

ASSIGNMENT No. 2

Q. 1 Fill in the blanks

- a) (i) The ratio of to..... is called pressure.
(ii) Atmospheric pressure is measured with an instrument called a
(iii) Collection of similar cells which perform a similar function is called
a
(iv) Planaria is an example o..... phylum.
(v) Vitamin A,D E & K is an example of

Fill in the blanks

- a) (i) The ratio of **Force** to **Area** . is called pressure.
(ii) Atmospheric pressure is measured with an instrument called a **Barometers**
(iii) Collection of similar cells which perform a similar function is called
a **Tissue**
(iv) Planaria is an example of **Platyhelminthes** phylum.
(v) Vitamin A,D E & K is an example of **Fat soluble vitamins**.

b) Give reasons

- (i) How step down transfer works.
(ii) Why frog belongs to class amphibian.
(iii) Why beauticians use convex mirror during make up.
(iv) Why dietary fibrous foods are recommended for good health.

(i) How step down transfer works

The electricity in your house is delivered at a steady 110v. In fact, throughout the United States, electricity companies generally use 110v, but this is not the case throughout the world. In many other countries, electricity is delivered to houses at 220v. If you take a look at the electrical equipment around your house, you will notice that almost everything has an electrical specification that says "110v." However, in order to work properly, many appliances are connected to a transformer. What if you purchase an appliance or an electrical product that operates at a lower voltage? If you connect that product to your house without any transformer, it is likely to go kaput as soon as you turn the switch on!

That's why step down transformers are used. A step down transformer is a device that can be connected to the switch and the appliance. There are two types of transformers that you should know about: step up and step down transformers. Step up transformers generally produce a higher output voltage than the input voltage. For instance, if you have an appliance that operates at 220v, you will probably need a step up transformer in order to amplify the voltage from 110 to 220v. However, if you need lesser voltage, step down transformers will be used.

If you are looking for transformers, you have come to the right place! At Bruce Electrical Equipment, we provide an extensive array of transformers and other electrical items at the most affordable prices. Apart from selling transformers, we also sell phase converters, transient voltage surge suppressors, circuit breakers, rectifiers, power line conditioners, transfer switches, panel boards, and a lot more!

How Does the Transformer Work

The concept of a step down transformer is actually quite simple. The transfer has more turns of wire on the primary coil as compared to the turns on the secondary coil. This reduces the induced

voltage running through the secondary coil, which ultimately reduces the output voltage. Most people think that as the voltage is reduced, the output power from the transformer will also be decreased, but that is not the case. According to the laws of physics, a drop in the voltage means that the current goes up.

Why Buy Through Us

Bruce Electrical Equipment was formed back in 1973, and since then, we have been delivering an extensive array of equipment to our clients throughout the country. We are renowned for the high quality of our products, and also offer rapid shipping for people who need them quickly. We also provide a comprehensive warranty with all of our products, so if something isn't working properly, just give us a call and we'll repair or replace it for you!

(ii) Why frog belongs to class amphibian.

Amphibian, (class Amphibia), any member of the group of vertebrate animals characterized by their ability to exploit both aquatic and terrestrial habitats. The name *amphibian*, derived from the Greek *amphibios* meaning “living a double life,” reflects this dual life strategy—though some species are permanent land dwellers, while other species have a completely aquatic mode of existence.

Approximately 8,100 species of living amphibians are known. First appearing about 340 million years ago during the Middle Mississippian Epoch, they were one of the earliest groups to diverge from ancestral fish-tetrapod stock during the evolution of animals from strictly aquatic forms to terrestrial types. Today amphibians are represented by frogs and toads (order Anura), newts and salamanders (order Caudata), and caecilians (order Gymnophiona). These three orders of living amphibians are thought to derive from a single radiation of ancient amphibians, and although strikingly different in body form, they are probably the closest relatives to one another. As a group, the three orders make up subclass Lissamphibia. Neither the lissamphibians nor any of the extinct groups of amphibians

were the ancestors of the group of tetrapods that gave rise to reptiles. Though some aspects of the biology and anatomy of the various amphibian groups might demonstrate features possessed by reptilian ancestors, amphibians are not the intermediate step in the evolution of reptiles from fishes.

Modern amphibians are united by several unique traits. They typically have a moist skin and rely heavily on cutaneous (skin-surface) respiration. They possess a double-channeled hearing system, green rods in their retinas to discriminate hues, and pedicellate (two-part) teeth. Some of these traits may have also existed in extinct groups.

Members of the three extant orders differ markedly in their structural appearance. Frogs and toads are tailless and somewhat squat with long, powerful hind limbs modified for leaping. In contrast, caecilians are limbless, wormlike, and highly adapted for a burrowing existence. Salamanders and newts have tails and two pairs of limbs of roughly the same size; however, they are somewhat less specialized in body form than the other two orders.

Many amphibians are obligate breeders in standing water. Eggs are laid in water, and the developing larvae are essentially free-living embryos; they must find their own food, escape predators, and perform other life functions while they continue to develop. As the larvae complete their embryonic development, they adopt an adult body plan that allows them to leave aquatic habitats for terrestrial ones. Even though this metamorphosis from aquatic to terrestrial life occurs in members of all three amphibian groups, there are many variants, and some taxa bear their young alive. Indeed, the roughly 8,100 living species of amphibians display more evolutionary experiments in reproductive mode than any other vertebrate group. Some taxa have aquatic eggs and larvae, whereas others embed their eggs in the skin on the back of the female; these eggs hatch as tadpoles or miniature frogs. In other groups, the young develop within the oviduct, with the embryos feeding on the wall of the oviduct. In some species, eggs develop within the female's stomach.

The three living orders of amphibians vary greatly in size and structure. The presence of a long tail and two pairs of limbs of about equal size

distinguishes newts and salamanders (order Caudata) from other amphibians, although members of the eel-like family Sirenidae have no hind limbs. Newts and salamanders vary greatly in length; members of the Mexican genus *Thorius* measure 25 to 30 mm (1 to 1.2 inches), whereas *Andrias*, a genus of giant aquatic salamanders endemic to China and Japan, reaches a length of more than 1.5 metres (5 feet). Frogs and toads (order Anura) are easily identified by their long hind limbs and the absence of a tail. They have only five to nine presacral vertebrae. The West African goliath frog, which can reach 30 cm (12 inches) from snout to vent and weigh up to 3.3 kg (7.3 pounds), is the largest anuran. Some of the smallest anurans include the South American brachycephalids, which have an adult snout-to-vent length of only 9.8 mm (0.4 inch), and some microhylids, which grow to 9 to 12 mm (0.4 to 0.5 inch) as adults. The long, slender, limbless caecilians (order Gymnophiona) are animals that have adapted to fossorial (burrowing) lifestyles by evolving a body segmented by annular grooves and a short, blunt tail. Caecilians can grow to more than 1 metre (3 feet) long. The largest species, *Caecilia thompsoni*, reaches a length of 1.5 metres (5 feet), whereas the smallest species, *Idiocranium russeli*, is only 90 to 114 mm (3.5 to 5 inches) long.

Distribution and abundance

Amphibians occur widely throughout the world, even edging north of the Arctic circle in Eurasia; they are absent only in Antarctica, most remote oceanic islands, and extremely xeric (dry) deserts. Frogs and toads show the greatest diversity in humid tropical environments. Salamanders primarily inhabit the Northern Hemisphere and are most abundant in cool, moist, montane forests; however, members of the family Plethodontidae, the lungless salamanders, are diverse in the humid tropical montane forests of Mexico, Central America, and northwestern South America. Caecilians are found spottily throughout the African, American, and Asian wet tropics.

For many years, habitat destruction has had a severe impact on the distribution and abundance of numerous amphibian species. Since the 1980s, a severe decline in the populations of many frog species has been observed. Although acid rain, global warming, and ozone depletion are contributing factors to these reductions, a full explanation of the disappearance in diverse environment remains uncertain. A parasitic fungus, the so-called

amphibian chytrid (*Batrachochytrium dendrobatidis*), however, appears to be a major cause of substantial frog die-offs in parts of Australia and southern Central America and milder events in North America and Europe.

(iii) Why beauticians use convex mirror during make up.

We all know what a mirror is – we see them everywhere every day. But when it comes to mirrors, there is a type to apply makeup or to shave, and that is a concave mirror.

This type of mirror provides an amount of magnification that enlarges your face – even your pores and hair follicles – making your features as clear as possible so you can accurately and evenly apply your makeup or close shave your face.

It may sound strange to you, but a concave mirror is much better than the type of mirror you would find in a car or in your bathroom.

The best type of makeup or shaving mirror is an LED lighted concave vanity mirror, which most makeup gurus swear by.

This type of mirror is often seen on TV fashion shows and is what makeup artists use when applying makeup to actors and models.

It magnifies your features so that you do not have to get closer to the mirror to see better.

Concave Mirror?

Concave mirrors bend inward in the center.

When your face is put between a focus and the concave mirror, it will reflect a magnified image. For your face, a concave mirror can even reflect the pores and hair follicles on your skin.

Concave mirrors are used as makeup mirrors or mirrors for shaving. When applying your makeup, you hold the mirror close to your face.

This lets you see a magnified version of your face which is very helpful when trying to achieve accuracy and precision when shaving or applying makeup.

How Does a Concave Mirror Work

The way in which a concave mirror works can be explained by the laws of reflection.

As there is a curve in the middle of the concave mirror's surface, an angle (called an incident angle) is present. This angle is where light hits the mirror's surface.

Based on where the light hits the mirror, the mirror can emphasize the light much in the same way camera lenses focus on light and create an image.

Concave mirrors enlarge whatever is being focused on, unlike a flat mirror which simply reproduces what is being focused on to a more or less life-size reflection.

Because of the curve in the mirror, whatever part of your face is being focused on appears as if it is floating in the air. This lets you hone your focus on that specific part of your face.

Why Use a Concave Mirror for Makeup or Shaving?

Simply put, a concave mirror magnifies images at a short range, which means that you gain a clearer representation of your face.

This is important when doing precise tasks like a close shave or applying eyeliner or false eyelashes.

Let's be honest; shaving and applying makeup can be a shaky experience at the best of times. It is a fiddly activity that can have some unattractive and downright painful results when done incorrectly.

With a concave mirror, you can focus properly on your eyes, mouth, eyebrows, or any other part of your face to carefully and precisely apply every part of your makeup.

For a close shave, or when shaving with a double-sided blade, a concave mirror lets you properly see what you are doing, meaning you will not accidentally nick or cut yourself.

This elegant mirror is one of my favorite concave mirrors. But, if you want one with which you can travel, you'll want to check out this floxite lighted mirror.

Final Thoughts

Concave mirrors are undoubtedly the ideal mirrors for applying your makeup or shaving, as well as any other tasks involving your face, such as dental care.

This is thanks to the excellent magnification that they offer you when you step into the focal zone.

Understanding the laws of reflection allow you to see why a concave mirror is used for makeup or shaving as it works to magnify your face, allowing you to focus on each part of your face.

Unlike regular flat mirrors, a concave mirror can reproduce real images of your face that aren't distorted and fuzzy – true images of your face at a much more magnified level.

Concave mirrors are typically used as makeup and shaving mirrors, and there are so many to choose from.

They vary in magnification levels, size, materials, design, color, and light bulb type. Selecting a concave mirror is quite simple once you know what your needs are.

(iv)Why dietary fibrous foods are recommended for good health.

Dietary fiber — found mainly in fruits, vegetables, whole grains and legumes — is probably best known for its ability to prevent or relieve constipation. But foods containing fiber can provide other health benefits as well, such as helping to maintain a healthy weight and lowering your risk of diabetes, heart disease and some types of cancer.

Selecting tasty foods that provide fiber isn't difficult. Find out how much dietary fiber you need, the foods that contain it, and how to add them to meals and snacks.

dietary fiber

Dietary fiber, also known as roughage or bulk, includes the parts of plant foods your body can't digest or absorb. Unlike other food components, such as fats, proteins or carbohydrates — which your body breaks down and absorbs — fiber isn't digested by your body. Instead, it passes relatively intact through your stomach, small intestine and colon and out of your body.

Fiber is commonly classified as soluble, which dissolves in water, or insoluble, which doesn't dissolve.

- **Soluble fiber.** This type of fiber dissolves in water to form a gel-like material. It can help lower blood cholesterol and glucose levels. Soluble fiber is found in oats, peas, beans, apples, citrus fruits, carrots, barley and psyllium.
- **Insoluble fiber.** This type of fiber promotes the movement of material through your digestive system and increases stool bulk, so it can be of benefit to those who struggle with constipation or irregular stools. Whole-wheat flour, wheat bran, nuts, beans and

vegetables, such as cauliflower, green beans and potatoes, are good sources of insoluble fiber.

The amount of soluble and insoluble fiber varies in different plant foods. To receive the greatest health benefit, eat a wide variety of high-fiber foods.

Benefits of a high-fiber diet

A high-fiber diet:

- **Normalizes bowel movements.** Dietary fiber increases the weight and size of your stool and softens it. A bulky stool is easier to pass, decreasing your chance of constipation. If you have loose, watery stools, fiber may help to solidify the stool because it absorbs water and adds bulk to stool.
- **Helps maintain bowel health.** A high-fiber diet may lower your risk of developing hemorrhoids and small pouches in your colon (diverticular disease). Studies have also found that a high-fiber diet likely lowers the risk of colorectal cancer. Some fiber is fermented in the colon. Researchers are looking at how this may play a role in preventing diseases of the colon.
- **Lowers cholesterol levels.** Soluble fiber found in beans, oats, flaxseed and oat bran may help lower total blood cholesterol levels by lowering low-density lipoprotein, or "bad," cholesterol levels. Studies also have shown that high-fiber foods may have other heart-health benefits, such as reducing blood pressure and inflammation.
- **Helps control blood sugar levels.** In people with diabetes, fiber — particularly soluble fiber — can slow the absorption of sugar and help improve blood sugar levels. A healthy diet that includes insoluble fiber may also reduce the risk of developing type 2 diabetes.
- **Aids in achieving healthy weight.** High-fiber foods tend to be more filling than low-fiber foods, so you're likely to eat less and stay satisfied longer. And high-fiber foods tend to take longer to eat and to be less "energy dense," which means they have fewer calories for the same volume of food.

- **Helps you live longer.** Studies suggest that increasing your dietary fiber intake — especially cereal fiber — is associated with a reduced risk of dying from cardiovascular disease and all cancers.

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Q. 2 What are forest ecosystem? Give detailed description for each type.

Forest Ecosystem

An ecosystem refers to a functional unit of nature in which living organisms interact among themselves as well as with the surrounding physical environment. Ecologists look at the entire biosphere as a global ecosystem. Besides, the forest ecosystem is a part of the terrestrial ecosystem.

It, however, may vary largely in size i.e. from a small pond to a sea or a large forest. Usually, these are self-sustaining. We can divide the ecosystems into two broad categories, namely, terrestrial ecosystem and aquatic ecosystem.

The terrestrial ecosystem includes desert, grassland and forest ecosystem, whereas pond, lake, wetland and river ecosystem are parts of the aquatic ecosystem.

Forest Ecosystem?

A forest ecosystem is a functional unit or a system which comprises of soil, trees, insects, animals, birds, and man as its interacting units. A forest is a large and complex ecosystem and hence has greater species diversity.

Also, it is much more stable and resistant to the detrimental changes as compared to the small ecosystems such as wetlands and grasslands.

A forest ecosystem, similar to any other ecosystem, also comprises of abiotic and biotic components. Abiotic components refer to inorganic materials like air, water, and soil. Biotic components include producers, consumers, and decomposers.

These components interact with each other in an ecosystem and thus, this interaction among them makes it self-sustainable.

Structural Features of the Forest Ecosystem

The two main structural features of a forest ecosystem are:

1. **Species composition:** It refers to the identification and enumeration of the plant and animal species of a forest ecosystem.
2. **Stratification:** It refers to the vertical distribution of different species which occupy different levels in the forest ecosystem. Every organism occupies a place in an ecosystem on the basis of source of nutrition. For example, in a forest ecosystem, trees occupy the top level, shrubs occupy the second and the herbs and grasses occupy the bottom level.

Components of a Forest Ecosystem

The components of a forest ecosystem are as follows:

1. Productivity

The basic requirement for any ecosystem to function and sustain is the constant input of solar energy. Plants are also the producers in a forest ecosystem.

There are two types of productivity in a forest ecosystem, primary and secondary. Primary productivity means the rate of capture of solar energy or biomass production per unit area over a period of time by the plants during photosynthesis.

It is further divided into Gross Primary Productivity (GPP) and Net Primary Productivity (NPP). GPP of an ecosystem is the rate of capture of solar energy or the total production of biomass. However, plants also use a significant amount of GPP in respiration.

Thus, NPP is the amount of biomass left after the utilization by plants or the producers. We can hence say that NPP is the amount which is available for the consumption to herbivores and decomposers. Secondary productivity means the rate of absorption of food energy by the consumers.

2. Decomposition

Decomposition is an extremely oxygen-requiring process. In the process of decomposition, decomposers convert the complex organic compounds of detritus into inorganic substances such as carbon dioxide, water and nutrients.

Detritus is the remains of the dead plant such as leaves, bark, flowers and also the dead remains of the animals including their faecal matter. The steps involved in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralization.

In the process of fragmentation, detritivores break down the detritus into smaller particles. In the process of leaching, water-soluble inorganic nutrients descend down into the soil and settle as unavailable salts.

Under the process of catabolism, bacterial and fungal enzymes reduce detritus into simpler inorganic substances. Humification and mineralization processes take place during the decomposition of soil and not detritus.

The process of humification leads to the accumulation of humus which undergoes decomposition at a very slow rate. In the process of mineralization, the humus gets further degraded by microbes and inorganic nutrients are released.

3. Energy flow

Energy flows in a single direction. Firstly, plants capture solar energy and then, transfer the food to decomposers. Organisms of different trophic levels are connected to each other for food or energy relationship and thus form a food chain.

Energy Pyramid is always upright because energy flows from one trophic level to the next trophic level and in this process, some energy is always lost as heat at each step.

4. Nutrient Cycling

Nutrient cycling refers to the storage and movement of nutrient elements through the various components of the ecosystem. There are two types of Nutrient cycling, gaseous and sedimentary.

For Gaseous cycle (i.e. nitrogen, carbon), atmosphere or hydrosphere is the reservoir whereas for the sedimentary cycle (i.e. phosphorus) Earth's crust is the reservoir.

Characteristics of Forest Ecosystem

A forest ecosystem is quite diverse in characteristics. Some of these characteristics may sound very interesting to you. Here are some of the major characteristics of a forest ecosystem –

Seasonal variation

The forest ecosystem of a particular region depends on the seasonal variation of the country in which the forest falls. For example- tropical rainforests receive heavy rainfall every year, whereas temperate forests experience four seasonal variations.

Deciduous or evergreen in nature

A forest ecosystem may be deciduous or evergreen, or it may be a mix of both. The trees of a deciduous forest shed the leaves during the winter season, whereas evergreen trees always remain green.

Canopy layer structure

The canopy layer is one of the most distinguishing characteristics of a forest ecosystem. The dense canopy layers act as a barrier against wind, rain, snow, etc. to protect various species.

Some forest ecosystems, such as rainforests, are characterized by distinct layers of the canopy like treetops, upper canopy layer, lower canopy layer, and forest floor.

Attract bird species to take shelter

The forest ecosystem provides the most favorable conditions to various species of birds. As a result, these species get attracted by the forest ecosystem and take shelter on trees.

Attract insects & provide habitat

The forest ecosystem is home to a huge variety of insects. These insects found thousands of options as their shelter in the forest ecosystem. Hence, these insects get attracted to the natural habitats provided by the forest ecosystem.

Soil fertility

The soil of forest ecosystems varies in terms of fertility. For example- the soil of temperate and tropical deciduous forests is very fertile enriched with nutrients.

On the other hand, the soil of boreal forests is mostly acidic due to the falling of conifer needles on the forest floor. In the case of tropical rainforests, the soil is impoverished in terms of fertility due to continuous leaching on nutrients caused by heavy rainfall.

Forests are the natural treasure of mother Earth was given to us. Unfortunately, the forests around the world are getting destroyed mainly due to pollution & deforestation to fulfill our needs. It is high time to recall the importance of forest ecosystems towards the environment. Also remember, how you can help to protect the forest ecosystem to save millions of plant and animal species.

Types of Forest Ecosystem

Forest ecosystem has been classified into three major types – tropical forest ecosystem, temperate forest ecosystem and boreal ecosystem. We will also understand savanna ecosystem. The types of forest ecosystems have been divided based on latitude and different characteristics. The different types of forest ecosystems are as follows –

Tropical Forest Ecosystem

- Tropical forests, also known as tropical rainforest, receives almost 100 inches of rain every year. The tropical forest has a wide variety of species among all other types of forest ecosystems.
- Tropical forests are usually found in latitude between 23.5 degrees North and 23.5 degrees South. The temperature recorded in tropical forests is between 68 degrees and 77 degrees Fahrenheit.
- Heavy rainfall in the tropical forest leads to poor quality of soil due to a lack of nutrients. High-level rainfall throughout the year causes leaching of soil nutrients.
- The vegetation of the tropical rainforest mostly includes broad-leafed trees that are very tall about 82-115 feet height. Due to dense canopy, the sun finds it quite tough to reach the forest floor.
- The tropical forest is a home for millions of animals that includes a massive variety of birds, mammals, amphibians, reptiles, etc. Here you can find almost half the species of animals that lived on Earth.
 - The tropical forest ecosystem is again divided into different categories and types. These are –
 - ***Evergreen forest***
 - The evergreen forest receives heavy year-round rainfall with no dry season.
 - ***Seasonal forest***
 - Seasonal forest host evergreen flora with a short-time dry season.
 - The tropical forest ecosystem is again divided into different categories and types. These are –

- ***Evergreen forest***
- The evergreen forest receives heavy year-round rainfall with no dry season.
- ***Seasonal forest***
- Seasonal forest host evergreen flora with a short-time dry season.

Temperate Forest Ecosystem

Temperate forests are usually found in North America, Eurasia, Japan, etc. Temperate forest receives less rainfall as compared to tropical forests approximately 30-60 inches every year.

Unlike tropical forests, temperate forests experience all the four seasons with variation in temperature. The winters in the temperate forest quite often experience temperature below freezing point, and in summers, the temperature becomes very high with a high level of humidity.

The soil of temperate forest is rich in organic matter that allows a huge variety of vegetation to grow in the temperate forest.

The temperate forest provides natural habitat to many animals such as squirrels, deer, black bears, raccoons, coyotes, various birds like warblers, owls, woodpeckers, hawks, etc.

The temperate forest ecosystem is further divided into two parts – Temperate Deciduous Forest and Temperate Coniferous Forest.

Temperate Deciduous Forest

Temperate Deciduous forests experience four specific seasons. It receives annual rainfall between 30-60 inches. In winter, the temperate deciduous forest experience snowfall.

The soil of this forest is quite fertile. As a result, you will find a wide variety of vegetation in the temperate deciduous forest, such as ferns, wildflowers, mosses, oak, birch, maple, etc.

As far as the animal of temperate deciduous forests is concerned, you can find various animal species like the red fox, woodpecker, cardinals, hawks, etc.

Temperate Coniferous Forest

The temperate coniferous forest ecosystem is usually found in coastal areas. Coniferous forests receive heavy rainfall throughout the year, approximately 50-200 inches. The floor of coniferous forests is mostly covered with a thick layer of decomposed matter. Temperate coniferous forest is covered with evergreen tall conifers. The most common plant species found in coniferous forests include cedar, Douglas fir, spruce, maple, cypress, pine, redwood, ferns, mosses, etc.

The typical animal species found in this forest include deer, black bear, marbled murrelet, elk, marmot, spotted owl, etc.

Boreal Forest Ecosystem

The boreal forest is also known as Taiga forests are generally found in Siberia, Northern Asia, Canada, and Scandinavia. One of the main characteristics of the boreal forest is that it experiences short summers and very long winter seasons. Boreal forests receive approximately 15-40 inches precipitation every year (mostly receives in the form of snowfall). The trees found in boreal forests are the evergreen type, such as pine, fir, spruce, etc. The boreal forest has a dense canopy that hardly allows the sun to reach the forest surface. This is why the vegetation is quite less in the forest floor.

The animals found in the boreal forest ecosystem are usually covered with thick fur to protect them from a long period of cold winters. Some examples of animals that lived in boreal forests are – elk, caribou, lynxes, wolverines, deer, snowshoe hare, moose, wolves, etc.

Savanna Forest Ecosystem

Savanna ecosystem is generally found in South America, Australia, and Africa. Savanna forests are quite vulnerable to forest fires; on the other hand, it has characterized by the ability to re-grow much faster.

The landscapes of the Savanna forest ecosystem are covered with large areas of green lands, bushes & clusters of feeble trees.

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Q. 3 What is meant by environmental quality? Identify factors causing degradation of environmental quality

"Environmental Quality" is a set of properties and characteristics of the environment, either generalized or local, as they impinge on human beings and other organisms. It is a measure of the condition of an environment relative to the requirements of one or more species, any human need or purpose.

Environmental quality includes the natural environment as well as the built environment, such as air, water purity or pollution, noise and the potential effects which such characteristics may have on physical and mental health.

United States

In the United States, the term is applied with a body of federal and state standards and regulations that are monitored by regulatory agencies. All states in the U.S. have some form of a department or commission that is responsible for a variety of activities such as monitoring quality, responding to citizen complaints, and enforcing environmental regulations. The agency with the lead implementation responsibility for most major federal environmental laws (e.g. Clean Air Act, Clean Water Act) is the US Environmental Protection Agency (EPA). Other federal agencies with significant oversight roles include the Council on Environmental Quality, Department of the Interior and the Army Corps of Engineers.

United Kingdom

In the United Kingdom, the environment has been the primary responsibility of the Department for Environment, Food and Rural Affairs (DEFRA). Predecessor bodies were merged in 2001 to create this department with a broader remit to link rural activities to the natural environment. Some responsibilities are devolved to the Scottish Government and are exercised by the Scottish

Environment Protection Agency (SEPA) and the National Assembly for Wales, while delivery of environmental initiatives often use partners, including: British Waterways, Environment Agency, Forestry Commission, and Natural England. DEFRA also has a remit to oversee impacts of activities within the built environment and the United Kingdom Climate Change Programme.

factors causing degradation of environmental quality.

Environmental degradation is the disintegration of the earth or deterioration of the environment through the consumption of assets, for example, air, water and soil; the destruction of environments and the eradication of wildlife. It is characterized as any change or aggravation to nature's turf seen to be pernicious or undesirable.

Ecological effect or degradation is created by the consolidation of an effectively substantial and expanding human populace, constantly expanding monetary development or per capita fortune and the application of asset exhausting and polluting technology.

“Environmental degradation is the deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems; habitat destruction; the extinction of wildlife; and pollution. It is defined as any change or disturbance to the environment perceived to be deleterious or undesirable.”

Causes of Environmental Degradation

Some environmental life species require substantial areas to help provide food, living space, and other different assets. These creatures are called area specific.

At the point when the biome is divided, the vast patches of living space don't exist anymore. It becomes more troublesome for the wildlife to get the assets they need in order to survive. The environment goes on, even though the animals and plant life are not there to help sustain it properly.

1. Land Disturbance

A more basic cause of environmental degradation is land damage. Numerous weedy plant species, for example, garlic & mustard, are both foreign and obtrusive.

A rupture in the environmental surroundings provides for them a chance to start growing and spreading. These plants can assume control over nature, eliminating the local greenery.

The result is a territory with a solitary predominant plant which doesn't give satisfactory food assets to all the environmental life. Thus the whole environment can be destroyed because of these invasive species.

2. Pollution

Pollution, in whatever form, whether it is air, water, land or noise is harmful to the environment. Air pollution pollutes the air that we breathe, which causes health issues.

Water pollution degrades the quality of water that we use for drinking purposes. Land pollution results in the degradation of the earth's surface as a result of human activities.

Noise pollution can cause irreparable damage to our ears when exposed to continuous large sounds like honking of vehicles on a busy road or machines producing large noise in a factory or a mill.

3. Overpopulation

Rapid population growth puts strain on natural resources, which results in the degradation of our environment. Mortality rate has gone down due to better medical facilities, which has resulted in an increased lifespan.

More population simply means more demand for food, clothes and shelter. You need more space to grow food and provide homes to millions of people. This results in deforestation, which is another factor in environmental degradation.

4. Landfills

Landfills pollute the environment and destroy the beauty of the city. Landfills come within the city due to the large amount of waste that gets generated by households, industries, factories and hospitals.

Landfills pose a great risk to the health of the environment and the people who live there. Landfills produce a foul smell when burned and cause substantial environmental degradation.

5. Deforestation

Deforestation is the cutting down of trees to make way for more homes and industries. Rapid growth in population and urban sprawl are two of the major causes of deforestation.

Apart from that, the use of forest land for agriculture, animal grazing, harvest for fuelwood and logging are some of the other causes of deforestation. Deforestation contributes to global warming as decreased forest size puts carbon back into the environment.

6. Natural Causes

Things like avalanches, quakes, tidal waves, storms, and wildfires can totally crush nearby animal and plant groups to the point where they can no longer survive in those areas.

This can either come to fruition through physical demolition as the result of a specific disaster or by the long term degradation of assets by the presentation of an obtrusive foreign species to the environment. The latter frequently happens after tidal waves, when reptiles and bugs are washed ashore.

Of course, humans aren't totally to blame for this whole thing. Earth itself causes ecological issues, as well. While environmental degradation is most normally connected with the things that people do, the truth of the matter is that the environment is always changing. With or without the effect of human exercises, a few biological systems degrade to the point where they can't help the life that is supposed to live there.

Reference:

https://en.wikipedia.org/wiki/Environmental_quality

<https://www.conserve-energy-future.com/causes-and-effects-of-environmental-degradation.php>

Q. 4 Describe structure and functions of parts of brain

Brain

The brain is composed of the cerebrum, cerebellum, and brainstem

Cerebrum: is the largest part of the brain and is composed of right and left hemispheres. It performs higher functions like interpreting touch, vision and hearing, as well as speech, reasoning, emotions, learning, and fine control of movement.

Cerebellum: is located under the cerebrum. Its function is to coordinate muscle movements, maintain posture, and balance.

Brainstem: acts as a relay center connecting the cerebrum and cerebellum to the spinal cord. It performs many automatic functions such as breathing, heart rate, body temperature, wake and sleep cycles, digestion, sneezing, coughing, vomiting, and swallowing.

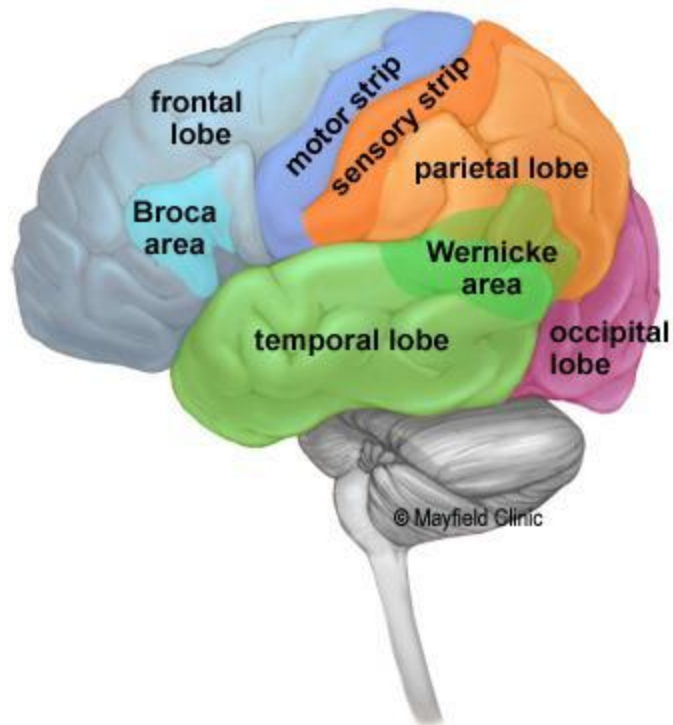
Right brain – left brain

The cerebrum is divided into two halves: the right and left hemispheres (Fig. 2) They are joined by a bundle of fibers called the corpus callosum that transmits messages from one side to the other. Each hemisphere controls the opposite side of the body. If a stroke occurs on the right side of the brain, your left arm or leg may be weak or paralyzed.

Not all functions of the hemispheres are shared. In general, the left hemisphere controls speech, comprehension, arithmetic, and writing. The right hemisphere controls creativity, spatial ability, artistic, and musical skills. The left hemisphere is dominant in hand use and language in about 92% of people.

Lobes of the brain

The cerebral hemispheres have distinct fissures, which divide the brain into lobes. Each hemisphere has 4 lobes: frontal, temporal, parietal, and occipital (Fig. 3). Each lobe may be divided, once again, into areas that serve very specific functions. It's important to understand that each lobe of the brain does not function alone. There are very complex relationships between the lobes of the brain and between the right and left hemispheres.



Frontal lobe

- Personality, behavior, emotions
- Judgment, planning, problem solving
- Speech: speaking and writing (Broca's area)
- Body movement (motor strip)
- Intelligence, concentration, self awareness

Parietal lobe

- Interprets language, words
- Sense of touch, pain, temperature (sensory strip)
- Interprets signals from vision, hearing, motor, sensory and memory
- Spatial and visual perception

Occipital lobe

- Interprets vision (color, light, movement)

Temporal lobe

- Understanding language (Wernicke's area)
- Memory
- Hearing
- Sequencing and organization

Language

In general, the left hemisphere of the brain is responsible for language and speech and is called the "dominant" hemisphere. The right hemisphere plays a large part in interpreting visual information and spatial processing. In about one third of people who are left-handed, speech function may be located on the right side of the brain. Left-handed people may need special testing to determine if their speech center is on the left or right side prior to any surgery in that area.

Aphasia is a disturbance of language affecting speech production, comprehension, reading or writing, due to brain injury – most commonly from stroke or trauma. The type of aphasia depends on the brain area damaged.

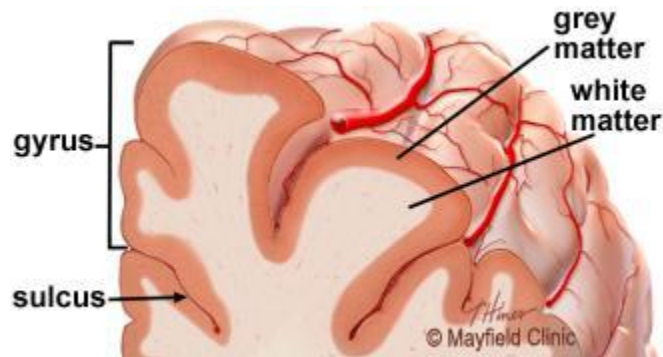
Broca's area: lies in the left frontal lobe . If this area is damaged, one may have difficulty moving the tongue or facial muscles to produce the sounds of speech. The person can still read and understand spoken language but has difficulty in speaking and writing (i.e. forming letters and words, doesn't write within lines) – called Broca's aphasia.

Wernicke's area: lies in the left temporal lobe Damage to this area causes Wernicke's aphasia. The individual may speak in long sentences that have no meaning, add unnecessary words, and even create new words. They can make speech sounds, however they have difficulty understanding speech and are therefore unaware of their mistakes.

Cortex

The surface of the cerebrum is called the cortex. It has a folded appearance with hills and valleys. The cortex contains 16 billion neurons (the cerebellum has 70 billion = 86 billion total) that are arranged in specific layers. The nerve cell bodies color the cortex grey-brown giving it

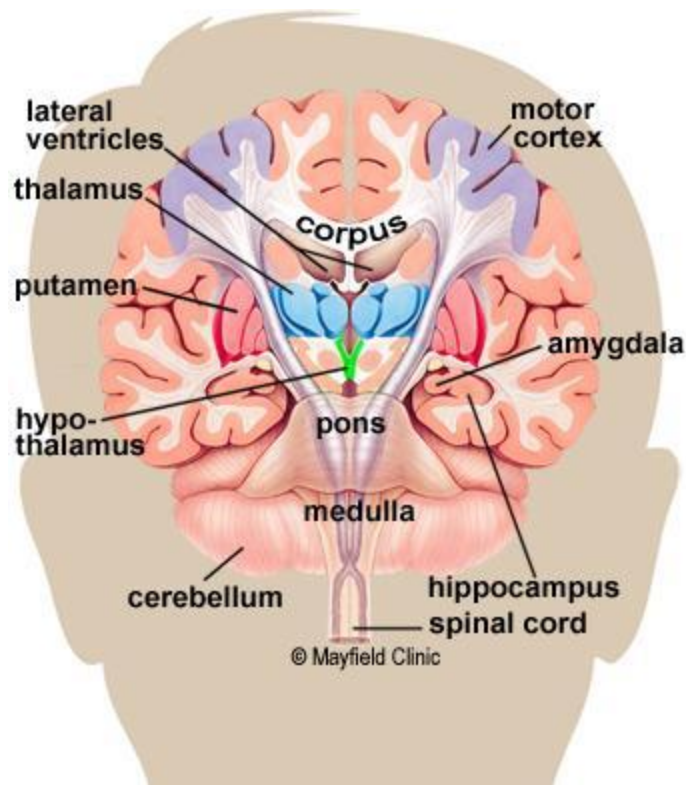
its name – gray matter Beneath the cortex are long nerve fibers (axons) that connect brain areas to each other — called white matter.



The folding of the cortex increases the brain's surface area allowing more neurons to fit inside the skull and enabling higher functions. Each fold is called a gyrus, and each groove between folds is called a sulcus. There are names for the folds and grooves that help define specific brain regions.

Deep structures

Pathways called white matter tracts connect areas of the cortex to each other. Messages can travel from one gyrus to another, from one lobe to another, from one side of the brain to the other, and to structures deep in the brain



Hypothalamus: is located in the floor of the third ventricle and is the master control of the autonomic system. It plays a role in controlling behaviors such as hunger, thirst, sleep, and sexual response. It also regulates body temperature, blood pressure, emotions, and secretion of hormones.

Pituitary gland: lies in a small pocket of bone at the skull base called the sella turcica. The pituitary gland is connected to the hypothalamus of the brain by the pituitary stalk. Known as the “master gland,” it controls other endocrine glands in the body. It secretes hormones that control sexual development, promote bone and muscle growth, and respond to stress.

Pineal gland: is located behind the third ventricle. It helps regulate the body’s internal clock and circadian rhythms by secreting melatonin. It has some role in sexual development.

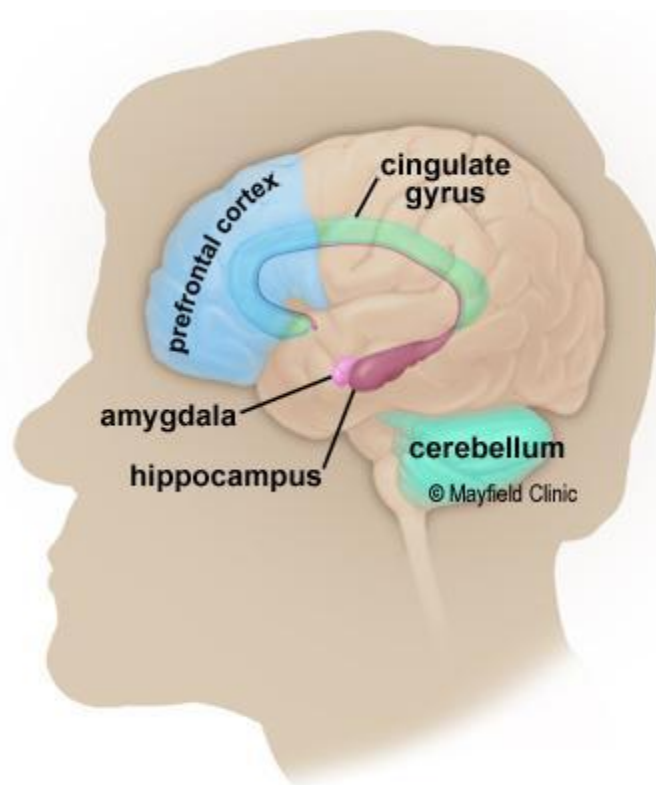
Thalamus: serves as a relay station for almost all information that comes and goes to the cortex. It plays a role in pain sensation, attention, alertness and memory.

Basal ganglia: includes the caudate, putamen and globus pallidus. These nuclei work with the cerebellum to coordinate fine motions, such as fingertip movements.

Limbic system: is the center of our emotions, learning, and memory. Included in this system are the cingulate gyri, hypothalamus, amygdala (emotional reactions) and hippocampus (memory).

Memory

Memory is a complex process that includes three phases: encoding (deciding what information is important), storing, and recalling. Different areas of the brain are involved in different types of memory. Your brain has to pay attention and rehearse in order for an event to move from short-term to long-term memory – called encoding.



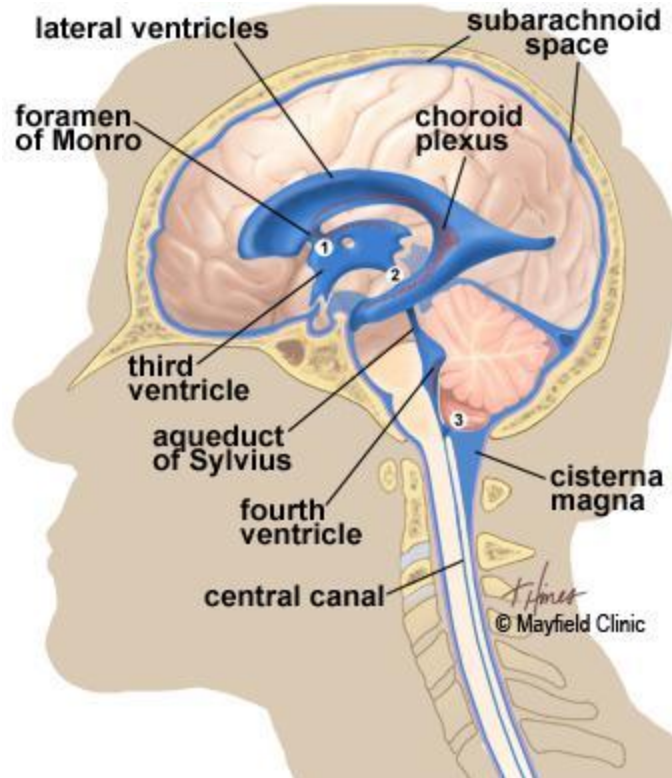
- Short-term memory, also called working memory, occurs in the prefrontal cortex. It stores information for about one minute and its capacity is limited to about 7 items. For example, it enables you to dial a phone number someone just told you. It also intervenes

during reading, to memorize the sentence you have just read, so that the next one makes sense.

- Long-term memory is processed in the hippocampus of the temporal lobe and is activated when you want to memorize something for a longer time. This memory has unlimited content and duration capacity. It contains personal memories as well as facts and figures.
- Skill memory is processed in the cerebellum, which relays information to the basal ganglia. It stores automatic learned memories like tying a shoe, playing an instrument, or riding a bike.

Ventricles and cerebrospinal fluid

The brain has hollow fluid-filled cavities called ventricles (Fig. 7). Inside the ventricles is a ribbon-like structure called the choroid plexus that makes clear colorless cerebrospinal fluid (CSF). CSF flows within and around the brain and spinal cord to help cushion it from injury. This circulating fluid is constantly being absorbed and replenished.



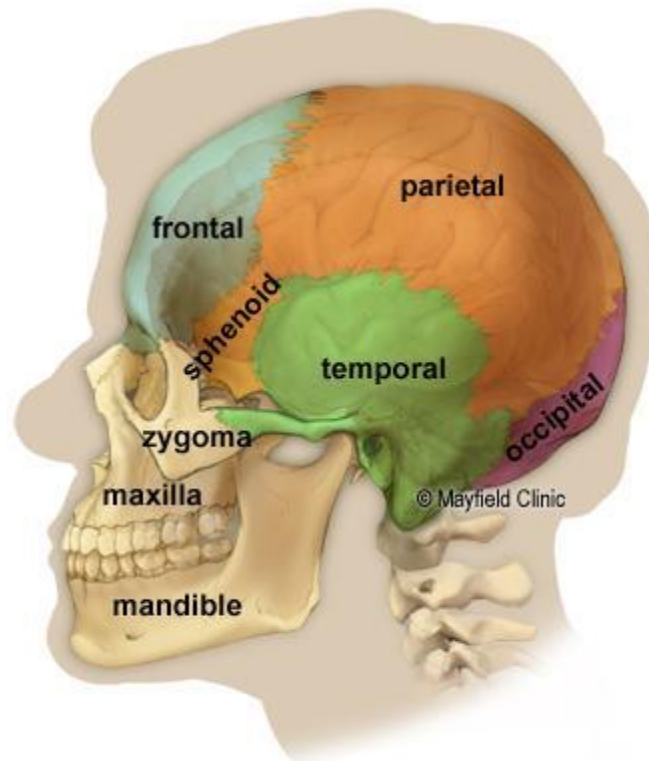
There are two ventricles deep within the cerebral hemispheres called the lateral ventricles. They both connect with the third ventricle through a separate opening called the foramen of Monro. The third ventricle connects with the fourth ventricle through a long narrow tube called the aqueduct of Sylvius. From the fourth ventricle, CSF flows into the subarachnoid space where it bathes and cushions the brain. CSF is recycled (or absorbed) by special structures in the superior sagittal sinus called arachnoid villi.

A balance is maintained between the amount of CSF that is absorbed and the amount that is produced. A disruption or blockage in the system can cause a build up of CSF, which can cause enlargement of the ventricles (hydrocephalus) or cause a collection of fluid in the spinal cord (syringomyelia).

Skull

The purpose of the bony skull is to protect the brain from injury. The skull is formed from 8 bones that fuse together along suture lines. These bones include the frontal, parietal (2), temporal

(2), sphenoid, occipital and ethmoid. The face is formed from 14 paired bones including the maxilla, zygoma, nasal, palatine, lacrimal, inferior nasal conchae, mandible, and vomer.



Inside the skull are three distinct areas: anterior fossa, middle fossa, and posterior fossa. Doctors sometimes refer to a tumor's location by these terms, e.g., middle fossa meningioma.

Reference:

<http://www.mayfieldclinic.com/pe-anatbrain.htm#:~:text=The%20brain%20has%20three%20main,the%20cerebrum%2C%20cerebellum%20and%20brainstem.&text=Cerebellum%3A%20is%20located%20under%20the,cerebellum%20to%20the%20spinal%20cord.>

Q. 5 Define biotechnology. Explain its use in different fields.

Biotechnology, the use of biology to solve problems and make useful products. The most prominent area of biotechnology is the production of therapeutic proteins and other drugs through genetic engineering.

People have been harnessing biological processes to improve their quality of life for some 10,000 years, beginning with the first agricultural communities. Approximately 6,000 years ago, humans began to tap the biological processes of microorganisms in order to make bread, alcoholic beverages, and cheese and to preserve dairy products. But such processes are not what is meant today by *biotechnology*, a term first widely applied to the molecular and cellular technologies that began to emerge in the 1960s and '70s. A fledgling “biotech” industry began to coalesce in the mid- to late 1970s, led by Genentech, a pharmaceutical company established in 1976 by Robert A. Swanson and Herbert W. Boyer to commercialize the recombinant DNA technology pioneered by Boyer, Paul Berg, and Stanley N. Cohen. Early companies such as Genentech, Amgen, Biogen, Cetus, and Genex began by manufacturing genetically engineered substances primarily for medical and environmental uses.

For more than a decade, the biotechnology industry was dominated by recombinant DNA technology, or genetic engineering. This technique consists of splicing the gene for a useful protein (often a human protein) into production cells—such as yeast, bacteria, or mammalian cells in culture—which then begin to produce the protein in volume. In the process of splicing a gene into a production cell, a new organism is created. At first, biotechnology investors and researchers were uncertain about whether the courts would permit them to acquire patents on organisms; after all, patents were not allowed on new organisms that happened to be discovered and identified in nature. But, in 1980, the U.S. Supreme Court, in the case of *Diamond v. Chakrabarty*, resolved the matter by ruling that “a live human-made microorganism is patentable subject matter.” This decision spawned a wave of new biotechnology firms and the infant industry’s first investment boom. In 1982 recombinant insulin became the first product made through genetic engineering to secure approval from the U.S. Food and Drug Administration (FDA). Since then, dozens of genetically engineered protein medications have been commercialized around the world, including recombinant versions of growth hormone, clotting factors, proteins for stimulating the production of red and white blood cells, interferons, and clot-dissolving agents.

In the early years, the main achievement of biotechnology was the ability to produce naturally occurring therapeutic molecules in larger quantities than could be derived from conventional sources such as plasma, animal organs, and human cadavers. Recombinant proteins are also less likely to be contaminated with pathogens or to provoke allergic reactions. Today, biotechnology researchers seek to discover the root molecular causes of disease and to intervene precisely at that level. Sometimes this means producing therapeutic proteins that augment the body's own supplies or that make up for genetic deficiencies, as in the first generation of biotech medications. (Gene therapy—insertion of genes encoding a needed protein into a patient's body or cells—is a related approach.) But the biotechnology industry has also expanded its research into the development of traditional pharmaceuticals and monoclonal antibodies that stop the progress of a disease. Such steps are uncovered through painstaking study of genes (genomics), the proteins that they encode (proteomics), and the larger biological pathways in which they act.

In addition to the tools mentioned above, biotechnology also involves merging biological information with computer technology (bioinformatics), exploring the use of microscopic equipment that can enter the human body (nanotechnology), and possibly applying techniques of stem cell research and cloning to replace dead or defective cells and tissues (regenerative medicine). Companies and academic laboratories integrate these disparate technologies in an effort to analyze downward into molecules and also to synthesize upward from molecular biology toward chemical pathways, tissues, and organs.

In addition to being used in health care, biotechnology has proved helpful in refining industrial processes through the discovery and production of biological enzymes that spark chemical reactions (catalysts); for environmental cleanup, with enzymes that digest contaminants into harmless chemicals and then die after consuming the available "food supply"; and in agricultural production through genetic engineering.

Agricultural applications of biotechnology have proved the most controversial. Some activists and consumer groups have called for bans on genetically modified organisms (GMOs) or for labeling laws to inform consumers of the growing presence of GMOs in the food supply. In the United States, the introduction of GMOs into agriculture began in 1993, when the FDA approved bovine somatotropin (BST), a growth hormone that boosts milk production in dairy cows. The

next year, the FDA approved the first genetically modified whole food, a tomato engineered for a longer shelf life. Since then, regulatory approval in the United States, Europe, and elsewhere has been won by dozens of agricultural GMOs, including crops that produce their own pesticides and crops that survive the application of specific herbicides used to kill weeds. Studies by the United Nations, the U.S. National Academy of Sciences, the European Union, the American Medical Association, U.S. regulatory agencies, and other organizations have found GMO foods to be safe, but skeptics contend that it is still too early to judge the long-term health and ecological effects of such crops. In the late 20th and early 21st centuries, the land area planted in genetically modified crops increased dramatically, from 1.7 million hectares (4.2 million acres) in 1996 to 160 million hectares (395 million acres) by 2011.

Overall, the revenues of U.S. and European biotechnology industries roughly doubled over the five-year period from 1996 through 2000. Rapid growth continued into the 21st century, fueled by the introduction of new products, particularly in health care.

Uses of biotechnology in different fields:

Biotechnology has applications in four major industrial areas, including health care (medical), crop production and agriculture, non-food (industrial) uses of crops and other products (e.g. biodegradable plastics, vegetable oil, biofuels), and environmental uses.

For example, one application of biotechnology is the directed use of microorganisms for the manufacture of organic products (examples include beer and milk products). Another example is using naturally present bacteria by the mining industry in bioleaching. Biotechnology is also used to recycle, treat waste, clean up sites contaminated by industrial activities (bioremediation), and also to produce biological weapons.

A series of derived terms have been coined to identify several branches of biotechnology, for example:

- Bioinformatics (also called "gold biotechnology") is an interdisciplinary field that addresses biological problems using computational techniques, and makes the rapid organization as well as analysis of biological data possible. The field may also be referred to as *computational biology*, and can be defined as, "conceptualizing biology in terms of molecules and then applying informatics techniques to understand and organize the information associated with these molecules, on a large scale." Bioinformatics plays a key role in various areas, such as functional genomics, structural genomics, and proteomics, and forms a key component in the biotechnology and pharmaceutical sector.
- Blue biotechnology is based on the exploitation of sea resources to create products and industrial applications. This branch of biotechnology is the most used for the industries of refining and combustion principally on the production of bio-oils with photosynthetic micro-algae.
- Green biotechnology is biotechnology applied to agricultural processes. An example would be the selection and domestication of plants via micropropagation. Another example is the designing of transgenic plants to grow under specific environments in the presence (or absence) of chemicals. One hope is that green biotechnology might produce more environmentally friendly solutions than traditional industrial agriculture. An example of this is the engineering of a plant to express a pesticide, thereby ending the need of external application of pesticides. An example of this would be Bt corn. Whether or not green biotechnology products such as this are ultimately more environmentally friendly is a topic of considerable debate. It is commonly considered as the next phase of green revolution, which can be seen as a platform to eradicate world hunger by using technologies which enable the production of more fertile and resistant, towards biotic and abiotic stress, plants and ensures application of environmentally friendly fertilizers and the use of biopesticides,

it is mainly focused on the development of agriculture. On the other hand, some of the uses of green biotechnology involve microorganisms to clean and reduce waste.

- Red biotechnology is the use of biotechnology in the medical and pharmaceutical industries, and health preservation. This branch involves the production of vaccines and antibiotics, regenerative therapies, creation of artificial organs and new diagnostics of diseases. As well as the development of hormones, stem cells, antibodies, siRNA and diagnostic tests.
- White biotechnology, also known as industrial biotechnology, is biotechnology applied to industrial processes. An example is the designing of an organism to produce a useful chemical. Another example is the using of enzymes as industrial catalysts to either produce valuable chemicals or destroy hazardous/polluting chemicals. White biotechnology tends to consume less in resources than traditional processes used to produce industrial goods.
- "Yellow biotechnology" refers to the use of biotechnology in food production, for example in making wine (winemaking), cheese (cheesemaking), and beer (brewing) by fermentation. It has also been used to refer to biotechnology applied to insects. This includes biotechnology-based approaches for the control of harmful insects, the characterisation and utilisation of active ingredients or genes of insects for research, or application in agriculture and medicine and various other approaches.

- Gray biotechnology is dedicated to environmental applications, and focused on the maintenance of biodiversity and the removal of pollutants.
- Brown biotechnology is related to the management of arid lands and deserts. One application is the creation of enhanced seeds that resist extreme environmental conditions of arid regions, which is related to the innovation, creation of agriculture techniques and management of resources
- Violet biotechnology is related to law, ethical and philosophical issues around biotechnology.
- Dark biotechnology is the color associated with bioterrorism or biological weapons and biowarfare which uses microorganisms, and toxins to cause diseases and death in humans, livestock and crops.

Medicine

In medicine, modern biotechnology has many applications in areas such as pharmaceutical drug discoveries and production, pharmacogenomics, and genetic testing (or genetic screening).

Pharmacogenomics (a combination of pharmacology and genomics) is the technology that analyses how genetic makeup affects an individual's response to drugs. Researchers in the field investigate the influence of genetic variation on drug responses in patients by correlating gene expression or single-nucleotide polymorphisms with a drug's efficacy or toxicity. The purpose of pharmacogenomics is to develop rational means to optimize drug therapy, with respect to the

patients' genotype, to ensure maximum efficacy with minimal adverse effects. Such approaches promise the advent of "personalized medicine"; in which drugs and drug combinations are optimized for each individual's unique genetic makeup.

Biotechnology has contributed to the discovery and manufacturing of traditional small molecule pharmaceutical drugs as well as drugs that are the product of biotechnology – biopharmaceutics. Modern biotechnology can be used to manufacture existing medicines relatively easily and cheaply. The first genetically engineered products were medicines designed to treat human diseases. To cite one example, in 1978 Genentech developed synthetic humanized insulin by joining its gene with a plasmid vector inserted into the bacterium *Escherichia coli*. Insulin, widely used for the treatment of diabetes, was previously extracted from the pancreas of abattoir animals (cattle or pigs). The genetically engineered bacteria are able to produce large quantities of synthetic human insulin at relatively low cost. Biotechnology has also enabled emerging therapeutics like gene therapy. The application of biotechnology to basic science (for example through the Human Genome Project) has also dramatically improved our understanding of biology and as our scientific knowledge of normal and disease biology has increased, our ability to develop new medicines to treat previously untreatable diseases has increased as well.

Genetic testing allows the genetic diagnosis of vulnerabilities to inherited diseases, and can also be used to determine a child's parentage (genetic mother and father) or in general a person's ancestry. In addition to studying chromosomes to the level of individual genes, genetic testing in a broader sense includes biochemical tests for the possible presence of genetic diseases, or mutant forms of genes associated with increased risk of developing genetic disorders. Genetic testing identifies changes in chromosomes, genes, or proteins. Most of the time, testing is used to find changes that are associated with inherited disorders. The results of a genetic test can confirm or rule out a suspected genetic condition or help determine a person's chance of developing or passing on a genetic disorder. As of 2011 several hundred genetic tests were in use. Since genetic testing may open up ethical or psychological problems, genetic testing is often accompanied by genetic counseling.

Agriculture

Genetically modified crops ("GM crops", or "biotech crops") are plants used in agriculture, the DNA of which has been modified with genetic engineering techniques. In most cases, the main aim is to introduce a new trait that does not occur naturally in the species. Biotechnology firms can contribute to future food security by improving the nutrition and viability of urban agriculture. Furthermore, the protection of intellectual property rights encourages private sector investment in agrobiotechnology.

Examples in food crops include resistance to certain pests, diseases, stressful environmental conditions, resistance to chemical treatments (e.g. resistance to a herbicide), reduction of spoilage, or improving the nutrient profile of the crop. Examples in non-food crops include production of pharmaceutical agents, biofuels and other industrially useful goods, as well as for bioremediation.

Farmers have widely adopted GM technology. Between 1996 and 2011, the total surface area of land cultivated with GM crops had increased by a factor of 94, from 17,000 square kilometers (4,200,000 acres) to 1,600,000 km² (395 million acres). 10% of the world's crop lands were planted with GM crops in 2010. As of 2011, 11 different transgenic crops were grown commercially on 395 million acres (160 million hectares) in 29 countries such as the US, Brazil, Argentina, India, Canada, China, Paraguay, Pakistan, South Africa, Uruguay, Bolivia, Australia, Philippines, Myanmar, Burkina Faso, Mexico and Spain.

Genetically modified foods are foods produced from organisms that have had specific changes introduced into their DNA with the methods of genetic engineering. These techniques have allowed for the introduction of new crop traits as well as a far greater control over a food's genetic structure than previously afforded by methods such as selective breeding and mutation breeding. Commercial sale of genetically modified foods began in 1994, when Calgene first marketed its Flavr Savr delayed ripening tomato. To date most genetic modification of foods

have primarily focused on cash crops in high demand by farmers such as soybean, corn, canola, and cotton seed oil. These have been engineered for resistance to pathogens and herbicides and better nutrient profiles. GM livestock have also been experimentally developed; in November 2013 none were available on the market, but in 2015 the FDA approved the first GM salmon for commercial production and consumption.

There is a scientific consensus that currently available food derived from GM crops poses no greater risk to human health than conventional food, but that each GM food needs to be tested on a case-by-case basis before introduction. Nonetheless, members of the public are much less likely than scientists to perceive GM foods as safe. The legal and regulatory status of GM foods varies by country, with some nations banning or restricting them, and others permitting them with widely differing degrees of regulation. GM crops also provide a number of ecological benefits, if not used in excess. However, opponents have objected to GM crops per se on several grounds, including environmental concerns, whether food produced from GM crops is safe, whether GM crops are needed to address the world's food needs, and economic concerns raised by the fact these organisms are subject to intellectual property law.

Industrial

Industrial biotechnology (known mainly in Europe as white biotechnology) is the application of biotechnology for industrial purposes, including industrial fermentation. It includes the practice of using cells such as microorganisms, or components of cells like enzymes, to generate industrially useful products in sectors such as chemicals, food and feed, detergents, paper and pulp, textiles and biofuels. In the current decades, significant progress has been done in creating genetically modified organisms (GMOs) that enhance the diversity of applications and economical viability of industrial biotechnology. By using renewable raw materials to produce a variety of chemicals and fuels, industrial biotechnology is actively advancing towards lowering greenhouse gas emissions and moving away from a petrochemical-based economy.

Environmental

The environment can be affected by biotechnologies, both positively and adversely. Vallero and others have argued that the difference between beneficial biotechnology (e.g. bioremediation is to clean up an oil spill or hazard chemical leak) versus the adverse effects stemming from biotechnological enterprises (e.g. flow of genetic material from transgenic organisms into wild strains) can be seen as applications and implications, respectively. Cleaning up environmental wastes is an example of an application of environmental biotechnology; whereas loss of biodiversity or loss of containment of a harmful microbe are examples of environmental implications of biotechnology.

Regulation

The regulation of genetic engineering concerns approaches taken by governments to assess and manage the risks associated with the use of genetic engineering technology, and the development and release of genetically modified organisms (GMO), including genetically modified crops and genetically modified fish. There are differences in the regulation of GMOs between countries, with some of the most marked differences occurring between the US and Europe. Regulation varies in a given country depending on the intended use of the products of the genetic engineering. For example, a crop not intended for food use is generally not reviewed by authorities responsible for food safety. The European Union differentiates between approval for cultivation within the EU and approval for import and processing. While only a few GMOs have been approved for cultivation in the EU a number of GMOs have been approved for import and processing. The cultivation of GMOs has triggered a debate about the coexistence of GM and non-GM crops. Depending on the coexistence regulations, incentives for the cultivation of GM crops differ.

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