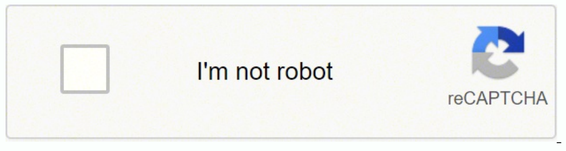

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List any 3 characteristics of living things

← Astrobiology Learning Progressions Table of ContentsThe things that live here on Earth all have a lot in common. The tiny parts inside you that are responsible for helping you do everything you do, like walking, breathing, and digesting your food – those tiny parts are almost exactly the same in all types of life, from flies and fish to trees and cows. All types of life have other things in common, too. All living things have a body of some kind. Some things have body parts that allow them to walk or fly or swim. These are things like legs and wings and fins. All of the living creatures we know have to eat food in order to have the energy to move and to grow. All living things can respond to their surroundings, just like you can taste something awful then spit it out and shout “YUCK!” And all life comes from other life – just like how you came from your mother and father. So even though we look so different from other living things, we are much more the same than different.LS1.A: Structure and Function: All organisms have external parts that they use to perform daily functions. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems,leaves, flowers, fruits) that help them survive and grow. (1-LS1-1)LS1.C: Organization for Matter and Energy Flow in Organisms: All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. (K-LS1-1)LS1.D: Information Processing: Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs. (1-LS1-1)LS3.A: Inheritance of Traits: Young animals are very much, but not exactly, like their parents. Plants also are very much, but not exactly, like their parents. (1-LS3-1)LS3.B: Variation of Traits: Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways. (1-LS3-1)Crosscutting ConceptsPatterns: Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) *Systems and System Models: Systems in the natural and designed world have parts that work together. (K-ESS2-2, K-ESS3-1)Big Ideas: All living things have similarities. They change in response to their environment, and need energy. They also have specific structures designed for specific functions.Boundaries: Grade level examples of patterns in living things could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and that all living things need water. (K-LS1-1)No appropriate content for this grade level. Please use the navigation arrows to switch levels.All living things on Earth have a lot in common. Both inside and outside. On the inside, all lifeforms have tiny structures inside their bodies that are almost exactly the same and help them do all the things that they need to do so they can live – things like walking, flying, or swimming, and even basic functions like breathing and digesting food. All lifeforms have similar characteristics or behaviors, too. There is order and structure to living things. All lifeforms exist in a body of some kind that is highly organized. Think of a tree – it has roots to absorb water, a trunk and branches, and leaves to absorb sunlight.All living things have the ability to reproduce, or procreate. Mammals, like whales and giraffes, do so by giving birth to young. All living things consume energy (they eat food), and use that energy for work, play, and growth. All living things respond to changes in the world around them. When the environment changes, life responds to those changes. For example, when the weather turns cold, bears return to their dens and hibernate for the winter. When spring comes, the bears can come out again. All across different types of life, some individuals will have characteristics that make them better at a particular task, which makes them more likely to survive. For example, in a population of giraffes, there may be a few who have longer necks than the rest. When the only leaves remaining to be eaten are at the very tops of the trees, only the giraffes with longest necks can reach them, and this makes them more likely to survive. Even though living things look very different, they are more the same than different.LS1.A: Structure and Function: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)LS1.B: Growth and Development of Organisms: Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)LS1.C: Organization for Matter and Energy Flow in Organisms: Food provides animals with the materials and energy they need for body repair, growth, warmth, and motion. Plants acquire material for growth chiefly from air, water, and process matter and obtain energy from sunlight, which is used to maintain conditions necessary for survival. (5-LS1-1)LS2.A: Interdependent Relationships in Ecosystems: The food of almost any animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)LS2.B: Cycles of Matter and Energy Transfer in Ecosystems: Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)LS2.C: Ecosystem Dynamics, Functioning, and Resilience: When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.LS2.D: Social Interactions and Group Behavior: Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. (3-LS2-1)LS3.A: Inheritance of Traits: Many characteristics of organisms are inherited from their parents. (3-LS3-1) Other characteristics result from individuals’ interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2)LS4.A: Evidence of Common Ancestry and Diversity: Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (3-LS4-1) Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3-LS4-1)LS4.B: Natural Selection: Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)LS4.C: Adaptation: For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)LS4.D: Biodiversity and Humans: Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)ESS2.E: Biogeology: Living things affect the physical characteristics of their regions. (4-ESS2-1)Crosscutting ConceptsPatterns: Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1) *Cause and Effect: Cause and effect relationships are routinely identified and used to explain change. (3-LS3-2, 3-LS4-2)Big Ideas: All living things share certain things in common. They all have internal and external similarities, change to better suit their environment, respond to their surroundings, and need energy. Plants are at the base of the energy cycle capturing sunlight along with air and water. Organisms sense and respond to their environment. They also have specific structures designed for specific functions. Organisms inherit traits from their parents. Some traits are more advantageous than others. Organisms are adapted to survive in certain environments.Boundaries: Internal and external differences primarily focuses on macroscopic structures of plant and animal systems (ie thorns, stems, roots, colored petals, arms, heart, lungs, etc). (4-LS1-1) Regarding traits inherited from parents, the emphasis within this grade band is on organisms other than humans, and non-human examples. (3-LS3-1)4-12 Finding Life beyond Earth, Activity 2: What is Life? Page 16. In this activity, students observe a number of objects, make a list of life’s characteristics, and develop a working definition of life. *Astrobiology in Your Classroom: Life on Earth….*and Elsewhere. Activity 1: What is Life? Activity 1 takes a close look at what characterizes life, and lays the groundwork to examine what life requires, what physical limits it can tolerate, and where it might be found in the solar system. Students compare real and fake or live and dead objects, play 20 Questions, and compare mystery samples (p.5) NASA. you ever thought about how we know something is alive or not alive? For instance, what makes a rock not alive while a whale is alive? All living things share many different traits. One way to consider something to be alive is if it has all of the traits shared by living organisms. For instance, the bodies of all living things are structured into cells, and use the same types of molecules to carry out functions inside of their cells. These cellular functions translate into everyday activities such as breathing, walking, flying, digesting food, etc.All living things have the ability to reproduce, or procreate. Mammals, like humans, do so by giving birth to live young while birds lay eggs that have to hatch and plants make seeds from which new plants can grow. All living things consume energy (they eat food), and use that energy for work, play, and growth. All living things exhibit “homeostasis,” which is the ability to maintain a steady internal environment regardless of their external environment. For example, most humans maintain a body temperature of 98.6 degrees Fahrenheit regardless of whether they are out playing in the snow or hiking in the hot desert. Homeostasis is achieved because of strict biochemical regulations in cells and organs.Living things also respond to stimuli (or changes in the environment). For example, when autumn comes, the leaves in many trees stop doing photosynthesis. The leaves then turn from green to brown and fall off, and the tree becomes dormant throughout winter. And all living things have the ability to adapt to their environment as it changes. For example, if there is a prolonged drought (or a period with little water), certain plants in a population will have the ability to survive it and others won’t. The ones that survive it pass on that ability to their offspring. Over time in a prolonged drought, the population of plants will be more adapted to its environment. We call this process natural selection, wherein the environmental pressures “select” for certain traits in a population.All life shares these aspects and abilities, from worms to birds to fish to tigers. Things that we don’t consider to be alive may have some of these traits, but not all of them. For example, a fire exhibits some of these traits. It consumes energy (wood and oxygen) and gives off by-products such as carbon dioxide and heat, it grows in size as it consumes more and more fuel, and may even appear to reproduce as it spreads. But because it doesn’t exhibit all of the traits of life, we don’t consider fire to be alive. Defining life from the viewpoint of examining its characteristics reveals how much life on Earth has in common, and helps distinguish between living and non-living things, which is important for learning if life could be possible beyond Earth.LS1.A: Structure and Function: All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1) ■ Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2) ■ In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3)LS1.B: Growth and Development of Organisms: Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2) ■ Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)LS1.C: Organization for Matter and Energy Flow in Organisms: Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6) ■ Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7)LS2.A: Interdependent Relationships in Ecosystems: Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) ■ In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1) ■ Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)LS2.B: Cycle of Matter and Energy Transfer in Ecosystems: Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)LS2.C: Ecosystem Dynamics, Functioning, and Resilience: Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)LS3.A: Inheritance of Traits: Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1) ■ Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)LS3.B: Variation of Traits: In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2) ■ In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)LS4.A: Evidence of Common Ancestry and Diversity: The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1) ■ Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2) ■ Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)LS4.B: Natural Selection: In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. (MS-LS4-5)LS4.C: Adaptation: Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)Crosscutting ConceptsPatterns ■ Patterns can be used to identify cause and effect relationships. (MS-LS4-2) ■ Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1, MS-LS4-3) ■ Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2) ■ Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4, MS-LS1-5, MS-LS4-5)Big Ideas: All living things have certain traits in common: Cellular organization, the ability to reproduce, growth & development, energy use, homeostasis, response to their environment, and the ability to adapt. Living things will exhibit all of these traits. Nonliving things may exhibit some, but not all, of these traits.Boundaries: For cellular organization, this grade band emphasizes the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions (MS-LS1-3.) *Evolution of species focuses on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures (MS-LS4-2)4-12 Finding Life beyond Earth, Activity 2: What is Life? Page 16. In this activity, students observe a number of objects, make a list of life’s characteristics, and develop a working definition of life. *Astrobiology in Your Classroom: Life on Earth….*and Elsewhere. Activity 1: What is Life? Activity 1 takes a close look at what characterizes life, and lays the groundwork to examine what life requires, what physical limits it can tolerate, and where it might be found in the solar system. 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Students estimate the increase in the mass of the DNA from an arsenic-loving bacterium in which phosphorus atoms have been replaced with arsenic. [Topics: integer math; percentages] do we know that something is alive? The answer seems obvious and intuitive, but when you ask that question in the context of searching for life on other planets, it becomes more difficult to pin down. In the unfamiliar environments of other planets, we need to find a way to distinguish between a phenomenon that isn’t alive as compared to one that is. One way to address this is by considering the characteristics of living things, which reveals how much all living things have in common. All life on Earth adheres to a common biochemistry. In all living things, cells are the main unit of organization, cellular membranes are made up of molecules called phospholipids, genetic information is made up of molecules called nucleic acids, and functions within and between cells are mostly carried out by molecules called proteins. This means that a fly has the same basic biochemistry as an elephant!Beyond this shared biochemistry, all life has certain general traits in common, too. Here are some of the key traits of life as we know it:1) All life is highly ordered and structured. Not only do all living things that we know of have cells and cellular structures, but many living things also have larger-scale structure such as bilateral symmetry (in humans) or radial symmetry (in starfish).2) All life reproduces itself, either sexually (as animals do) or asexually (such as budding in yeast or one cell splitting into two identical daughter cells via binary fission as bacteria do).3) All life grows and develops to reach maturity, such as from a caterpillar to a butterfly.4) All life takes in and utilizes energy to carry out the functions of its cells, which results in growth and development. Mechanisms for energy intake are vastly different across all species, and can range from eating food like humans do, to converting sunlight into sugars like plants do, to the harnessing of the energy produced when rocks radioactively decay like some bacteria do.5) All living things exhibit homeostasis, which is the ability to maintain a steady internal environment regardless of their external environment. For example, most humans maintain a body temperature of 98.6 degrees Fahrenheit regardless of whether they are out playing in the snow or hiking in the hot desert. Homeostasis is achieved because of strict biochemical regulations in cells and organs.6) All living things respond to their environment by sensing external stimuli and changing their biochemistry and/or behavior. For example, when cuttlefish sense danger, they can instantaneously change their colors to match whatever background they are against to avoid being seen by a predator.7) Finally, all living things adapt to external pressures, and evolve because of them. Adapting is much like responding to a stimulus in the environment, but takes it to the next level. In evolutionary adaptation, one cuttlefish will have the ability to change colors more quickly and effectively than another (because of its genetic makeup), and it will inherently be more likely to survive than another one that doesn’t do it as well or as quickly. The first one is more likely to pass on its genes to its offspring, and that offspring will pass it on to their offspring, and so on. Over time, the population of cuttlefish descended from that one who changed colors more quickly and effectively is more highly adapted to its environment. They have undergone the process of natural selection and are more likely to survive. Their genes were “selected for” by the external pressures of the environment.Something that is alive will exhibit all of these traits, while phenomena that we do not consider to be alive can exhibit some, but not all of them. For example, a fire exhibits some of these traits – it consumes energy (wood and oxygen) and gives off by-products such as CO~2~ and heat, it grows in size as it consumes more and more fuel, and it may appear to reproduce as it spreads. But because it doesn’t exhibit all of these traits, we don’t consider fire to be alive. Defining life from the viewpoint of examining its characteristics reveals how much life on Earth has in common, and helps distinguish between living and non-living things. If there is other life out there in the cosmos and it’s like the life that we know, then we would expect it to also show these traits of living things.LS1.A: Structure and Function: All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (HS-LS1-1)LS1.B: Growth and Development of Organisms: In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)LS1.C: Organization for Matter and Energy Flow in Organisms: The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5) The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6) As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6, HS-LS1-7)LS2.B: Cycles of Matter and Energy Transfer in Ecosystems: Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3)LS2.D: Social Interactions and Group Behavior: Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8)LS3.A: Inheritance of Traits: Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species’ characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)LS3.B: Variation of Traits: In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2) Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2, HS-LS3-3)LS4.A: Evidence of Common Ancestry and Diversity: Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1)LS4.B: Natural Selection: Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information — that is, trait variation — that leads to differences in performance among individuals. (HS-LS4-2, HS-LS4-3) The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)LS4.C: Adaptation: Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment’s limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2) Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3, HS-LS4-4) Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3) Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline – and sometimes the extinction – of some species. (HS-LS4-5) Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species’ evolution is lost. (HS-LS4-5)LS4.D: Biodiversity and Humans: Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (HS-LS2-7) Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7, HS-LS4-6)Crosscutting ConceptsStability and Change: Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6, HS-LS2-7)Big Ideas: All living things have certain traits in common: Cellular organization, the ability to reproduce, growth & development, energy use, homeostasis, response to their environment, and the ability to adapt. Living things will exhibit all of these traits. Nonliving things may exhibit some, but not all, of these traits.Boundaries: Grade level appropriate examples of maintenance of homeostasis include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels. (HS-LS1-3)4-12 Finding Life beyond Earth, Activity 2: What is Life? Page 16. In this activity, students observe a number of objects, make a list of life’s characteristics, and develop a working definition of life. Astrobiology Math. 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Through the Origin of Life module, students address questions such as: What is life? What is the evidence for early evolution of life on Earth? How did life begin? Sample lesson on the website and the curriculum is available for purchase. SETI. The Rules of Life. This podcast covers how we predict the phenotype, the structure, function and behavior of an organism, based on what we know about its genes and environment. If we can identify some of the basic rules of life across scales of time, space and complexity, we may be able to predict how cells, brains, bodies and biomes respond to changing environments. NSF. 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