to humans. Reproductive cloning may come into conflict with religious values concerning human dignity as well as questions of freedom, identity and autonomy. Therapeutic cloning offers the possibility of treating humans suffering from diseases or injuries, but also requires the destruction of human embryos in the test tube. Opponents argue that using this technique to collect embryonic stem cells is wrong, regardless of the benefits it may bring to sick or injured people.

▲ Gene cloning in test tubes.

SCIENTIFIC NOTEBOOK

CHROMOSOMES
Chromosomes are strands of DNA in the cell nucleus, which contain an organism's genetic instructions (everything from height to eye colour), passed down from parents. In most cells humans have 22 of these pairs, plus another pair that determines gender (XX in females and XY in males) for a total of 46.



▲ *I Robot* (2004) starring Will Smith in the role of the technophobic cop Del Spooner.

Robotics – Improving Life

Artificial life. The word 'robot' suggests many different ideas. In its positive acceptance we see robots as machines programmed to do hard, repetitive or unpleasant jobs that we would rather avoid. More negative views fear the emergence of creatures who will one day become more intelligent or powerful than their human masters and take over the world.

The name, from the Czech word 'robota' meaning forced labour, first appears in *Rossum's Universal Robots*, a play written by a Czech playwright, Karl Capek in 1921. Capek's robots worked on factory assembly lines but then rebelled against their human masters.

The term 'robotics' was coined by a writer, the Russian-American science fiction writer Isaac Asimov. He drew up the three 'Laws of Robotics', followed by his own robots and by many other robotic characters in later science fiction works.

- Law One: a robot may not injure a human being or, through inaction, allow a human being to come to harm.
- Law Two: A robot must obey orders given to it by a human being except where such orders would conflict with the First Law.
- Law Three: A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

How do we define a robot? The Robot Institute of America (1979) offers this definition:

'A reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through various programmed motions for the performance of a variety of tasks.'

The British Department of Industry describes a robot simply as 'a reprogrammable manipulator device'. Finally Professor Mike Brady of the Robotics Research Laboratory at the University of Oxford defines robotics as 'that field concerned with intelligent connection of perception to action.'

First robots. The first modern robots appeared in the 20th century. In the early 1950s the American inventor George Devol patented a reprogrammable manipulator which he called 'Unimate' (Universal Automation), but this failed to find much interest in industry. At the end of the 1960s Joseph Engelberger modified Devol's patent into an industrial robot and created a company called Unimation, which successfully manufactured and marketed the robots.

In the same period research institutes made steps forward in the creation of new robots. Charles Rosen led a team at the Stanford Research Institute and developed a robot called 'Shakey'. Shakey was a more sophisticated creation than the Unimate, which had been designed for specific industrial applications. Shakey could move around in unfamiliar surroundings, see with a television camera 'eyes' and respond to his environment. The robot was called Shakey to express its unsure, noisy movement.

▼ Unimate 2000B industrial robot, c 1979.

M. Shelley • Frankenstein

The myth of artificial life is common in literature. In English literature it was explored primarily by Mary Shelley: in *Frankenstein* (1818), a classic of Romantic literature, Mary Shelley rewrites the myth of Prometheus by telling the story of a scientist who uses his medical knowledge to give life to an 'artificial' creature.

CHAPTER 4

- **Read the passage from Mary Shelley's novel and say why Frankenstein's creature can be considered one of the first examples of humanoid robots in Western literature.**

Artificial intelligence – Imitating Humans

▲ Statue of British mathematician Alan Turing working on a code-breaking machine at the Bletchley Park during the Second World War.

Intelligent machines. Artificial intelligence (AI) is an area of modern computer science and refers to intelligence exhibited by machines, capable of perceiving their environment, making decisions and generally imitating cognitive functions associated with human minds, such as learning and problem solving. Skills now associated with AI include understanding human speech, competing successfully in strategic games like chess, navigation systems, autonomous cars and interpreting complex data.
The expression 'artificial intelligence' was first used at a conference at Dartmouth College, in Hanover, New Hampshire, in 1956, where cognitive scientist Marvin Minsky and others were extremely optimistic about AI's future.
The creation of an artificially intelligent being, however, proved to be not so simple, and was hindered by reduced government funding for many years.
Fresh interest was stimulated in the 90s, notably in 1997 when IBM's chess-playing computer 'Deep Blue' defeated the Russian chess grandmaster Garry Kasparov.
More recently, in 2011, IBM's question-answering machine 'Watson' won the American TV quiz game 'Jeopardy'.
The efficiency of artificial intelligence is measured by a machine's ability to imitate human intelligence. This can be tested through the 'Turing Test', proposed by British mathematician and computer scientist Alan Turing in 1950. The test is based on the ability of a machine to trick judges into believing they are having a conversation with a human being. In 2014 three Russian researchers in St Petersburg passed this test with a talking computer which convinced some of the judges that they were talking to a real person.

CHECKPOINT

1. Match the names (1-8) with the correct phrases (a-h).

1 Charles Darwin	**4** Gregor Mendel	**7** Karl Capek
2 Deep Blue	**5** Ian Wilmut	**8** Watson and Crick
3 Alan Turing	**6** Isaac Asimov	

a proposed the theory of evolution.
b experimented on inheritance and genetics using pea plants.
c created the 3-D double-helical model of DNA.
d led a research team which achieved the first successful cloning of a mammal.
e first used the word 'robot' in a play.
f coined the term 'robotics' in a story published in 1942.
g was an IBM computer that defeated a Russian chess grandmaster in 1987.
h was an early British computer scientist who devised a test of AI.

2. Answer the following questions.

1 What objections may be made to reproductive cloning?
2 Why has the idea of robots so often created reactions of fear?
3 What distinguishes robotics from artificial intelligence studies?

VOCABULARY LAB FOR SCIENTISTS

3. Match the nouns below with their definitions (1-6).

offspring • gene • trait • chromosome • clone • embryo

1 a distinguishing feature or characteristic .....
2 a DNA molecule containing genetic material of an organism .....
3 a genetically identical copy of a biological organism .....
4 an unborn offspring in the process of development .....
5 basic unit of heredity .....
6 organism(s) produced by sexual or asexual reproduction .....

The Myth of Artificial Life

The three texts that follow represent three different literary interpretations of the myth of artificial life: in the first text, taken from Aldous Huxley's best-known novel, *Brave New World*, human reproduction is controlled by a group of scientists, who literally produce 'artificial' human beings thanks to the advancements of genetics. The second passage is written by the science fiction writer Daniel Wilson and contains a provoking reflection on the danger of a mutiny carried out by robots to take control of the humans. The last excerpt is taken from Brian Aldiss' short story *Supertoys Last All Summer Long*: this text shows a future world in which artificial life is so sophisticated that it is possible to talk about 'artificial intelligence', a form of intelligence that, if controlled, can solve long-lasting problems of mankind.

Aldous Huxley

Brave New World

(1932)

CHAPTER 6

Aldous Huxley was born in 1894 into an intellectual family of scientists, teachers and writers. After leaving Oxford University, where he studied literature, Aldous became a poet, journalist and art critic. He travelled frequently in Europe and became aware of the alarming changes that were coming about in Western civilization. His most famous novel, *Brave New World*, was published in 1932. Huxley's work is one of the most interesting examples of a 20th-century dystopian novel. As such, it presents a future anti-utopian world in which technology and science dominate and gives a pessimistic interpretation of the progress of humanity in the modern age. He died in 1963.

THINKING ROUTINE — See, think, wonder

C **COMPETENCES:** developing awareness of learning and thinking processes

SEE

1. **Observe the picture and answer the following questions.**
   1. What can you see on the tablet's screen?
   2. What are the circles that can be seen on the right of the screen?

THINK

2. **Whose hands do you think are the ones you can see in the picture?**
3. **What do you think the person is doing with the tablet?**

WONDER

4. **What does the picture want to make you reflect on?**
   1. Parents should have the right to choose their children's physical qualities.
   2. Thanks to the advancements of technology it is possible to modify the genetic code of a child before his/her birth.
5. **Do you agree with the idea of modifying the genetic code of an unborn child?**

008

The Human Farm

As long ago as 1932, the English writer and philosopher Aldous Huxley (1894-1963) foresaw a future world, six hundred years on from the present, in which technology dominated human life and society in which children are produced in test tubes and subjected to psychological conditioning so that each individual would be happy with his or her position in society. The dystopian world he creates in *Brave New World* is a world of permanent, unthinking happiness but a world which offers no freedom. The following excerpt represents the very beginning of Huxley's dystopian novel *Brave New World*: the action takes place in a laboratory that produces human beings.

A squat[1] grey building of only thirty-four stories. Over the main entrance the words, CENTRAL LONDON HATCHERY[2] AND CONDITIONING CENTRE, and, in a shield[3] the World State's motto, COMMUNITY, IDENTITY, STABILITY.

The enormous room on the ground floor faced towards the north. Cold for all the summer beyond the panes[4], for all the tropical heat of the room itself, a harsh thin light glared through the windows[5], hungrily seeking some draped lay figure[6], some pallid shape of academic goose-flesh[7], but finding only the glass and nickel and bleakly shining porcelain of a laboratory. Wintriness responded to wintriness[8]. The overalls of the workers were white, their hands gloved with a pale corpse-coloured rubber. The light was frozen, dead, a ghost. Only from the yellow barrels[9] of the microscopes did it borrow a certain rich and living substance, lying along the polished tubes like butter, streak after luscious[10] streak in long recession down the work tables.

'And this,' said the Director opening the door, 'is the Fertilizing Room.'

Bent over their instruments, three hundred Fertilizers were plunged, as the Director of Hatcheries and Conditioning entered the room, in the scarcely breathing silence, the absent-minded, soliloquizing hum[11] or whistle, of absorbed concentration. A troop of newly arrived students, very young, pink and callow[12], followed nervously, rather abjectly[13], at the Director's heels. [...] The D. H. C.[14] for Central London always made a point of personally conducting his new students round the various departments. [...]

'To-morrow,' he would add, smiling at them with a slightly menacing geniality, 'you'll be settling down to serious work. You won't have time for generalities'. [...]

'I shall begin at the beginning,' said the D.H.C. [...] 'These,' he waved his hand, 'are the incubators.' And opening an insulated door he showed them racks[15] upon racks of numbered test-tubes. 'The week's supply of ova. Kept,' he explained, 'at blood heat; whereas the male gametes,' and here he opened another door, 'they have to be kept at thirty-five instead of thirty-seven. Full blood heat sterilizes.' Rams wrapped in theremogene beget no lambs[16].

Still leaning against the incubators he gave them, while the pencils scurried illegibly across the pages, a brief description of the modern fertilizing process; spoke first, of course, of its surgical introduction – 'the operation undergone voluntarily for the good of Society, not to mention the fact that it carries a bonus amounting to six months' salary'; continued with some account of the technique for preserving the excised ovary alive and actively developing; passed on to a consideration of optimum temperature, salinity, viscosity; referred to the liquor in which the detached and ripened eggs were kept; and, leading his charges to the work tables, actually showed them how this liquor was drawn off from the test-tubes; how it was let out drop by drop onto the specially warmed slides of the microscopes; how the eggs which it contained were inspected for abnormalities, counted and transferred to a porous receptacle; how (and he now took them to watch the operation) this receptacle was immersed in a warm bouillon[17] containing free-swimming spermatozoa – at a minimum concentration of one hundred thousand per cubic centimetre, he insisted; and how, after ten minutes, the container was lifted out of the liquor and its contents re-examined; how, if any of the eggs remained unfertilized, it was again immersed, and, if necessary, yet again; how the fertilized ova went back to the incubators; where the Alphas and Betas remained until definitely bottled; while the Gammas, Deltas and Epsilons were brought out again, after only thirty-six hours, to undergo Bokanovsky's Process[18].

1 **squat:** pesante
2 **hatchery:** incubazione
3 **shield:** stemma
4 **panes:** vetri
5 **glared through the windows:** entrava dalle finestre
6 **draped lay figure:** manichino drappeggiato
7 **academic goose-flesh:** mummia accademica
8 **Wintriness responded to wintriness:** Gelo rispondeva a gelo
9 **barrels:** cilindri
10 **luscious:** luminosa
11 **hum:** canterellando
12 **callow:** imberbi
13 **abjectly:** con una certa apprensione
14 **D. H. C.:** acronimo per Director of Hatcheries and Conditioning
15 **racks:** file (di portaprovette)
16 **Rams wrapped in theremogene beget no lambs:** Gli arieti avvolti nel termogene non generano agnelli
17 **bouillon:** brodo
18 **Bokanovsky's Process:** il Processo Bokanovsky (è il nome che nel mondo di *Brave New World* viene dato alla clonazione umana)

COMPREHENSION AND INTERPRETATION

1. Focus on the initial description of the laboratory.

a What is its dominant colour?
b Find two references to death. What is contradictory about them?

2. In the passage there are many references to scientific instruments. List them.

3. What effect do they create? Tick as appropriate.

a coldness
b efficiency
c objectivity
d fear
e dehumanisation
f other (specify)

4. What actions need to be carried out in order to produce life? Put them in order.

a The ovary needs to be removed from the female body.
b Spermatozoa need to be kept at 35°C.
c Ovaries need to be kept alive and developing.
d Ripened eggs need to be kept in a special liquor that maintains them alive.
e Eggs need to be inspected to prevent the emergence of abnormalities.
f Eggs need to be fertilised.
g Fertilised eggs need to be sent to the incubator.

5. Where do these actions normally take place?

6. In the world depicted by Huxley the advancement of technology makes it possible to create human life outside the womb. What aspects of human procreation have been replaced by science and technology in Huxley's world?

a fertilisation
b love
c sex
d maternity (and paternity)
e other (specify)

7. What are the advantages of using technology to create life in the dystopian world depicted by Huxley? Explain this concept by making reference to the text.

8. Can the beings produced at the Hatchery and Conditioning Centre be considered forms of 'artificial life'? Why/Why not?

THINKING ROUTINE Consider, defend

C **COMPETENCES:** developing awareness of learning and thinking processes

In today's world there are many technologies that make it possible for scientists to control and modify the genetic code of individuals. The scientific community is divided between those who believe it is right to use technology to modify the genetic composition of human beings and those who believe this is not acceptable. What is your opinion about this issue? Follow the next steps to clarify it and share it with your classmates.

CONSIDER

1. Consider what you know and have read about cloning and genetic modification. Search the Web for further information and define:

- the positive aspect of cloning and genetic modifications
- the negative aspect of cloning and genetic modifications.

DEFEND

2. If you are in favour of genetic modifications defend your position by:

- finding at least two reasons why genetic modifications should be implemented and promoted
- pointing out a case study that shows how genetic modifications can have a positive effect on our lives.

3. If you are not in favour of genetic modifications defend your position by:

- finding at least two reasons why genetic modifications should be avoided or, at least, regulated
- pointing out a case study that shows how genetic modifications can be harmful or dangerous.

K. Ishiguro • **Never Let Me Go**

The theme of cloning is at the core of *Never Let Me Go* (2005), a dystopian novel by Kazuo Ishiguro depicting a world in which human clones are used as sources for new organs.

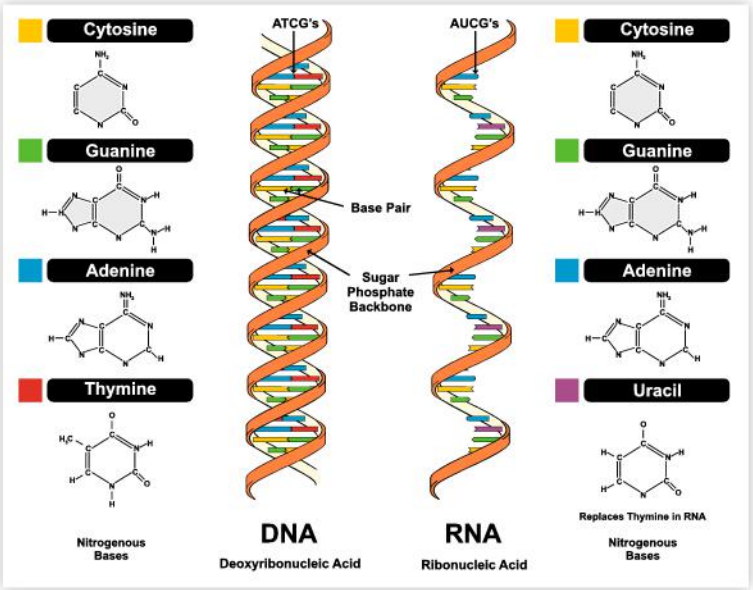
CHAPTER 7

- **What similarities and/or differences can you draw between Huxley's and Ishiguro's novels?**

The Language of Science

CLIL

The Human Genome Project



The **Human Genome Project** is an international collaboration that successfully determined, stored, and rendered publicly available the sequences of almost all the genetic content of the chromosomes of the human organism, otherwise known as the human genome.

The Human Genome Project (HGP) operated from 1990 to 2003 and provided researchers with basic information about the sequences of the three billion chemical base pairs (i.e., adenine [A], thymine [T], guanine[G], and cytosine [C]) that make up human genomic DNA deoxyribonucleic acid.

To appreciate the magnitude, challenge, and implications of the Human Genome Project, it is important first to consider the foundation of science upon which it was based – the fields of **classical**, **molecular**, and **human genetics**. Classical genetics is considered to have begun in the mid-1800s with the work of Austrian botanist **Gregor Mendel**, who succeeded in explaining that, for any given gene, offspring inherit from each parent one form, or allele, of the gene. In addition, the allele that an offspring inherits from a parent for one gene is independent of the allele he/she inherits from that parent for another gene.

Mendel's basic laws of genetics were expanded upon in the early 20th century when **molecular geneticists** began conducting research using model organisms that provided a more comprehensive view of the complexities of genetic transmission. The field of molecular genetics emerged from the realization that **DNA** and **RNA** (ribonucleic acid) constitute the genetic material in all living things. In physical terms, a gene is a discrete stretch of nucleotides within a DNA molecule, with each nucleotide containing an A, G, T, or C base unit. It is the specific sequence of these bases that encodes the information contained in the gene and that is ultimately translated into a final product, a molecule of protein or in some cases a molecule of RNA.

The public availability of a complete human genome sequence represented a defining moment for both the biomedical community and for society. The human genome database has enabled the identification of a variety of genes that are associated with disease. This has enabled more objective and accurate diagnoses, in some cases even before the clinical symptoms appear. These studies have led to the concept of **personalised medicine** – the idea that knowledge of a patient's entire genome sequence will give health care providers the ability to deliver the most appropriate and effective care for that patient.

(Abridged and adapted from *Encyclopaedia Britannica*)

CHECKPOINT

1. Answer the following questions.

1 When was the Human Genome Project operative?
2 How is the human genome defined?
3 What was controversial about the project?
4 Who may be considered the father of classical genetics?
5 What discovery led to the study of molecular genetics?
6 What two types of factor influence human traits?
7 What benefit has the human genome database provided?
8 What is meant by 'personalised medicine'?

VOCABULARY LAB FOR SCIENTISTS

2. Match the nouns below with their definitions (1-6).

allele • RNA • genome • DNA • genetics • nucleotide

1 the basic building block of nucleid acid polymers (e.g. DNA and RNA)
2 an alternative form of a gene (one member of a pair) that is located at a specific position on a specific chromosome and can result in different observable phenotypic traits
3 all the inheritable traits of an organism
4 a nucleic acid that is generally single stranded and plays a role in transferring information from DNA to protein-forming system of the cell
5 the science which studies heredity
6 a double-stranded nucleic acid that contains the genetic information for cell growth, division, and function

Daniel H. Wilson

Robot Uprising

(2014)

Daniel H. Wilson (1978 -) is a contemporary science fiction writer and screenwriter who has published several successful books on robots and artificial intelligence. His titles include *How to Survive a Robot Uprising, Where's my Jetpack?* (2005) and the bestselling novel *Robopocalypse* (2011). His latest novel, *The Clockwork Dynasty*, was published in 2017. Wilson's works revolve around the challenges emerging from a society dominated by robots and artificial intelligence and are often characterised by humour and grotesque tones.

WARM UP

1. It is commonly believed that technology can improve the living conditions of human beings: for instance robotics can be used to create exoskeletons that allow paraplegic people to walk. Look at the picture and answer the following questions.

1 Can you think of other ways in which technology has been used to improve the conditions of life of human beings?

2 Do you think the use of technology is always positive? Why/Why not?

009

Killer Robots

The passage you are going to read is a reflection on the future of artificial intelligence written by Daniel H. Wilson as a foreword to the collection of short stories entitled *Robot Uprising* (2014).

Someday soon, our technology is going to rise up[1] and we humans are going to be sliced into bloody chunks[2] by robots that in our hubris[3] we decided to design with buzz saws[4] for hands. That's a fact as cold and hard as metal. […]

Well, maybe. But even if we are not 100 percent confident that this horrific future is going to happen, it's fair to say that we won't be surprised when the robots come for us[5]. […]

The robot uprising is inherently dramatic. Robots are made in the image of humanity, yet they are bent on destroying their own creators. The built-in themes just won't quit: humankind daring to play God and creating life; the terrifying thought that we will one day replace ourselves; and the old nuclear fear of birthing a technology that's too powerful and ultimately destroys the world. The robot uprising holds up a distorted mirror to humanity and allows storytellers to explore human morality, what it means to be human, and the ultimate fate of our species. […]

Robots are no longer just actors wearing rubber suits with severely limited arm movement; today, we have mechanical devices that can actually think and function in the real world (albeit still with severely limited arm movement; that part hasn't changed much). Artificially intelligent personal assistants live on our smartphones, tracking our schedules. Self-driving cars have been legalized in multiple states and are quietly taking to the road. The CIA has a private air force made of drone aircraft that is out scouring the world for targets, weapons hot. That's quite a bit scarier than a guy in a rubber suit, waving[6] his arms wildly while an old-school modem connection noise blares[7] from his mouth speaker.

Robots are unique among all movie monsters in that they are real. The robot uprising induces a queasy[8] feeling because it is possible. At this very moment, mobile robots are stalking the dark sewers[9] under our feet, mapping routes. Algorithms imbued with AI are planning supply

1 **rise up**: ribellarsi
2 **chunks**: pezzettini sanguinanti
3 **hubris**: tracotanza
4 **buzz saws**: seghe circolari
5 **come for us**: verranno a cercarci
6 **wawing**: agitando
7 **blares**: risuona
8 **quesy**: nauseabondo
9 **sewers**: fogne

logistics for troop deployments. Surgical robots are poised and waiting in hospitals, their needles glistening. We live in a world teeming with monsters made real. Why should it be a surprise that we long for stories in which our fears can be projected onto a killer robot that can be shot in the face with a shotgun, again and again, until we are reassured that we— raw adaptable humankind— will always triumph in the end?

COMPREHENSION AND INTERPRETATION

2. Answer the following questions.

1 The word 'hubris' means 'exaggerated and uncontrolled pride'. Why does the author call the attempt to create robots 'hubris'? Tick as appropriate and find evidence in the text to support your idea.

- **a** It is prohibited by natural law to create robots.
- **b** Robots are dangerous beings.
- **c** By constructing human-like robots human beings want to be like God.
- **d** The author believes that a 'robot uprising' is not unlikely. Why?
- **e** The idea that the creature can revolt against its creator is common.
- **f** Technology can get out of control.
- **g** Robots are able to take decisions independently.

2 What is the difference between old and contemporary robots? Explain this concept making reference to the text.

3 Robots are common presences in many areas of contemporary life. What are the ones mentioned by the author? Tick as appropriate.

- **a** medicine
- **b** communication
- **c** education
- **d** work
- **e** transportation
- **f** artistic production
- **g** catering
- **h** army
- **i** other (specify)

4 What is the difference between 'robots' and 'movie monsters'?

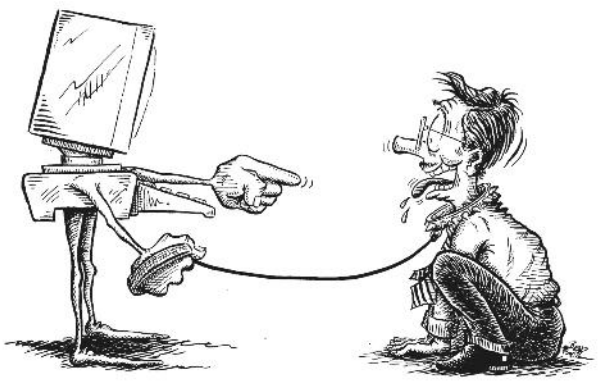
5 Why were robots invented by human beings? Make reference to the text.

6 Focus on the last paragraph of the passage. What is man's final fear with robots?

A scene from *Terminator 3*: *Rise of the Machines* (2003).

YOUR VOICE

3. Look at this cartoon satirising the relationship between men and technology. Answer the following questions.



1 What does the cartoon represent?

2 Computers were introduced to help human beings perform certain complex tasks. Does the cartoon suggest that computers have actually improved human life? Why/Why not?

3 Has the relationship between man and technology remained the same over the course of history?

4 Are you a slave of technology or do you think you can control technology?

5 Contemporary life is pervaded by technology and its forms. Do you think man still has complete control over technology or is contemporary technology enslaving man? Share your ideas with the rest of the class.

The Language of Science

CLIL

Two Intriguing Uses for Artificial Intelligence

Rather than leading to the violent downfall of humankind, artificial intelligence is helping people around the world do their jobs, in a variety of fields including medicine and health care as well as tracking endangered animals in the wild.
Advancements in the field of artificial intelligence (AI) haven't always been met with enthusiasm. Famed astrophysicist Stephen Hawking has warned on several occasions that a fully developed AI could destroy the human race. But at a recent conference in Pittsburgh scientists explained how newly developed AI is accelerating research and improving lives.
Here are two interesting examples of AI inventions that are already redefining technology.

Wildlife preservation

Many researchers want to know how many animals are out there and where they live, but 'scientists do not have the capacity to do this, and there are not enough GPS collars or satellite tracks in the world,' Tanya Berger-Wolf, a professor of computer science at the University of Illinois at Chicago, said at the conference.
Instead, Berger-Wolf and her colleagues developed https://link.pearson.it/C0148149, a site that houses an AI system and algorithms, which can scour vast amounts of data. Algorithms are basically programmed procedures and formulae for solving problems, based on conducting a sequence of specified actions. Computer programs can be seen as elaborate algorithms.
The system inspects photos uploaded online by experts and the public. It can recognize each animal's unique markings, track its habitat range by using GPS coordinates provided by each photo, estimate the animal's age and reveal whether it is male or female, professor Berger-Wolf explained.
'The ability to use images with photo identification is democratizing access to conservation in science,' claimed the University of Illinois scientist. 'We now can use photographs to track and count animals.'

Restoring touch

In a landmark event announced in 2016, researchers revealed that a paralyzed man's feelings of touch were restored with a mind-controlled robotic arm and brain chip implants. A 2004 car accident left the man, Nathan Copeland, with quadriplegia, meaning he couldn't feel or move his legs or lower arms. Dr. Michael Boninger, a professor in the Department of Physical Medicine and Rehabilitation at the University of Pittsburgh School of Medicine, explained how innovations allowed Copeland to feel sensation in his hand again.
Doctors implanted two small electronic chips into Copeland's brain — one in the sensory cortex, which controls touch, and the other in the motor cortex, which controls movement. During one trial, Copeland was able to control the robotic arm with his thoughts. Even more exciting was the fact that the man reported feeling the sensation of touch when the researchers touched the robotic hand.
Many challenges remain, including developing a system that has a long battery life and enables full sensation and movement for injured people, he said. 'All of this will require AI and machine learning,' Boninger said.

(Adapted from livescience.com)

CHECKPOINT

1. Answer the following questions.

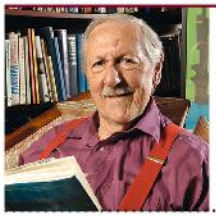
1 What is the purpose of the Wildbook.org system?
2 What does the Wildbook.org use to facilitate and accelerate this search procedure?
3 What information can be obtained using this system?
4 What medical breakthrough has been achieved at the University of Pittsburgh School of Medicine?
5 What is the function of the sensory cortex in the brain?

VOCABULARY LAB FOR SCIENTISTS

2. Match the nouns below with their definitions (1-6).

track • scour • upload • microchip • implant • algorithm

1 add data (files, images etc.) onto a computer
2 a set of electronic circuits on one small flat piece of semiconductor material, normally silicon
3 a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer
4 insert a substance or object into the body
5 look through (a large quantity of data)
6 observe and monitor movements and positions



Brian Aldiss

Supertoys Last All Summer Long

(1969)

Brian Wilson Alidiss was a poet, critic, fiction and science fiction writer. Born in 1925 in Norfolk, he worked as a bookseller in Oxford for almost ten years. After publishing his first science fiction novel, *Non-Stop*, in 1958, he became a full-time writer and published more than 50 science fiction books. His most famous titles are *Hothouse* (1962), *The Saliva Tree* (1966), and *Helliconia Spring* (1982). Aldiss died in 2017.

WARM UP

1. Look at these four quotes about artificial intelligence (A-D). Then answer the questions.

A Artificial intelligence has the same relation to intelligence as artificial flowers have to flowers.
D. Parnas, Canadian software engineer

B By 2100, our destiny is to become like the gods we once worshipped and feared. But our tools will not be magic wands and potions but the science of computers, nanotechnology, artificial intelligence, biotechnology and most of all, the quantum theory.
M. Kakau, Japanese American theoretical physicist and cosmologist

C I visualize a time when we will be to robots what dogs are to humans, and I'm rooting for the machines.
C. Shannon, American mathematician

D Computers will overtake humans with AI within the next 100 years. When that happens, we need to make sure the computers have goals aligned with ours.
S. Hawking, American mathematician and physicist

1 Which quote suggests the idea that artificial intelligence:
   a will probably destroy the human race?
   b is fake?
   c will make human beings similar to God?
   d will adopt human beings as 'pets'?
2 Which quote do you most agree with? Why?
3 Which quote do you most disagree with? Why? Share your ideas with the rest of the class.

010

A Full-size Serving Man

The excerpt you are going to read is taken from a 1969 short story entitled *Supertoys Last All Summer Long*. The story is said to be the source of inspiration for Steven Spielberg's sciencefiction film *A.I. Artificial Intelligence*, which was released in 2001. The text follows two narrative lines: one is centred around Monica Swinton, who lives with her husband, Henry Swinton, and her son David, a young android who is having problems with his language functions. The second narrative line is focused on Henry Swinton, whose company, the Synthtank, is launching a brand new form of artificial life that is capable of solving the problem of human loneliness. The passage you are going to read contains the second narrative line of the story.

After a couple of jokes, he said, 'Today marks a real breakthrough for the company. It is now almost ten years since we put our first synthetic life-forms on the world market. You all know what a success they have been, particularly the miniature dinosaurs. But none of them had intelligence. 'It seems like a paradox that in this day and age we can create life but not intelligence. Our first selling line, the Crosswell Tape, sells best of all, and is the most stupid of all.' Everyone laughed. 'Though three-quarters of the overcrowded world are starving, we are lucky here to have more than enough, thanks to population control. Obesity's our problem, not malnutrition. I guess there's nobody round this table who doesn't have a Crosswell working for him in the small

intestine, a perfectly safe parasite tape-worm[1] that enables its host to eat up to fifty percent more food and still keep his or her figure. Right?' General nods of agreement.

'Our miniature dinosaurs are almost equally stupid. Today, we launch an intelligent synthetic life-form – a full-size serving-man. 'Not only does he have intelligence, he has a controlled amount of intelligence. We believe people would be afraid of a being with a human brain. Our serving-man has a small computer in his cranium. 'There have been mechanicals on the market with mini-computers for brains – plastic things without life, super-toys – but we have at last found a way to link computer circuitry[2] with synthetic flesh.' [...]

'Our serving-man will be, in many senses, a product of the computer. Without computers, we could never have worked through the sophisticated biochemics that go into synthetic flesh. The serving-man will also be an extension of the computer – for he will contain a computer in his own head, a microminiaturized computer capable of dealing with almost any situation he may encounter in the home. With reservations, of course.' Laughter at this; many of those present knew the heated debate that had engulfed[3] the Synthank boardroom before the decision had finally been taken to leave the serving-man neuter under his flawless[4] uniform.

'Amid all the triumphs of our civilization – yes, and amid the crushing[5] problems of overpopulation too – it is sad to reflect how many millions of people suffer from increasing loneliness and isolation. Our serving-man will be a boon[6] to them; he will always answer, and the most vapid[7] conversation cannot bore him.

'For the future, we plan more models, male and female – some of them without the limitations of this first one, I promise you! – of more advanced design, true bio-electronic beings.

'Not only will they possess their own computer, capable of individual programming; they will be linked to the World Data Network. Thus everyone will be able to enjoy the equivalent of an Einstein in their own homes. Personal isolation will then be banished forever!'

He sat down to enthusiastic applause. Even the synthetic serving-man, sitting at the table dressed in an unostentatious suit, applauded with gusto.

1 **tape-worm:** tenia
2 **circuitry:** circuito
3 **engulfed:** investito
4 **flawless:** impeccabile
5 **crushing:** urgenti
6 **boon:** dono
7 **vapid:** stupida

COMPREHENSION AND INTERPRETATION

2. Answer the following questions.

1 Henry Swinton calls many of the best-selling synthetic life forms his company created 'stupid'. Why? Tick as appropriate.

- **a** Because they are futile.
- **b** Because they have no intelligence.
- **c** Because they are artificial creatures.

2 Focus on the new robot Swinton is about to launch. Find references in the text about:

- **a** his size
- **b** his intelligence
- **c** the source of his intelligence
- **d** his sex

3 Why would people be afraid of a 'being with a human brain'?

4 What differentiates the new 'full-size serving man' from the other super-toys?

5 What human problem will the new robot contribute to solving? Tick as appropriate.

- **a** hunger
- **b** obesity
- **c** isolation
- **d** social injustice
- **e** overpopulation
- **f** other (specify)

6 What will make the android robot able to solve the problem? Tick as appropriate.

- **a** It will never be bored by any conversations.
- **b** It will be neuter.
- **c** It will be connected to the World Data Network.
- **d** Other (specify).

YOUR VOICE

3. Will the robot provide human beings with real company? Explain your viewpoint.

Seen on Screen

The myth of artificial life is a common theme of science fiction novels and films. Two of the films that best explore and analyse this theme are Ridley Scott's ***Blade Runner*** (1982) and Steven Spielberg's *A.I. Artificial Intelligence* (2001). Inspired by Philip K. Dick's famous science fiction novel *Do Androids Dream of Electric Sheep?* (1968), *Blade Runner* explores what it means to be 'human' in a world dominated by android creatures, replicants and robots. Scott's film is a deep meditation on the consequences of the dehumanisation caused by the uncontrolled development of technology.

Steven Spielberg's ***A.I. Artificial Intelligence***, on the contrary, was inspired by Brian Aldiss' short story *Supertoys last all summer long* (1969). Spielberg's film explores the relationship between human beings and technology in a future world in which men have developed android creatures that are so perfect that they can coexist with human beings and serve them.

TITLE: Blade Runner
DIRECTOR: Ridley Scott
MAIN ACTORS: Harrison Ford, Rutger Hauer, Sean Young
YEAR: 1982
COUNTRY: USA

TITLE: A.I. Artificial Intelligence
DIRECTOR: Steven Spielberg
MAIN ACTORS: Haley Joel Osment, Frances O'Connor, Jude Law
YEAR: 2001
COUNTRY: USA

SCIENTIFIC ISSUE — Technology versus Humanity?

COMPETENCES: critical thinking • making connections • digital literacy • effective communication

As technology progresses exponentially, providing us with many of the everyday benefits of communication technology, mechanical and domestic appliances and knowledge systems, do we run the risk of losing our humanity and even of becoming slaves to technology?

STEP 1 DISCUSSING THE QUESTIONS

1. **Answer the questions below.**
   1 How dependent are you on modern technology? Could you survive without your smartphone? How do you imagine your life in ten years' time?
   2 Discuss these questions with your classmates and note down your positive and negative ideas about technology.

STEP 2 RESEARCHING THE QUESTION

2. **Read the quotation below. Then search the Web for articles about artificial intelligence and safety. Use this search string: 'AI safety myths' . Make a list of the myths and facts concerning artificial intelligence. Which ones of them surprise you? Which ones worry you? Discuss with your classmates.**

> What we really need to do is make sure that life continues into the future. […] It's best to try to prevent a negative circumstance from occurring than to wait for it to occur and then be reactive.
>
> *Elon Musk on keeping AI safe and beneficial*

STEP 3 TAKE ACTION

3. **Work in small groups. Create a short presentation about the pros and cons of rapid technological progress. Say what benefits we have achieved and in what fields and indicate what fears we might have for our future.**

REAL-LIFE EXPERIENCES

SCUOLA › LAVORO

THEME: Overview of genetics, genomics and health care

TASK: Preparing and delivering a project presentation for a medical research company to be delivered at the opening of a conference. The presentation will have the following title: **From genetics to genomics and health care** and will last between 15 and 20 minutes.

C COMPETENCES:
- analyse, select and manage useful and reliable information;
- improve communicative and presentation skills;
- demonstrate the ability to work effectively with diverse teams and collaborate;
- plan, organise and control work;
- use digital technology, communication tools and/or networks appropriately to access, manage, integrate, evaluate and create information;
- synthesise and harmonise material contributed by different groups.

STEP 1 PREPARING A WORK PLAN, ASSIGNING TASKS, CREATING A WORK-FLOW CHART (full class)

The research company that has commissioned this presentation requires you to focus on answering the following questions:

1. – What is meant by genetics and genomics?
   – Why are genetics and genomics important for an individual's health?
2. Why is family history important and how can it contribute to health care and medical treatment?
3. What are pharmacogenetics and pharmacogenomics and how do they contribute to medical treatment?
4. – What are stem cells and what is stem cell therapy?
   – What are the main differences between embryonic stem cells and adult stem cells?
5. What moral, ethical and legal issues are raised by stem cell research?

The class should decide how much time will be available for each of the numbered topics and create 5 work groups, one for each of the topics listed above. A project leader should be nominated. He/She will be responsible for controlling progress of the various phases of the project.

SOFT SKILLS

TEAM WORK AND TIME MANAGEMENT

A **flowchart** is a linear chart which illustrates your workflow and lists all the steps needed for successful completion of a project. It will clearly state which steps are to be taken, in what order, by whom and by what dates each step must be completed. The project leader can thus tick off steps as they are completed, deal with any problems that may arise and insist on respect of fixed deadlines.

STEP 2 RESEARCHING, ANALYSING AND SELECTING MATERIAL (individual and group work)

Groups should work on researching material for their topic. Initially this may be done individually. Students should use the Internet to find material that they consider valid and pertinent. They should download text that can serve as a basis for their presentation, clearly indicating their sources.

Students within each group can now compare their material and together decide on what is more and less useful and pertinent and which sources they consider to be **authoritative**.

SOFT SKILLS

MULTIMEDIA SKILLS: SEARCHING ONLINE

Not all the material accessed online is accurate. Authoritative material should be seen as material produced by experts who are recognised in their field; examples include peer-reviewed articles, government and institutional websites and books by well-known publishers.

STEP 3 **SYNTHESISING AND PRODUCING A WRITTEN DRAFT** (group work)

Having pooled and selected their material, groups should now work on producing a first written draft of their part of the presentation. They should consider the time available for their part of the presentation and edit their text so that essential information can be communicated within this time.

STEP 4 **INTEGRATION** (whole class)

The textual material produced by each group should be circulated and shared by the whole class. The class can now work together to harmonise the single contributions, checking that the style is uniform and that the material can be presented orally within the time allotted for the presentation.

STEP 5 **PREPARING THE SLIDES** (full-class discussion and group work)

Each group should now decide:

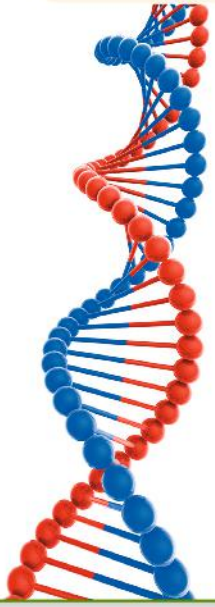
- how many slides their part requires;
- what each slide should contain (text and illustrative images).

The full class can now agree on a format for the slides, choosing background colour, font colour, size and transitions. If possible this should be tested with the technology that will be used for the presentation (in the room/hall where the presentation will be given). Groups can now gather useful graphic material (photographs, images etc.) to illustrate their part of the presentation. They should also decide how much (how little!) text should appear on each slide.

SOFT SKILLS

COMMUNICATE EFFECTIVELY

Watch and analyse professional presentations and note down their characteristics. Worthwhile examples can be found on the TED-conference website. One very useful example can be found by looking on the Internet for *How to avoid death By PowerPoint* by David J.P. Phillips.
It is important to remember that the presenter(s) is the presentation and that slides are merely their support. The slides should contain images and no more than three lines of text.



STEP 6 **REVIEWING THE SLIDES** (full class)

A full-class session can now be held with each group appointing one person who will show the group's slides and give (read) the oral presentation. Each group's presentation should be timed. Feedback can now be given by the whole class so that any problems can be eliminated.
A final slide can now be added to the presentation, listing the sources of information used, thanking the audience for their attention and inviting questions.

STEP 7 **REHEARSING THE PRESENTATION** (full class)

The class can now decide how many students will participate actively in the presentation (a single student or one student for each of the topics dealt with). The presenter(s) should memorise their speech(es) so that they can speak with the exclusive support of the slides and, if necessary, short speaker's notes visible on the computer but not on the projection screen. The rehearsal will be repeated until the timings and delivery are perfect.