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Biology is the study of life. The word "biology" is derived from the Greek words "bios" (meaning life) and "logos" (meaning "study"). In general, biologists study the structure, function, growth, origin, evolution and distribution of living organisms.Biology is important because it helps us understand how living things work and how they function and interact on multiple levels, according to the Encyclopedia Britannica. Advances in biology have helped scientists do things such as develop better medicines and treatments for diseases, understand how a changing environment might affect plants and animals, produce enough food for a growing human population and predict how eating new food or sticking to an exercise regimen might affect our bodies.Four principles unify modern biology, according to the book "Managing Science" (Springer New York, 2010):You may like Cell theory is the principle that all living things are made of fundamental units called cells, and all cells come from preexisting cells.Gene theory is the principle that all living things have DNA, molecules that code the structures and functions of cells and get passed to offspring.Homeostasis is the principle that all living things maintain a state of balance that enables organisms to survive in their environment.Evolution is the principle that describes how all living things can change to have traits that enable them to survive better in their environments. These traits result from random mutations in the organism's genes that are "selected" via a process called natural selection. During natural selection, organisms that have traits better-suited for their environment have higher rates of survival, and then pass those traits to their offspring.Although there are only four unifying principles, biology covers a broad range of topics that are broken into many disciplines and subdisciplines.On a high level, the different fields of biology can each be thought of as the study of one type of organism, according to "Blackie's Dictionary of Biology" (S Chand, 2014). For example, zoology is the study of animals, botany is the study of plants and microbiology is the study of microorganisms.A botanist is a biologist who studies plants. (Image credit: Shutterstock)Within those broader fields, many biologists specialize in researching a specific topic or problem. For example, a scientist may study behavior of a certain fish species, while another scientist may research the neurological and chemical mechanisms behind the behavior.There are numerous branches and subdisciplines of biology, but here is a short list of some of the more broad fields that fall under the umbrella of biology:Biochemistry: The study of the chemical processes that take place in or are related to living things, according to the Biochemical Society. For example, pharmacology is a type of biochemistry research that focuses on studying how drugs interact with chemicals in the body, as described in a 2010 review in the journal Biochemistry.Ecology: The study of how organisms interact with their environment. For example, an ecologist may study how honeybee behavior is affected by humans living nearby.Genetics: The study of heredity. Geneticists study how genes are passed down by parents to their offspring, and how they vary from person to person. For example, scientists have identified several genes and genetic mutations that influence human lifespan, as reported in a 2019 review published in the journal Nature Reviews Genetics. Physiology: The study of how living things work. Physiology, which is applicable to any living organism, "deals with the life-supporting functions and processes of living organisms or their parts," according to Nature. Physiologists seek to understand biological processes, such as how a particular organ works, what its function is and how it's affected by outside stimuli. For example, physiologists have studied how listening to music can cause physical changes in the human body, such as a slower or faster heart rate, according to the journal Psychological Health Effects of Musical Experiences. .Biology is often researched in conjunction with other fields of study, including mathematics, engineering and the social sciences. Here are a few examples:Astrobiology is the study of the evolution of life in the universe, including the search for extraterrestrial life, according to NASA. This field incorporates principles of biology with astronomy.Bioarchaeologists are biologists who incorporate archaeological techniques to study skeletal remains and derive insights about how people lived in the past, according to George Mason University.Bioengineering is the application of engineering principles to biology and vice versa, according to the University of California Berkeley. For example, a bioengineer might develop a new medical technology that better images the inside of the body, like an improved Magnetic Resonance Imaging (MRI) that scans the human body at a faster rate and higher resolution, or apply biological knowledge to create artificial organs, according to the journal Cell Transplant.Biotechnology involves using biological systems to develop products, according to the Norwegian University of Science and Technology. For example, biotechnologists in Russia genetically engineered a better-tasting and more disease-resistant strawberry, which the researchers described in their 2007 study published in the journal Biotechnology and Sustainable Agriculture 2006 and Beyond. Biophysics employs the principles of physics to understand how biological systems work, according to the Biophysical Society. For example, biophysicists may study how genetic mutations leading to changes in protein structure impacts protein evolution, according to the Journal of the Royal SocietyA 3d Illustration of the chain of amino acids that make up protein. (Image credit: Getty Images)Biologists can work in many different fields, including research, healthcare, environmental conservation and art, according to the American Institute of Biological Sciences. Here are a few examples:Research: Biologists can perform research in many types of settings. Microbiologists, for instance, may study bacterial cultures in a laboratory setting. Other biologists may perform field research, where they observe animals or plants in their native habitat. Many biologists may work in the lab and in the field for example, scientists may collect soil or water samples from the field and analyze them further in the lab, like at North Carolina University's Soil and Water Lab.Conservation: Biologists can help with efforts in environmental conservation by studying and determining how to protect and conserve the natural world for the future. For example, biologists may help educate the public on the importance of preserving an animal's natural habitat and participate in endangered species recovery programs to stop the decline of an endangered species, according to the U.S. Fish & Wildlife Service.An ecologist taking a water samples from a creek. (Image credit: Getty Images)Healthcare: People who study biology can go on to work in healthcare, whether they work as doctors or nurses, join a pharmaceutical company to develop new drugs and vaccines, research the efficacy of medical treatments or become veterinarians to help treat sick animals, according to the American Institute of Biological Sciences.Art: Biologists who also have a background in art have both the technical knowledge and artistic skill to create visuals that will communicate complex biological information to a wide variety of audiences. One example of this is in medical illustration, in which an illustrator may perform background research, collaborate with experts, and observe a medical procedure to create an accurate visual of a body part, according to the Association of Medical Illustrators.Additional resourcesIf youre curious about just how wide-reaching biology is, The University of North Carolina at Pembroke has listed a number of biology subdisciplines on their website. Interested in a career in biology? Check out some options at the American Institute of Biological Sciences website.Bibliography Lornande Loss Woodruff, History of Biology, The Scientific Monthly, Volume 12, March 1921, . P.N. Campbell, Biology in Profile: A Guide to the Many Branches of Biology, Elsevier, October 2013.The University of North Carolina at Pembroke, Biology Sub-disciplines, October 2010.University of Minnesota Duluth, What is Biology?, January 2022.Eric J. Simon et al, Campbell Essential Biology, Pearson Education, January 2018.Fungi (singular: fungus) are a kingdom of usually multicellular eukaryotic organisms that are heterotrophs (cannot make their own food) and have important roles in nutrient cycling in an ecosystem. Fungi reproduce both sexually and asexually, and they also have symbiotic associations with plants and bacteria. However, they are also responsible for some diseases in plants and animals. The study of fungi is known as mycology. Some fungi are single-celled, while others are multicellular. Single-celled fungi are called yeast. Some fungi alternate between single-celled yeast and multicellular forms depending on what stage of the life cycle they are in. Fungi cells have a nucleus and organelles, like plant and animal cells do. The cell walls of fungi contain chitin, which is a hard substance also found in the exoskeletons of insects and arthropods such as crustaceans. They do not contain cellulose, which commonly makes up plant cell walls. Multicellular fungi have many hyphae (singular: hypha), which are branching filaments. Hyphae have a tubular shape and are split into cell-like compartments by walls that are known as septa. These cells can have more than one nucleus, and nuclei and other organelles can move in between them. (There is some debate over whether multicellular fungi are truly multicellular, because organelles and cytoplasm can move from one cell to the other in a process called cytoplasmic streaming. They are commonly known as multicellular, but they are not multicellular in the same way as plants and animals, which have enclosed cells.) A funguss network of hyphae is called a mycelium.These are hyphae of a Penicillium fungus.Fungi are heterotrophs; they cannot make their own food and must obtain nutrients from organic material. To do so, they use their hyphae, which elongate and branch off rapidly, allowing the mycelium of the fungus to quickly increase in size. Some fungi hyphae even form root-like threads called rhizomorphs, which help tether the fungus to the substrate that it grows on while allowing it to quickly obtain more nutrients from other sources. Fungi are opportunists, which means that they can obtain nutrients from a wide variety of sources and thrive in a wide range of environmental conditions. Some fungi obtain nutrients from dead organic matter; these fungi are called saprobes and are decomposers, which break down and get rid of dead organisms. Other fungi parasitize plants and are responsible for plant diseases like Dutch elm disease. However, fungi can also have symbiotic (mutually beneficial) relationships with photosynthetic algae or bacteria, and with plant roots. A symbiotic association of a fungus and an animal that photosynthesizes is called a lichen, while a plant root-and-fungus association is called a mycorrhiza. Most fungi can reproduce through both sexual and asexual reproduction. Asexual reproduction occurs through the release of spores or through mycelial fragmentation, which is when the mycelium separates into multiple pieces that grow separately. In sexual reproduction, separate individuals fuse their hyphae together. The exact life cycle depends on the species, but generally multicellular fungi have a haploid stage (where they have one set of chromosomes), a diploid stage, and a dikaryotic stage where they have two sets of chromosomes but the sets remain separate. All fungi reproduce using spores. Spores are microscopic cells or groups of cells that disperse from their parent fungus, usually through wind or water. Spores can become dormant for a long time until conditions are favorable for growth. This is an adaptation for opportunism; with a sometimes unpredictable food source availability, spores can be dormant until they are able to colonize a new food source. Fungi produce spores through sexual and asexual reproduction. There are five phyla of fungi: Chytridiomycota, Zygomycota, Glomeromycota, Ascomycota, and Basidiomycota. The following is a brief description of each phylum. Chytrids, the organisms found in Chytridiomycota, are usually aquatic and microscopic. They are usually asexual, and produce spores that move around using flagella, small tail-like appendages. The chytrid Batrachochytrium dendrobatidis can cause a fungal infection in frogs by burrowing under their skin, and it has recently devastated populations of harlequin frogs, killing off two-thirds of them in Central and South America. Zygomycetes are mainly terrestrial and feed off of plant detritus or decaying animal material. They also cause problems by growing on human food sources. One example of a zygomycte is Rhizopus stolonifer, a bread mold. The hyphae of zygomycetes are not separated by septa, making their mycelia essentially one large cell with many nuclei. They usually reproduce asexually, through spores. Glomeromycetes make up half of all fungi found in soil, and they often form mycorrhizae with plants; in fact, 80-90 percent of all land plants develop mycorrhizae with glomeromycetes. The fungi obtain sugars from the plant, and in return, dissolve minerals in the soil to provide the plant with nutrients. These fungi also reproduce asexually. Ascomycetes are often pathogens of plants and animals, including humans, in which they are responsible for infections like athletes foot, ringworm, and ergotism, which causes vomiting, convulsions, hallucinations, and sometimes even death. However, some ascomycetes normally are found inside humans, such as Candida albicans, a yeast which lives in the respiratory, gastrointestinal, and female reproductive tracts. Ascomycetes have reproductive sacs known as asci, which produce sexual spores, but they also reproduce asexually. Like ascomycetes, basidiomycetes also produce sexual spores called basidiospores in cells called basidia. Basidia are usually club-shaped, and basidiomycetes are also known as club fungi. Most basidiocytes reproduce sexually. Mushrooms are a common example of basidiomycetes. Fungi are sometimes overlooked in biology, especially compared to bacteria, plants and animals. This is partially because many fungi are microscopic, and the field of mycology did not really develop until after the invention of the microscope. However, there are many common examples of fungi. Yeasts are one example. As mentioned before, Candida albicans grows naturally inside the human body, but sometimes it can grow excessively and cause a yeast infection. Yeast infections are extremely common; 75 percent of women will have at least one yeast infection during their lifetime.Fungi are also often associated with food. Mushrooms and truffles are examples of fungi that are sometimes edible, the latter being highly prized in haute cuisine internationally. Molds are fungi that grow on foods over time, causing them to spoil. Food is refrigerated in order to prevent mold growth since few molds grow at 4C (39F). However, some molds are used in the process of cheese-making. Molds are added to soft ripened cheeses like brie, washed rind cheeses like Limburger, and blue cheeses. Heterotroph An organism that cannot make its own food and must obtain nutrients from other organic sources.Hyphae Branching filaments of a fungus.Mycelium A network of hyphae.Yeast Single-celled fungi. 1. Which of these is NOT a fungus?A. MoldB. MushroomC. AlgaeD. YeastC is correct. Algae are not fungi, but photosynthetic algae can form symbiotic relationships with fungi. A fungus and photosynthetic organism are collectively called a lichen.2. What is a mycorrhiza?A. A network of hyphaeB. A fungus that has hyphae without septaC. A symbiotic association of plant roots and fungiD. A symbiotic association of bacteria and fungiC is correct. Mycorrhizae are associations of plant roots and fungi. The plants and fungi have a symbiotic relationship and each provides nutrients for the other; fungi take sugars from the plant, and they break down nutrients in the soil so that the plant can uptake them.3. Which fungi have greatly reduced populations of harlequin frogs?A. ChytridsB. AscomycetesC. BasidiomycetesD. ZygomycetesA is correct. Chytrids, specifically Batrachochytrium dendrobatidis, has caused fungal infections in large numbers of harlequin frogs. This has reduced their numbers in Central and South America by two-thirds.Biohazards can be found anywhere, including the workplace. Hence, its crucial to be familiar with at least 10 biological hazard examples so that you have an idea on how to address certain risks that your workers are exposed to. Even more so, employers must establish safety guidelines and be aware of possible resistances to ensure minimal risks brought about by such workplace hazards, further keeping workers safe and healthy while on duty.10 Biological Hazard ExamplesBiological hazards are biological materials that can pose a threat to living organisms, particularly to humans and animals. Some examples of biological hazards include viruses, bacteria, fungi, parasites, and toxins. While various workplaces and industries deal with different biohazards, there are common ones that pose major threats to the health and safety of workers.1. Human blood and blood productsBodily fluids, tissues that contain blood, serum, plasma, and other blood components in liquid or semi-liquid form are examples of biological hazards.2. Animal wasteAny animal body part or the beddings of infected animals are also considered as biological hazards.3. Human bodily matterDirect contact with biological hazards such as human bodily matter in the workplaceblood, saliva, urine, and mucusis highly risky most especially to healthcare workers.4. Microbiological wasteUsually found in laboratories, this waste may contain concentrated forms of infectious products, such as blood or bodily fluids that have infectious pathogens, specimen cultures, and viruses.5. Pathological wasteThis covers any human body part, tissue, or organ that may have been taken out during surgical procedures.6. Sharps wasteBelonging to the larger group of infectious waste, this type of biological hazard pertains to syringes, sharp tools, and broken glass that are at risk of pathogenic cross-contamination and piercing through human skin protection.7. Molds and yeastsThese are found in nature, needed for the breakdown of plant debris. Such microorganisms can enter a building directly or their spores can be carried in by the air. For some people, inhalation of the molds, fragments of the molds, or spores can lead to serious health problems or worsen certain health conditions.8. Organic materialWorkers may also be exposed to rubbish, waste water and sewerage, plant materials, and organic dust.9. Airborne pathogensPathogenic microbes, which are small enough to be discharged from an infected person, are easily transmitted through sneezing, coughing, and direct or close contact.10. Stinging insectsAs these can be found throughout various geographic regions, stinging insects are especially dangerous to outdoor workers. Such insects include bees, wasps, hornets, and non-venomous and venomous spiders.Cultivate a safe working environment and streamline compliance with our EHS solutions.Biohazard Safety Levels As cited by Aftermath, the Centers for Disease Control and Prevention (CDC) lists the 4 biosafety levels, with each of them having specific controls to contain microbes and biological agents:Biohazard Level 1: Often pertains to agents that include viruses and bacteria, this biosafety level requires minimal precaution, such as wearing face masks and maintaining no close contact. The biological hazard examples in the first level include E.coli and other non-infectious bacteria.Biohazard Level 2: Usually causing severe diseases to humans, the second level classifies agents that can be transmitted through direct contact with infected materials. HIV and hepatitis B are some biological hazard examples that pose moderate risks to humans.Biohazard Level 3: Mainly through respiratory transmission, pathogens that are highly likely to become airborne can cause serious or lethal diseases to humans. Mycobacterium tuberculosis, the bacteria that causes tuberculosis, is an example of a level-3 biohazard.Biohazard Level 4: Extremely dangerous pathogens that expose humans to life-threatening diseases, the fourth and last level requires workers to utilize maximum protection and containment. Some biological hazard examples are the Ebola virus and the Lassa virus.Per the given biosafety level, there are strict requirements when it comes to the laboratory design, Personal Protective Equipment (PPE), biosafety equipment, and other assets or tools used. Further, there are Standard Microbiological Practices to be enforced at all biosafety levels. The 10 biological hazard examples listed in this article may be categorized under each level depending on the potential risks involved. This is why conducting a job hazard analysis and a risk assessment are recommended to streamline safe and quality operations.RegulationsAccording to the UK Health and Safety Executive (HSE), the Control of Substances Hazardous to Health Regulations 2002 is the main legislation applicable to biohazards. As a UK Statutory Instrument, the law describes general requirements on employers to protect their workers and other people from the hazards of substances. This must be enforced by doing the following: Manage Biological Hazards Through Consistent Safety TrainingBuilding a culture of safety starts with helping employees create and embody a mindset and attitude that prioritizes safety in the workplace. One way to incorporate this into an organizations holistic approach is to provide regular training on safe work practices, covering biological hazards and other threats that employees may encounter.Using a training tool like SafetyCulture (formerly iAuditor)s Training is essential to streamline processes on conducting training for employees. With Training, organizations can monitor and follow up on course completion progress for compliance.Monitor Biohazards Using a Powerful ToolAs a dynamic inspection software and mobile app, SafetyCulturelets you perform biological hazard assessments efficiently and accurately. In detail, you can do the following using the apps unique features: Try SafetyCulture for free!Page 2There are 5 types of controls that can be applied, each intended for a specific purpose:1. EliminationThis control is considered as the most effective method. It involves physically removing or eliminating the hazard from the environment where it poses risks to people (e.g., hazardous equipment, machines, tools, assets, or materials).2. SubstitutionThis control acts as the second defense. It replaces the hazard with something thats less or non-hazardous. For example, replacing a cleaning chemical with something that doesnt produce harmful fumes.3. Engineering ControlsWhen a hazard cant be controlled through means of the first two controls, the next best option is to apply engineering controls. This means, rearranging the work environment to isolate people from the hazard. For example, placing guardrails or fences around areas with high voltage equipment, use of sound dampening materials, and other more.4. Administrative ControlsLess effective than the ones above, but nonetheless keeps people safe by directing people to safer work procedures. Using rules and policies, warning signs and labels, and training.5. PPEAs the last line of defense, PPEs are designed to equip people with the right equipment to combat hazards. Common PPE includes helmets or hard hats, goggles, gloves, boots, respirators, and high visibility clothing.In choosing the most effective control, employers will have to rely on the data gathered from a safety audit and the information provided by workers.Cultivate a safe working environment and streamline compliance with our EHS solutions. Interested in online learning? Edukatico will keep you updated from time to time. (You can stop this at any time.) More filters Less filters ...go to top Extend Your Knowledge with Online Courses in BiologyAre you studying Biology and wish to supplement your specialist knowledge from lectures, seminars, or scientific exercises? Or are you generally interested in this scientific field?You will find a broad spectrum of online courses in specialized subjects of Biology, Biochemistry, and Biotechnology. These courses and other related fields are available in our directory.Biology as a Multi-Faceted DisciplineBiology is the area of natural sciences described as the study of living things. In particular, it investigates the construction, organisation, and development of life. It can be subdivided into many subject areas.These subject areas can be defined by the living things being studied. Botany is the study of plants. This subject area originated from the study of medicinal plants. Similarly, Zoology is dedicated to the analysis of animals. Human Biology, which is a crossover with the study of Human Medicine, focusses on humans. It only became a scientific discipline in its own right in the second half of the 20th century. The smallest living things bacteria, fungi, viruses are studied in Microbiology.Other specialist areas of biology include Molecular Biology, Cell Biology, Development Biology, Behavioural Biology, Genetics, and Ecology. These disciplines encompass all species.You can find interesting online courses in many of these categories on our site. These e-learning offerings are continually expanded. Independent further study in the field of Biology is thus possible via the digital route.What Online Offers Are Available in the Area of Biology?Online courses provide an outstanding opportunity to study Biology. With online learning, you can review a topic at any time or pause at particular points. In contrast, some explanations might get lost in a typical two-hour university lecture. You can also prepare for practical activities and tests with the help of online courses or deepen certain areas of interest with additional information.You will find a great selection of online courses in the subject of Biology in our directory. The courses come from large platforms like edX or Coursera. Biology courses and Biology MOOCs (massive open online courses) by top international universities are made available through these platforms. And, as with all of the courses in our directory, these courses are purely online offers with no attendance requirements.Browse all the available courses now! ...go to top The foot is a part of vertebrate anatomy which serves the purpose of supporting the animals weight and allowing for locomotion on land. In humans, the foot is one of the most complex structures in the body. It is made up of over 100 moving parts bones, muscles, tendons, and ligaments designed to allow the foot to balance the bodys weight on just two legs and support such diverse actions as running, jumping, climbing, and walking.Because they are so complicated, human feet can be especially prone to injury. Strains, sprains, tendonitis, torn ligaments, broken bones, fallen arches, bunions, corns, and plantar warts can all occur. Here we will talk more about the anatomy of the human foot and its many moving parts. The complexity of the human foot may stem from the fact that it evolved from hand-like, grasping feet like those we see in apes today. Our ancient ancestors were tree-dwellers, and needed to be able to hang onto branches tightly with all four limbs. This caused them to evolve extraordinarily intricate hands and feet, which were capable of grasping, rotating, and gripping with dexterity that engineers are still trying to replicate in fields like robotics today.Scientists are not sure why our ancestors eventually developed to walk upright, which caused the fingers of our feet to fuse and create a flat surface for walking on. It may have been because our ancestors began living on treeless grasslands, where standing tall to be able to see over the grass was more important than climbing. It could also have been because, as we began using tools, the ability to walk on two feet while using our hands to carry items became important.Feet are present in other species too; especially mammals, birds, reptiles, and amphibians. Invertebrates such as mollusks and insects may have feet that they use to walk or move, but these are not complex bony structures like those found in vertebrates. Here we will discuss the anatomy of the human foot, and some things that can go wrong to cause injuries or disorders.These descriptions are meant for informational purposes only. You should always see a doctor if foot injury is suspected, as prompt and proper treatment can make for a faster, easier recovery! It is especially important to see a doctor if a suspected foot injury involves numbness, bleeding, or inability to move the foot, as these may be signs of serious complications.Proper diagnosis and treatment takes a trained professional; improper diagnosis and treatment may lead to longer-lasting problems! The foot contains 26 bones, 33 joints, and over 100 tendons, muscles, and ligaments. This may sound like overkill for a flat structure that supports your weight, but you may not realize how much work your foot does!The foot is responsible for balancing the bodys weight on two legs a feat which modern roboticists are still trying to replicate. This requires strong, subtle muscles which can keep the foot standing firm even as we move our bodys weight around at different positions and angles. The many bones work together to allow to allow this fine, delicate movement by subtly shifting inside the foot. They also allow us to perform intricate actions such as standing, climbing, and grasping at the ground with our feet on moving or uneven surfaces.Here we will discuss the most important parts of the anatomy of the foot, and some injuries and disorders that can occur when these parts are damaged.Of note, here we will make general statements about how different foot injuries and disorders may be treated by doctors. This is not a substitute for medical advice.See a doctor about any suspected foot injury or disorder, as prompt diagnosis and treatment can make for a faster, easier recovery, while improper treatment may lead to long-term damage. There are 26 bones in the foot. These include: The phalanges, which are the bones in your toes The metatarsals, which run through the flat part of your foot The cuneiform bones, the navicularis, and the cuboid, all of which function to give your foot a solid yet somewhat flexible foundation The calcaneus, which is the bone in your heel The talus, which is the bone in your ankle The talus connects to the tibia, which is the main bone in your lower legWhile you may not notice these bones in action every day, youll notice quickly if something is wrong with one of them. These bones allow your feet to execute the delicate shifts which enable you to keep your balance while walking, running, jumping, climbing, dancing, and playing sports!Injury to a bone in the foot often results in a sharp or throbbing pain, especially when you move in a way that causes your weight or a nearby muscle to put pressure on the bone.The most common broken bones in the foot are broken toes, which may occur after hitting a toe on a hard or sharp surface while walking, running, swimming, or playing sports.Broken bones in the foot usually call for rest, ice, compression, and elevation to reduce any swelling. It is helpful to remember the acronym RICE for Rest, Ice, Compression, and Elevation. This combination of at-home treatments is a good first-line response for many leg and foot injuries.Supportive wraps or protective casts may be used to reduce pain and keep bones properly aligned. Sometimes, crutches or other means of keeping weight off the foot entirely might be prescribed. In rare cases where a bone breaks into two or more pieces and these pieces become misaligned, surgery may be required to move the pieces back into alignment so they can heal.Physical therapy may also be suggested to help regain healthy use of the muscles after the injury.Another possible problem with bones in the foot is the problem of bunions, or bone spurs.Bone spurs occur when extra bone growth occurs, usually near the end or joint of a bone. This can be caused by chronic irritation of the joint, such as rubbing against another bone or joint. The most common types of bone spurs in feet occur in the big toe, and these are called bunions.Bunions and bone spurs can cause significant pain. Internally, they can rub against other bones, muscles, and nerves beneath the skin. Externally, they can change the shape of the foot, resulting in pain and discomfort from wearing normal shoes.Mild bunions can be treated by wearing more comfortable shoes or shoe inserts, taking over-the-counter anti-inflammatory medications, applying rest, ice, compression, and elevation, and taping, or splinting the affected area. All of these measures might reduce swelling and prevent the bunion from causing pain.If pain is not relieved by these activities, surgery may be required to remove some of the bunion tissue.The risk for bunions is increased if you wear tight, narrow shoes, which may force bones to rub against each other. The risk is also increased if you have arthritis or a history of injuries to the foot. Ligaments are bands of very strong, flexible tissue that perform the important job of connecting bones together. Ligaments are very strong and difficult to injure, but ligament injuries can be serious when they do occur. This is because ligaments do not receive much blood flow like bones and muscles, so they are slow to repair themselves.There are a lot of bones in the foot, so you might guess correctly that there are a lot of ligaments. In fact there are so many ligaments that we need three different diagrams to show them all to you!This diagram shows the sole of the foot. You can see the toes on the top and the heel on the bottom, while the arch and sole of the foot are made up of a thick web of ligaments holding the bones together:This diagram shows the medial aspect of the foot. This term comes from the terms medial, meaning center, or in the middle, and aspect, meaning face. In other words, this is the face that the foot shows to the center of the body. It is the side of the foot that faces inward.This diagram shows the heel on the right, while the toes reach off the screen to the left.Here you can see that the ankle is also a thick web of ligaments, where the tibia is connected to the bones of the ankle and the core of the foot. You can also see the bands of ligaments where the metatarsals and phalanges are connected to each other.Lastly, this diagram shows the lateral aspect of the foot, with lateral meaning to the side. This is the view of the foot from the side of the body, then; the view of the part of the foot that faces outward.On the left side of the image, above the heel, you can see the delicate leg bone called the fibula. The fibula is smaller than the tibia and runs alongside it. Having two separate bones instead of one connecting the foot to the leg gives the foot and leg extra balance and maneuverability.You can also see the thick web of ligaments on the top of the foot, where the bones of the foots core are connected on the top side.Now you can begin to see why the middle of your foot feels solid, even though its made up of many bones. The many bones are bound together tightly by strong, flexible ligaments, which allow the center of your foot to shift subtly while remaining solid and stable.Although ligaments are strong, they can be injured especially in an area like the ankle, where the whole weight of your body hinges on a single joint.Sprains occur when a body part is wrenched or twisted, resulting in damage to a ligament. Such damage can cause swelling and significant pain. Because ligaments do not receive much nourishing blood flow from the body, sprains can take a long time to heal, and long-term damage can result from continued stress on a sprained ligament.Like broken bones, sprains are often treated with rest, ice, compression, and elevation; and a supportive wrap or cast to take stress off the sprained area. Sometimes, crutches or other means of keeping weight off the foot entirely might be prescribed.Physical therapy can be especially helpful in the case of sprains, where it can ensure that the injured ligament is strengthened gradually and is properly supported by surrounding muscles.A torn ligament occurs when the foot is wrenched or twisted so violently that the ligament actually snaps. This condition can be serious as ligaments which are completely torn may not heal themselves the way a bone or muscle would.Torn ligaments can sometimes be treated in the same way as strains, but may require surgery if the tear is severe or if there is lasting damage to foot function. With surgery, doctors can join the two ends of a damaged ligament together, or replace a damaged ligament with a healthy one from another part of the body. Just as there are many bones and ligaments of the sole of the foot, there are also many muscles. These can be divided up into four major groups: The central muscles of the sole of the foot The lateral muscles of the sole of the foot The medial muscles of the sole of the foot The muscles of the dorsum (top) of the footYou can learn more about each individual group of muscles in the foot using this table:If muscles are overworked or overstressed, they can become torn or strained. Strains usually manifest as pain, especially with movement or pressure.Mild strains often go away in days or weeks if the muscle is rested and not subjected to further stress. More serious muscle tears, however, may take months.It is a good idea to see a doctor if a severe strain is suspected, as severe muscle strains can lead to serious complications.The most severe form of muscle overuse rhabdomyolysis occurs when muscles are so stressed that their cells rupture and release toxic chemicals. This can actually be fatal if left untreated.Rest, ice, compression, and elevation to reduce swelling are recommended to treat mild to moderate strains. Supportive wraps or casts and crutches or braces may be recommended if the strain is especially severe.Physical therapy may also be suggested to help regain healthy use of the muscles after the injury. Tendons are thick bands of tissue that connect muscles to bones. By connecting our rigid bones to our powerful muscles, tendons allow us to move. Movement occurs when our muscles pull on our bones, relocating them.The following diagram shows the tendons of the lateral aspect of the foot that is, the aspect that faces outward, away from your body:Here you can see the tendons that extend down the top of your foot toward your toes, allowing you to curl your toes upward if need be.You can also see what is arguably the most important tendon in the foot the calcaneal, or Achilles tendon, which allows the muscles of your calf to control the movement of your foot.The Achilles tendon gets its name from the mythical Greek hero Achilles, who was invulnerable except for his ankle. An injury to his ankle possibly to the Achilles tendon left him unable to stand and fight.This image of the medial aspect of the foot shows tendons that run along the bottom of the foot. It is these tendons that allow you to curl your toes and grip surfaces with your feet, by permitting muscles on the bottom of the foot to pull tight.Injuries may happen to any tendon in the foot, and these may cause pain or impair balance. Achilles tendon injuries are one of the most common tendon injuries that can occur, as the body relies on the Achilles tendon to support its weight.Lesser injuries to tendons can be treated with rest, ice, compression, elevation, and over-the-counter anti-inflammatory medications. Doctors may recommend prolonged periods of rest, and prescribe a supportive wrap or cast for substantial tendon injuries.Severe injuries to the Achilles tendon that may occur while playing sports can require surgery to repair.In addition to acute injuries like strains and tears, tendons can become irritated due to chronic stress.Tendonitis occurs when a tendon a touch cord of tissue which attaches a muscle to a bone becomes irritated over time. This can occur from overuse or misuse if a person is moving in a way that causes stress to the tendon.Tendonitis often appears slowly, manifesting as a sharp pain when a person performs a certain movement. People with tendonitis in the foot may find that it is painful to put weight on the foot, despite the absence of a clear injury like trauma or strain.Tendonitis can be treated with RICE and over-the-counter anti-inflammatory drugs. Physical therapy can also be extremely beneficial, as this can gently exercise and stretch the tendon, and correct any movement habits that may have caused the irritation. Normally, tendons in the foot pull the bones of the foot in toward each other, resulting in distinctive arches between the heel and toes, and between the inner and outer toes. This arch is important for ensuring that weight is properly distributed among the strongest muscles of the leg and foot, and to ensure we can shift our weight as needed to keep our balance or move quickly.Fallen arches, or flat feet, can occur when the tendons of the foot do not pull the foots bones together with a normal amount of strength. This results in the foot becoming flat, which can lead to pain, balance problems, and tiredness in the leg or foot.Flat feet can occur as a result of injury, or some peoples tendons simply never pull together properly. Rarely, other health problems such as arthritis or problems with the nerves going to the feet can cause flat feet.Flat feet may ache and tire easily. Back pain and leg pain may also result as muscles in the back and legs may work to overcompensate for the normal balancing functions of the arch.Treatment for flat feet may depend on the cause. If you believe you have flat feet, see a doctor to find out what is the best treatment for you! The internal parts of the foot are not the only important parts! The skin on the bottom of our feet protects our muscles, bones, tendons and ligaments from injury. It also prevents infection.Toenails protect the top of our toes, which, as we all know, can sometimes be vulnerable to being stubbed, stepped on, or having things dropped on them.However, there are things that can go wrong with each of these and lead to problems.Plantar warts Plantar warts are growths that appear on the bottom of the foot, and may become painful. They are caused by a strain of human papillomavirus that infects skin of the feet and causes unusual growth of skin and blood vessels.The strain of human papillomavirus that causes plantar warts and other warts is very common in the environment. It is not known why some people develop warts and others dont. Avoiding sharing shoes and socks with people who have plantar warts may help protect against them, but many people develop plantar warts with no known instances of person-to-person transmission.If plantar warts remain small, they might not cause pain, and no treatment may be needed. If they become painful, however, they may need to be removed. Several options exist for doing this, including over-the-counter applications, and procedures to freeze the wart tissue which can be performed by a doctor.Corns and calluses are hard areas of skin which build up as a result of frequent friction against the skin. The body creates corns and calluses to toughen the skin against repeated stress.People who work with their hands such as carpenters, gardeners, and musicians often develop calluses on their hands in areas where they frequently rub against their instruments. People who walk often or whose feet rub against the insides of their shoes may develop corns and calluses on their feet.People with conditions that cause fragile skin or impaired blood flow to the feet, such as diabetes, should talk with their doctor as soon as corns or calluses develop. This may be a sign of an underlying problem, and treatments that are appropriate for healthy people may cause harm to people with these conditions.For people who do not have such health conditions, over-the-counter corn-removal and exfoliation treatments can help relieve discomfort caused by corns and calluses. Changing ones shoes or walking habits may also prevent them from forming in the future.Once, human toenails served a similar function to those of fingernails or animals claws. However, the foot has undergone some important changes in evolutionary history. Toenails have not always kept up.Ingrown toenails occur when a toenail inappropriately curves, causing it to stab into the flesh of the toe. This is a painful condition, and may become serious if injury and infection occur.Ingrown toenails can sometimes be managed at home through frequent clipping. But in serious cases, medical attention may be necessary to avoid dangerous infections.See your doctor immediately if an ingrown toenail causes severe pain, or if a toe with an ingrown toenail becomes red and swollen. 1. Why is it important to see a doctor if a foot injury is suspected?A. Because different types of injuries such as broken bones, sprains, and strains may have similar symptoms but require different treatmentsB. Because prompt treatment can make for a slower, easier healing process than if an injury is ignored or treated improperly at firstC. Because doctors can prescribe helpful devices like supportive wraps, casts, and crutches that decrease pain and help with healingD. All of the aboveD is correct. All of the above are reasons to consult a doctor if a foot injury occurs.2. Which of the following is NOT a bone found in the foot?A. The calcaneusB. The cuboid boneC. The metacarpalsD. The phalangesC is correct. The metaCARPals sound similar to the metaTARSals, which are found in the foot. But metacarpals are found in the hands, not the feet. You can remember this because carpal refers to the same anatomy as carpal tunnel syndrome, which is a disease of the hands and wrists.3. Which of the following is not a foot-related health problem?A. A broken toeB. An Achilles tendon injuryC. A sprained ankleD. Carpal tunnel syndromeD is correct. Carpal tunnel syndrome occurs in the wrists and hands, not in the feet or ankles.ReferencesHoffman, M. (n.d.). Picture of the Feet. Retrieved July 05, 2017, from H. (2012). Anatomy of the human body. London, England: Bounty.Foot Injuries | Foot Disorders | MedlinePlus. (n.d.). Retrieved July 05, 2017, from anatomy of the lower extremity, part II: knee, leg, ankle, and foot. [Video file]. (n.d.).Muscles of the foot. (n.d.). Retrieved July 05, 2017, from and Corns Topic Overview. (n.d.). Retrieved July 05, 2017, from is the process in eukaryotic, sexually-reproducing animals that reduces the number of chromosomes in a cell before reproduction. Many organisms package these cells into gametes, such as egg and sperm. The gametes can then meet, during reproduction, and fuse to create a new zygote. Because the number of alleles was reduced during meiosis, the combination of two gametes will yield a zygote with the same number of alleles as the parents. In diploid organisms, this is two copies of each gene. Meiosis is necessary for many sexually-reproducing animals to ensure the same number of chromosomes in the offspring as in the parents. The act of fertilization includes two cells fusing together to become a new zygote. If the number of alleles of each gene is not reduced to 1 in the gametes that produce the zygote, there will be 4 copies of each gene in the offspring. In many animals, this would lead to many developmental defects. In other organisms, polyploidy is common and they can exist with many copies of the same gene. However, if the organism cannot survive if they are polyploidy, meiosis must occur before reproduction. Meiosis occurs in two distinct divisions, with different phases in each. Before meiosis, the DNA is replicated, as in mitosis. Meiosis then consists of two cell divisions, known as meiosis I and meiosis II. In the first division, which consists of different phases, the duplicated DNA is separated into daughter cells. In the next division, which immediately follows the first, the two alleles of each gene are separated into individual cells.The following are descriptions of the two divisions, and the various phases, or stages of each meiosis. Remember, before meiosis starts the normally diploid DNA has been duplicated. This means there are 4 copies of each gene, present in 2 full sets of DNA, each set having 2 alleles. In the diagram below, the red chromosomes are the ones inherited from the mother, the blue from the father. At the start of the following diagram, the DNA has already been replicated, which is why the red and blue chromosomes look like the letter X. Each one of these X chromosomes consists of two sister chromatids cloned DNA from replication. They are connected at the centromere for storage but can separate into individual chromosomes. Meiosis Stages Prophase I, the first step in meiosis I, is similar to prophase in mitosis in that the chromosomes condense and move towards the middle of the cell. The nuclear envelope degrades, which allows the microtubules originating from the centrioles on either side of the cell to attach to the kinetochores in the centromeres of each chromosome. Unlike in mitosis, the chromosomes pair with their homologous partner. This can be seen in the red and blue chromosomes that pair together in the diagram. This step does not take place in mitosis. At the end of prophase I and the beginning of metaphase I, homologous chromosomes are primed for crossing-over.Between prophase I and metaphase I, homologous chromosomes can swap parts of themselves that house the same genes. This is called crossing-over and is responsible for the other law of genetics, the law of independent assortment. This law states that traits are inherited independently of each other. For traits on different chromosomes, this is certainly true all of the time. For traits on the same chromosome, crossing-over makes it possible for the maternal and paternal DNA to recombine, allowing traits to be inherited in an almost infinite number of ways. In metaphase I of meiosis I, the homologous pairs of chromosomes line up on the metaphase plate, near the center of the cell. This step is referred to as a reductional division. The homologous chromosomes that contain the two different alleles for each gene are lined up to be separated. As seen in the diagram above, while the chromosomes line up on the metaphase plate with their homologous pair, there is no order upon which side the maternal or paternal chromosomes line up. This process is the molecular reason behind the law of segregation. The law of segregation tells us that each allele has the same chance of being passed on to offspring. In metaphase I of meiosis, the alleles are separated, allowing for this phenomenon to happen. In meiosis II, they will be separated into individual gametes. In mitosis, all the chromosomes line up on their centromeres, and the sister chromatids of each chromosome separate into new cells. The homologous pairs do not pair up in mitosis, and each is split in half to leave the new cells with 2 different alleles for each gene. Even if these alleles are the same allele, they came from a maternal and paternal source. In meiosis, the lining up of homologous chromosomes leaves 2 alleles in the final cells, but they are on sister chromatids and are clones of the same source of DNA. Much like anaphase of mitosis, the chromosomes are now pulled towards the centrioles at each side of the cell. However, the centrosomes holding the sister chromatids together do not dissolve in anaphase I of meiosis, meaning that only homologous chromosomes are separated, not sister chromatids. In telophase I, the chromosomes are pulled completely apart and new nuclear envelopes form. The plasm membrane is separated by cytokinesis and two new cells are effectively formed. Two new cells, each haploid in their DNA, but with 2 copies, are the result of meiosis I. Again, although there are 2 alleles for each gene, they are on sister chromatid copies of each other. These are therefore considered haploid cells. These cells take a short rest before entering the second division of meiosis, meiosis II. Prophase II resembles prophase I. The nuclear envelopes disappear and centrioles are formed. Microtubules extend across the cell to connect to the kinetochores of individual chromatids, connected by centromeres. The chromosomes begin to get pulled toward the metaphase plate. Now resembling mitosis, the chromosomes line up with their centromeres on the metaphase plate. One sister chromatid is on each side of the metaphase plate. At this stage, the centromeres are still attached by the protein cohesin. The sister chromatids separate. They are now called sister chromosomes and are pulled toward the centrioles. This separation marks the final division of the DNA. Unlike the first division, this division is known as an equational division, because each cell ends up with the same quantity of chromosomes as when the division started, but with no copies. As in the previous telophase I, the cell is now divided into two and the chromosomes are on opposite ends of the cell. Cytokinesis or plasma division occurs, and new nuclear envelopes are formed around the chromosomes. At the end of meiosis II, there are 4 cells, each haploid, and each with only 1 copy of the genome. These cells can now be developed into gametes, eggs in females and sperm in males. Human meiosis occurs in the sex organs. Male testis produce sperm and female ovaries produce eggs. Before these gametes are made, however, the DNA must be reduced. Humans have 23 distinct chromosomes, existing in homologous pairs between maternal and paternal DNA, meaning 46 chromosomes. Before meiosis, the DNA in the cell is replicated, producing 46 chromosomes in 92 sister chromatids. Each pair of sister chromatids has a corresponding (either maternal or paternal) set of sister chromosomes. These pairs are known as homologous chromosomes. During meiosis I, these homologous chromosomes line up and divide. This leaves 23 chromosomes in each cell, each chromosome consisting of sister chromatids. These chromatids may no longer be identical, as crossing-over may have occurred during metaphase I of meiosis I. Finally, meiosis II takes place, and the sister chromatids are separated into individual cells. This leaves 4 cells, each with 23 chromosomes, or 4 haploid cells. Fruit flies have 4 pairs of chromosomes or 8 chromosomes in regular cells. Before meiosis takes place, each chromosome is replicated, leaving 8 chromosomes and 16 sister chromatids. Meiosis I takes place, and there are 2 cells, each with only 4 chromosomes. Each chromosome is still made of sister chromatids, and some crossing-over may have occurred during metaphase I. Meiosis II now takes place on those two cells. In total, 4 cells are created, again. However, these cells have 4 chromosomes. When two gametes meet to create a new fruit fly, the resulting zygote will have 8 chromosomes of 4 pairs of sister chromosomes, 4 coming from each parent. Haploid Organism with only one copy of each gene in each cell, or gametes with such.Diploid Two copies of each gene, per cell.PolyploidDominance Multiple (more than two) copies of each gene per cell.Sister Chromatids The replicated DNA that exist as a single chromosome until separated in anaphase. 1. A cell is going through meiosis. The sister chromatids are lined up on the metaphase plate. What phase of meiosis is this?A. Metaphase IB. Prophase IIC. Metaphase IIC is correct. This is metaphase II. In metaphase I, the homologous chromosomes are lined up on the metaphase plate. This is an extremely important difference between the two. Metaphase II is just like mitosis, while metaphase I results in the reduction of ploidy.2. An adult organism has 60 chromosomes or 30 homologous chromosomes. 30 are maternally derived, 30 are paternally derived. How many chromosomes are in each cell after mitosis?A. 60 chromosomes, 30 homologs.B. 120 chromosomes, 60 homologs.C. 30 chromosomes, no homologs.A is correct. Mitosis produces the same number of chromosomes. Essentially, mitosis produces an exact clone of the parent cell.3. An adult organism has 60 chromosomes or 30 homologous pairs of chromosomes. 30 are maternally derived, 30 are paternally derived. How many chromosomes are in each cell after meiosis?A. 30 chromosomes, no homologous chromosomes.B. 60 chromosomes, 30 homologous chromosomes.C. 120 chromosomes, 60 homologous chromosomes.A is correct. Meiosis reduces the ploidy of each cell. Effectively, this means that only one copy of each chromosome, either the maternal or paternal copy, will be retained in each cell. The homologous copies of each chromosome are sorted on the metaphase plate in metaphase I. Each copy consists of two sister chromatids, which are separated after metaphase II. In this way, the final gamete will have 30 chromosomes, none of which will have a copy. Thus, when two gametes meet, they can create a zygote with 30 homologous pairs of chromosomes, or 60 total. What is a biological product? Biological products include a wide range of products such as vaccines, blood and blood components, allergenics, somatic cells, gene therapy, tissues, and recombinant therapeutic proteins. Biologics can be composed of sugars, proteins, or nucleic acids or complex combinations of these substances, or may be living entities such as cells and tissues. Biologics are isolated from a variety of natural sources - human, animal, or microorganism - and may be produced by biotechnology methods and other cutting-edge technologies. Gene-based and cellular biologics, for example, often are at the forefront of biomedical research, and may be used to treat a variety of medical conditions for which no other treatments are available. How do biological products differ from conventional drugs? In contrast to most drugs that are chemically synthesized and their structure is known, most biologics are complex mixtures that are not easily identified or characterized. Biological products, including those manufactured by biotechnology, tend to be heat sensitive and susceptible to microbial contamination. Therefore, it is necessary to use aseptic principles from initial manufacturing steps, which is also in contrast to most conventional drugs. Biological products often represent the cutting-edge of biomedical research and, in time, may offer the most effective means to treat a variety of medical illnesses and conditions that presently have no other treatments available.

What are examples of biological agents. What are the example of biological weathering. What are the example of biological hazard. What are the example of biological disaster.