I'm not a bot

Author: Rachel Baxter, MSc • Reviewer: Francesca Salvador, MSc Last reviewed: September 11, 2023 Reading time: 30 minutes There are over 200 different cell types in the human body. Each type of cells is specialised to carry out a particular function, either solely, but usually by forming a particular tissue. Different tissues then combine and form specific organs, where the organ is like a factory where every type of cell has its own job. Since every tissue has its own function that contributes to the multifunctionality of an organ, every type of cell is equally important. The most important types of cells are listed below. Key facts about the cell types in the human body Stem cells Embryonic stem cellsAdult stem cells Red blood cells Erythrocytes White blood cells Granulocytes (neutrophils, eosinophils, basophils)Agranulocytes (monocytes, lymphocytes) Platelets Fragments of megakaryocytes Nerve cells Neurons Neuroglial cells Muscle cells Skeletal Cardiac Smooth Cartilage cells Chondrocytes Bone cells Osteoblasts Osteoclasts Osteocytes Lining cells Skin cells Keratinocytes Melanocytes Merkel cells Langerhans cells Endothelial Lining blood vessels Epithelial cells Lining body cavities Fat cells White adipocytes Brown adipocytes Sex cells Spermatozoa Ova This article will discuss the histology of most important types of cells in the human organism. Before a cell becomes specialised, it first starts out as a stem cell. The unique feature of stem cells is that they are pluripotent - they have the potential to become any type of cell in the body. These incredible cells are the ancestors of all cells in the body, from simple skin cells to complex neurons. Without these cells, we wouldn't be as complex or functional as human beings. Not only this, these "magic" cells even have the power to replicate into healthy cells in order to speed up regeneration after certain pathological conditions. The process that allows stem cells to transform into any kind of cell is known as cell differentiation and is controlled by a combination of internal genetics and external factors such as chemicals and physical contact with other cells. Stem cells have the ability to divide and replicate themselves for long periods of time. There are two types of stem cells, embryonic stem cells and adult stem cells. Embryonic stem cells are from embryos. Generally used in a research setting, embryonic stem cells are harvested from fertilised eggs. Adult (or somatic) stem cells are present throughout the human body [amongst other specialised tissue cells]. They exist in order to repair and maintain surrounding specialised tissues. As these cells are unspecialised, stem cell anatomy is that of a simple cell. Stem cells have a cell membrane, surrounding the cytoplasm. The cytoplasm contains a nucleus, mitochondria, ribosomes, endoplasmic reticulum, golgi apparatus, lysosomes and centrioles. The nucleus contains DNA and RNA, which are expressed when differentiation occurs in the cell. Red blood cells are known as erythrocytes, and are the most common type of blood cell. They are shaped like a biconcave disc (I.e. donut shaped). They have a diameter of around 6 to 8 μm and have an average thickness of 2 μm, being 2.5 μm thick at their thickest point and 1 μm thick at the center. Red blood cells are fairly flexible, allowing them to squeeze through thin blood capillaries. The main role of red blood cells is to transport oxygen around the body using haemoglobin. However, they also help to control pH of the blood by forming an acid-base buffer maintaining the blood at a neutral pH of 7.35 to 7.45. They also release an enzyme called carbonic anhydrase, which causes water in the blood to carry carbon dioxide to the lungs, so that it can be expelled from the body. Haemoglobin is a molecule in red blood cells that binds to oxygen, allowing it to be transported through the blood. Haemoglobin is comprised of a heme molecule and a globin molecule. Heme molecules are formed from succinyl-CoA and glycine. Four of these molecules together bind with iron forming a heme molecule. This combines with a globin polypeptide chain forming a haemoglobin chain (also named globulin chain). Four of these chains together create a haemoglobin molecule. There are four different types of haemoglobin chains; alpha, beta, gamma and delta. The most common combination is two alpha chains and two beta chains, which form a haemoglobin A molecule. White blood cells, also known as leukocytes, are a vital component of the immune system. There are five different types, which fall under two main categories; granulocytes and agranulocytes. As suggested by their names, granulocytes contain granules in the cytoplasm as agranulocytes do not. Granulocytes include neutrophils, eosinophils and basophils. Agranulocytes include lymphocytes and monocytes. Neutrophils are the most common type of leukocyte, making up around 65% of all white blood cells. They are 12 to 14 μm in diameter, and contain a single nucleus. They contain few cell organelles and protein synthesis does not take place within them. Neutrophils originate in the bone marrow and circulate in the bloodstream for 6 to 10 hours, before entering the surrounding tissues. Once in the tissues, they destroy damaged cells and bacteria through phagocytosis, before self-destructing. Eosinophils are rare in the bloodstream. They are 12 to 17 μm in diameter and contain toxic proteins. Like neutrophils, they originate in the bone marrow and move into the bloodstream before entering loose connective tissue in the respiratory tract and intestines. Here they destroy antigen-antibody complexes using phagocytosis. The cells release the specialised enzymes histaminase and arylsulfatase B which are involved in the inflammatory response. Eosinophils also play a role in destroying bacteria, viruses and parasites that invade the body. Basophils are the rarest form of white blood cell and are involved in the body's defense against parasites. They are 14 to 16 μm in diameter. They accumulate at infected areas, releasing histamines, serotonin and prostaglandins to increase blood flow which causes an inflammatory response. Lymphocytes can be divided into two different types, B-cells and T-cells. Lymphocytes vary in size, with most being around 6 to 9 μm in diameter, and a tenth of them being 10 to 14 μm in diameter. The largest lymphocytes tend to be favored, and contain more cytoplasm, mitochondria and ribosomes than their smaller counterparts. Both B-cells and T-cells are involved in the adaptive immune response, but have different roles. Both originate from haematopoietic stem cells in the bone marrow. However, T-cells mature in the thymus gland between the lungs and in front of the heart. The thymus gland atrophies into fat as children become adults yet can still stimulate the maturation of T-cells. B-cells develop into plasma cells and are involved in the synthesis of antibodies which attack foreign antigens. T-cells are involved in the destruction of bacteria, viruses and other damaging cells such as cancer cells. The final type of white blood cells are the monocytes. These are as large as 20 μm in diameter. They have a large kidney bean shaped nucleus. Monocytes circulate in the bloodstream between one and three days before entering the tissues of the body where they become macrophages. Macrophages are large phagocytic cells that engulf and kill dead cells and bacterial cells. Learning the types of cells is tricky business! Practice your tissue identifiction skills with our free histology slide worksheets, quizzes and labeling diagrams. Just like the white and red blood cells, platelets also form an important component of the blood. Technically platelets are fragments of cells rather than true cells, but are vital in the control of bleeding. They are fragments of large cells called megakaryocytes which are produced in the bone marrow. They have surface proteins which allow them to bind to one another, and to bind to damaged blood vessel walls. Platelets are recruited when bleeding occurs, initiating a process known as hemostasis. They plug the source of the bleeding, coagulating and sticking together to form a blood clot, together with a fibrous protein known as fibrin. Megakaryocyte (histological slide) Learn everything about the blood cells with the following study unit and quiz. Nerve cells, commonly known as neurons, transmit information throughout the body in the form of electrical signals or nerve impulses. Structurally, neurons have four specific regions; the cell body, dendrites, the axon and axon terminals. The cell body contains a nucleus and is responsible for synthesising neural proteins. The axon is long and thin, and protrudes from the cell body like a tail and can be myelinated or unmyelinated. Axons are responsible for conducting electrical impulses in the form of action potentials, away from the cell body. Action potentials cause a change in voltage across the plasma membrane. Axons connect to other neurons via synapses, which are formed by small branches at the end of the axon called axon terminals. Impulses are received from other cells by dendrites, which are multiple branching structures protruding from the cell body. Neurons can have multiple, two or one dendrite(s) which makes them multipolar, bipolar or unipolar respectively. They convert chemical signals from the synapse into small electrical impulses, and transmit them towards the cell body. Electrical disturbance in the dendrites is transmitted to a structure called the axon hillock at the base of the axon, and with enough voltage, generates an action potential which moves down the axon and continues its course. Test your knowledge on the structure of the neuron with the quiz below! Neuroglial cells, more commonly known as glial cells or glia, are cells of the nervous system that are not involved in the conduction of nervous impulses. Glia are very common in the brain, outnumbering neurons at a ratio of 3 to 1. Glia are smaller than neurons, and do not have axons or dendrites. They have a variety of roles in the nervous system, they modulate synaptic action and rate of impulse propagation, they provide a scaffold for neural development, and aid recovery from neural injuries. There are four types of glial cells in the central nervous system; astrocytes, oligodendrocytes, microglial cells, and ependymal cells. Astrocytes are found in the brain and spinal cord, and have a starlike appearance. They are involved in the maintenance of the chemical environment required for neuron signalling. Oligodendrocytes are responsible for forming a lipid-rich myelin sheath around axons, increasing the speed at which action potentials are conducted. Microglial cells are very small and are involved in the removal of debris from sites of injury. Ependymal cells line the ventricles and central canal of the brain to produce cerebrospinal fluid. In the peripheral nervous system, Schwann cells are responsible for the myelination of axons and satellite cells regulate the neural cell environment. There are 3 types of muscle cells, known as myocytes, in the human body. These types are skeletal, cardiac and smooth muscle. Skeletal and cardiac muscle cells are known as striated, due to the aligned arrangement of myosin and actin proteins within them. Actin and myosin allow muscle contraction by sliding past one another, as described by sliding filament theory. Actin and myosin are arranged more randomly in smooth muscle cells, creating a smooth rather than striated appearance. Skeletal muscle cells are attached to bones and tendons and can reach up to 30 cm in length, although they are usually 2 to 3 cm long. Skeletal muscle cells are responsible for voluntary movements. They are multinucleated and comprise a sarcolemma (cell membrane), sarcoplasm (cytoplasm), myofibrils (actin and myosin), sarcosomes (mitochondria) and a sarcoplasmic reticulum, which is like the smooth endoplasmic reticulum of other cells. They also contain two proteins called troponin and tropomyosin which regulate the interaction between actin and myosin during contraction. The basic units of striated muscle cells comprising actin and myosin are known as sarcomeres. You've almost finished learning about the types of cells in the body - but what about the parts of a cell? Learn this topic easily and fuss-free using our handy diagams and cell quizzes! Cardiac muscle cells are also called cardiomyocytes which together make up the most important muscular tissue in the entire body, the tissue of the heart. Individually, they are about 0.02 mm wide and 0.1 mm long and linked together via gap junctions. The cells contract in unison creating the contractions of the heart. This is coordinated by nervous impulses which depolarises the cell membrane, spreading from cell to cell relatively quickly as the cells are very closely anchored via intercalated discs. Cardiomyocytes contain many sarcosomes to provide sufficient energy for contraction. Smooth muscle cells are responsible for involuntary contractions in hollow and visceral organs like the bladder and lungs, and the walls of blood vessels. They are responsible for peristalsis, whereby food is propelled through the digestive system via wavelike contractions. They are 10 to 600 μm long spindle-shaped cells and have a central nucleus. Smooth muscle cells are arranged in sheets allowing them to contract simultaneously. As they are smaller than cardiomyocytes and skeletal myocytes, they contain fewer cell organelles, and do not contain sarcomeres. Cartilage cells, also known as chondrocytes, make up cartilage, a firm tissue that is vital to the body's structure. Cartilage is found in joints between bones, in the ears and nose, in the airways as well as other locations. For example, cartilage can be found between the vertebrae in the spinal column. Chondrocytes produce and maintain the extracellular matrix of cartilage, comprising collagen, proteoglycan and elastin fibers. They lack blood vessels meaning that cartilage is repaired slower than other tissues, and nutrients have to be absorbed by diffusion from the tissue surrounding the cartilage, known as the perichondrium. Articular cartilage (cartilage found in synovial joints) differs from other cartilages since it does not contain perichondrium. Learn more and test your knowledge on the different types of cartilage with the following study unit and quiz! There are four types of bone cells in the body; osteoblasts, osteoclasts, osteocytes and lining cells. Osteoclasts are large multinucleated cells that are involved in bone resorption. This is where the bone is broken down during the process of renewal. Osteoclasts break down bone by forming sealed compartments on its surface, and releasing enzymes and acids. After they complete the process, they die by apoptosis (programmed cell death). Osteoblasts have the opposite function, they are involved in the generation of new bone. They are cuboidal in shape and have one central nucleus. They work by synthesising protein which forms the organic matrix of the bone. They are triggered to create new bone by hormones such as vitamin D and estrogen, and have specialised receptors on their surfaces which detect them. Osteocytes are cells that are found inside the bone. They have long branched structures protruding from them allowing cell to cell contact and access to the bone's surface. Osteocytes can sense mechanical strain being placed on the bone, and secrete growth factors which activate bone growth in response. The final type of bone cells are lining cells. These originate as osteoblasts before becoming flat in structure. As their name suggests, they line the surface of the bone and are responsible for the release of calcium from the bone into the bloodstream when it falls too low. Lining cells have receptors on their surfaces which are receptive to hormones and other chemicals that signify a need for bone growth and remodeling. They also work to protect the bone from chemicals in the blood which might be damaging to the bone's structure. Go through these resources to solidify your knowledge about bone tissue: There are many different types of cells in the epidermis (top layer) of the skin. The epidermis contains the following cell types: Keratinocytes: These cells make up 95% of the epidermis and are sometimes known as basal cells, as they are found in the basal layer of the epidermis. Keratinocytes generate the protein keratin, but are also important in protecting the body by blocking toxins and pathogens, and preventing loss of heat and moisture. They also stimulate inflammation and secrete inhibitory cytokines. The outermost layer of epidermis is formed by keratinized epithelial cells which are responsible for forming the protective barrier. Hair and nails are examples of fully keratinized epithelial cells. Melanocytes: The role of melanocytes in the skin is to produce the pigment melanin, which determines skin coloration. Langerhans cells: These are dendritic cells involved in antigen processing when the skin becomes infected, they act as antigen-processing cells. They contain large organelles known as Birbeck granules, but the exact function of these is still unknown. Merkel cells: These act as mechanosensory cells and are involved in touch reception (the ability to feel). Other types of sensory cells are present within the skin, however are found in the deeper layers and known as cutaneous receptors. Why not test your knowledge of the skin with some quiz questions? Endothelial cells are the cells that form the lining of blood vessels. They are flat in structure, and are between 1 and 2 μm thick. They have a central nucleus, and are connected to one another via intercellular junctions. Endothelial cells are highly adaptable, being able to migrate and adjust their numbers and arrangements to accommodate the body's needs. This allows growth and repair of body tissues, as new blood vessel networks can easily form. As well as healthy body tissues, cancer cells also rely on endothelial cells and blood vessels to survive As a result, a lot of research is focused on preventing the formation of blood vessels in cancerous tissues. Endothelial cells express different surface proteins, depending on whether they are forming veins or arteries. Epithelial cells make up the linings of cavities in the body such as the lungs, small intestine and stomach. They are joined to one another forming sheets called epithelia, and are connected by tight junctions, adherens, desmosomes and gap junctions. Tight junctions are unique to epithelial cells and form the closest type of junction between any cell type in the body. They are supported by a basement membraneknown as a basal lamina, which covers a capillary bed. The nucleus of an epithelial cell is found close to the basal lamina, towards the bottom of the cell. Epithelial cells are innervated with nerve endings, and can become sensory cells, detecting stimuli such as scent. Epithelial cells can also specialise to become secretory cells, that release mucous, hormones and enzymes into the body. These cells contain vesicles of hormones or enzymes ready to be released. Specialised secretory epithelial cells include goblet cells and paneth cells in the intestines, which secrete mucous and antibacterial proteins respectively. Quiz yourself to reinforce what you have learned about the epithelial cells. Fat cells, also referred to as adipocytes and lipocytes are the cells of the body that are specialised to store energy in the form of adipose tissue, or fat. There are two types of fat cell, white fat cells and brown fat cells. White fat cells, or unilocular cells, are vacuolar cells that contain a lipid droplet and cytoplasm. They have a nucleus which is flat and at the edge of the cell, rather than the centre. White fat cells vary in size, but on average they are around 0.1 mm in diameter. The fat inside white fat cells is mainly made up of triglycerides and cholesteryl ester, and is stored in semi-liquid form. Brown fat cells, or multilocular cells, have multiple vacuoles and are shaped like polygons. They contain more cytoplasm that white fat cells, and fat droplets are scattered throughout them. The nucleus is not flattened but round, and is found randomly positioned towards the centre of the cell. The key role of brown fat is to generate heat energy, and therefore the cells contain many mitochondria, which give them their brownish coloration. Sexual reproduction is the result of the fusion of two different types of sex cells called gametes. Male sex cells are commonly known as sperm cells, or spermatozoa, and female gametes are known as eggs or ova. When they fuse together, fertilization occurs and a zygote is formed. Spermatozoa and ova are structurally very different from one another. Spermatozoa are smaller, being about 50 μm long, and have a head, a midpiece region and a long tail (flagellum) for propulsion and motility. The head contains an acrosome, which is a type of covering filled with enzymes that enable penetration of the female ovum during fertilisation. The head of the cell contains a nucleus that is densely packed with DNA, with little cytoplasm present. The midpiece region of the cell contains mitochondria which provide the energy required for locomotion. Ova are very large compared to other cell bodies, being as large as 0.2 mm in diameter. They are round in shape and are produced in the ovaries during embryological development. The cell itself comprises a nucleus, cytoplasm, the zona pellucida and the corona radiata. The zona pellucida is a membrane that surrounds the cell membrane of the cell, and the corona radiata forms protective layers which surround the zona pellucida. During the process of fertilization, the spermatozoa binds with the ovum at the zona pellucida. After, the penetration of the spermatozoa and the release of its contents into the ovum can then occur (acrosome reaction). Stem cells are pluripotent cells that have the potential to become any type of cell in the body through a process called differentiation. Stem cells have the ability to divide and replicate themselves for long periods of time. There are two types of stem cells, embryonic stem cells, and adult stem cells. Red blood cells are known as erythrocytes and are the most common type of blood cell. They are shaped like a biconcave disc. The main role of red blood cells is to transport oxygen around the body using hemoglobin. White blood cells, also known as leukocytes, are a vital component of the immune system. There are five different types, which fall under two main categories; granulocytes and agranulocytes. As suggested by their names, granulocytes contain granules in the cytoplasm as agranulocytes do not. Granulocytes include neutrophils, eosinophils, and basophils. Agranulocytes include lymphocytes and monocytes. Platelets are fragments of cells rather than true cells but are vital in the control of bleeding. They are fragments of large cells called megakaryocytes. They have surface proteins that allow them to bind to one another, and to bind to damaged blood vessel walls. Nerve cells, commonly known as neurons, transmit information throughout the body in the form of electrical signals or nerve impulses. Structurally, they have four specific regions; the cell body, dendrites, the axon and axon terminals. Neurons can have multiple, two or one dendrite(s) which makes them multipolar, bipolar or unipolar respectively. Neuroglial cells, more commonly known as glial cells or glia, are cells of the nervous system that modulate synaptic action and rate of impulse propagation, provide a scaffold for neural development, and aid recovery from neural injuries. There are four types of glial cells in the central nervous system; astrocytes, oligodendrocytes, microglial cells, and ependymal cells. There are 3 types of muscle cells, known as myocytes, in the human body. These types are skeletal, cardiac and smooth muscle. Skeletal and cardiac muscle cells are known as striated, due to the aligned arrangement of myosin and actin proteins within them. Actin and myosin allow muscle contraction by sliding past one another, as described by sliding filament theory. Cartilage cells, also known as chondrocytes, make up cartilage, a firm tissue that is vital to the body's structure. Chondrocytes produce and maintain the extracellular matrix of cartilage, comprising collagen, proteoglycan and elastin fibers. There are four types of bone cells in the body; osteoblasts, osteoclasts, osteocytes, and lining cells. Osteoclasts are large multinucleated cells that are involved in bone resorption. Osteoblasts have the opposite function, they are involved in the generation of new bone. Osteocytes can sense mechanical strain being placed on the bone, and secrete growth factors that activate bone growth in response. Lining cells line the surface of the bone and are responsible for the release of calcium from the bone into the bloodstream when it falls too low. There are many different types of cells in the epidermis (top layer) of the skin. The epidermis contains many types of cells, including keratinocytes, melanocytes, Langerhans cells, and Merkel cells. Endothelial cells are the cells that form the lining of blood vessels and are connected to one another via intercellular junctions. Endothelial cells are highly adaptable, being able to migrate and adjust their numbers and arrangements to accommodate the body's needs. Epithelial cells make up the linings of cavities in the body, forming sheets called epithelia. They are connected by tight junctions, adherens, desmosomes and gap junctions. Fat cells, also referred to as adipocytes and lipocytes, are the cells of the body that are specialized to store energy in the form of adipose tissue, or fat. There are two types of fat cells, white fat cells and brown fat cells. Sexual reproduction is the result of the fusion of two different types of sex cells called gametes. Male sex cells are commonly known as sperm cells or spermatozoa, and female gametes are known as eggs or ova. When they fuse together, fertilization occurs and a zygote is formed. All content published on Kenhub is reviewed by medical and anatomy experts. The information we provide is grounded on academic literature and peer-reviewed research. Kenhub does not provide medical advice. You can learn more about our content creation and review standards by reading our content quality guidelines.

References: A. Mandal: What is Cartilage? News medical (accessed 2nd August 2016) B. Alberts, A. Johnson, J. Lewis, et al.: Molecular Biology of the Cell, 4th Edition, Garland Science (2002) D. Purves, G. J. Augustine, D. Fitzpatrick, et al.: Neuroscience, 2nd Edition, Sinauer Associates (2001) E. A. Woodcock, S. J. Matkovich: Cardiomyocytes structure, function and associated pathologies (accessed 1st August 2016) H. Lodish, A. Berk, S. L. Zipursky, et al.: Molecular Cell Biology, 4th Edition, W. H. Freeman (2000) J. McGeachie: Endothelial Cells. The University of Western Australia School of Anatomy and Human Biology (accessed 2nd August 2016) J. P. Whickson: What is the Structure of Stem Cells? Cuteness (accessed 3rd August 2016) J. N. George: Platelets. The Latest Information on TTP, ITP and Drug-Induced Thrombocytopenia (accessed 3rd August 2016) Keratinocytes. Keratinocyte transfection (accessed 2nd August 2016) M. Cichorek, M. Wachulska, A. Stasiewicz, et al.: Skin Melanocytes. biology and development. Advances in Dermatology and Allergology (2013), volume 30, issue 1, p. 30-41 M. Harms, P. Seale: Brown and beige fat: development, function and therapeutic potential. Nature Medicine (2013), volume 19, p. 1252-1263 M. J. Oursler, T. Bellido: Bone Cells. ASBMR Bone Curriculum (accessed 2nd August 2016) M. P. Gaidhu, R. B. Ceddia: The Role of Adenosine Monophosphate Kinase in Remodeling the White Adipose Tissue Metabolism. Exercise and Sports Science Reviews (2011), volume 39, issue 2, p. 102-108 R. Bailey: Sex Cells. About Education (accessed 2nd August 2016) S. Maksimovic, M. Nakatani, Y. Baba, et al.: Epidermal Merkel cells are mechanosensory cells that tune mammalian touch receptors. Nature (2014), volume 509, issue 7502, p. 617-621 White Blood Cells. University of Leeds Histology Guide (accessed 3rd August 2016) Illustrators: Sperm & Egg photo - Photo via TBIT via VisualHunt Types of cells in the human body: want to learn more about it? Our engaging videos, interactive quizzes, in-depth articles and HD atlas are here to get you top results faster. What do you prefer to learn with? "I would honestly say that Kenhub cut my study time in half." – Read more. Kim Bengochea, Regis University, Denver See also: Cell type Part of a series of lists aboutHuman anatomy General Features Regions Variations Movements Systems Structures Arteries Bones Eponymous Foramina Glands endocrine exocrine Lymphatic vessels Nerves Organs Systems Veins Muscles Abductors Adductors Depressors Elevators Extensors Flexors Rotators external internal See also Glossary of medicine Epithelia Anatomical terminology Index of anatomy articles Outline of human anatomy Cell types by origin vte The list of human cell types provides an enumeration and description of the various specialized cells found within the human body, highlighting their distinct functions, characteristics, and contributions to overall physiological processes. Cells may be classified[1] by their physiological function, histology (microscopic anatomy),[2] lineage, or gene expression. The adult human body is estimated to contain about 30 trillion (3×1013) human cells,[citation needed] with the number varying between 20 and 100 trillion depending on factors such as sex, age, and weight. Additionally, there are approximately an equal number of bacterial cells. The exact count of human cells has not yet been empirically measured in its entirety and is estimated using different approaches based on smaller samples of empirical observation.[3][4][5][6][7][8][9] It is generally assumed that these cells share features with each other and thus may be organized as belonging to a smaller number of types.[10][11] As a definition of "cell type" is yet to be agreed, it is not possible yet to arrive at a precise number of human cell types.[12] There is, for example, significant variation in these cell types depending on the specific surface proteins they possess. An extensive listing of human cell types was published by Vickaryous and Hall in 2006, collecting 411 different types of human cells (with 145 types of neuron among those).[11] The Human Cell Atlas project, which started in 2016, had as one of its goals to "catalog all cell types (for example, immune cells or brain cells) and sub-types in the human body".[13] By 2018, the Human Cell Atlas description based the project on the assumption that "our characterization of the hundreds of types and subtypes of cells in the human body is limited", but the word hundreds was removed in later versions.[14][13] On 2021, Stephen Quake guessed that the upper limit of the number of human cell types would be around 6000, based on a reasoning that "if biologists had discovered only 5% of cell types in the human body, then the upper limit of cell types to discover is somewhere around 6000 (i.e., 300/0.05)."[10] Other different efforts have used different numbers. A count of cells in the human body published in 2023 divided the cells in about 400 types to perform the calculation.[4] The main cellular components of the human body by count[6] Cell type % cell count Erythrocytes (red blood cells) 84.0 Platelets 4.9 Bone marrow cells 2.5 Vascular endothelial cells 2.1 Lymphocytes 1.5 Hepatocytes 0.8 Neurons and glia 0.6 Bronchial endothelial cells 0.5 Epidermal cells 0.5 Respiratory interstitial cells 0.5 Adipocytes (fat cells) 0.2 Dermal fibroblasts 0.1 Muscle cells 0.001 Other cells 2.0 In 1996, scientists revealed a 'map' of 16,000 human genes.[15] This led to estimates that humans likely had around 100 000 genes[16] (or regions that code for human proteins). However, actual sequencing did not start before around 1999, and it was not until 2003[17] that the first complete draft of a human genome revealed that there was roughly 20000-25000 protein-coding genes, as most DNA does not code for any protein. It is difficult to say that there have not been similar mistakes when estimating how many cells humans have as there are still substantial gaps in understanding human cells.[citation needed] Several efforts have been made to make a list or a map of all human cells.[18][19][20] One of the largest and most recent is the HuBMAP (Human BioMolecular Atlas Program).[21] The HuBMAP project has organized 1551 different samples in 17 collections, each dedicated to a different system. However, this project still only mapped about 31 of the human bodies' 70 organs. Their datasets and visualisations place great emphasis on biomarkers and location in the body, but less on cell development and how cells can change over time. Usually specific surface proteins are used to identify cells, and based on this they are put into different categories. Another major effort to make an overview of these proteins that allows us to observe cell types is the Human Protein Atlas.[22] A similar project, the Human Brain Project has also attempted to map the human brain, although much of the publicly accessible model does not have cellular resolution.[23][24] So far not all cells which can be found in the human body have been documented. There is no good way to make the experiment where one checks if all cell types identified so far could be taken from and measured in a single donor, proving that the cell types are universal to all humans. This is partly due to a lack of standards, as scientists are still not entirely sure what is needed to measure, in order to capture every cell type which can be found.[citation needed] Some attempts have been made – and some are still in progress– for creating standards for identifying cells consistently.[25][26][27] The Cell Ontology provides arguably the most comprehensive metadata standard to date, cataloging over 2500 cell classes and being used actively by the Human Cell Atlas community.[28] There is still no standard which is used industry wide, nor any definitions which have been accepted by the wider scientific community. Often making it difficult to say whether some collected and observed cells are really one or multiple types of cells. This lack of standards makes it difficult to estimate how many cell types and how many of each cell types can be found in the human body, as well as difficult to predict which young cells one would need to develop with mature cells. The list on this Wikipedia article also suffers to some inconsistencies due to multiple sources using different conventions.[citation needed] This section needs expansion. You can help by adding to it. (April 2024) Cell type Develops from Tissue of origin [citation needed] Function Group [29] Subgroup Germ layer of origin Biomarkers Brunner's gland cell crypt basal stem cells in duodenum, duodenal submucosa[citation needed] enzyme and alkaline mucus secretion Exocrine secretory epithelial cells Endoderm Insulated goblet cell respiratory and digestive tracts mucus secretion Foveolar cell stomach Chief cell pepsinogen secretion Parietal cell hydrochloric acid secretion Pancreatic acinar cell pancreas bicarbonate and digestive enzyme secretion Paneth cell small intestine lysozyme secretion Type II pneumocyte lungs surfactant secretion Club cell Type I pneumocyte formation of the Blood-Gas Barrier Barrier cell Gall bladder epithelial cell gall bladder Centroacinar cell pancreas Intestinal brush border cell (with microvilli) K cell gastric inhibitory peptide secretion Hormone-secreting cells Enteroendocrine cell L cell glucagon-like peptide-1, peptide YY3-36, oxyntomodulin, and glucagon-like peptide-2) secretion I cell cholecystokinin (CCK) secretion G cell gastrin secretion Enterochromaffin cell serotonin secretion Enterochromaffin-like cell histamine secretion N cell neurotensin secretion S cell secretin secretion D cell somatostatin secretion Mo cell (or M cell) motilin secretion other hormones secreted: vasoactive intestinal peptide, substance P, alpha and gamma-endorphin, bombesin Thyroid epithelial cell Thyroid gland cells Parafollicular cell Parathyroid chief cell Parathyroid gland cells Oxyphil cell Alpha cell glucagon secretion Pancreatic islets (islets of Langerhans) Beta cell insulin and amylin secretion Delta cell somatostatin secretion Epsilon cell ghrelin secretion PP cell (gamma cell) pancreatic polypeptide secretion Salivary gland mucous cell Exocrine secretory epithelial cells Ectoderm Salivary gland serous cell Von Ebner's gland cell in tongue (washes taste buds) Mammary gland cell (milk secretion) Lacrimal gland cell (tear secretion) Ceruminous gland cell in ear (earwax secretion) Eccrine sweat gland dark cell (glycoprotein secretion) Eccrine sweat gland clear cell (small molecule secretion) Apocrine sweat gland cell (odoriferous secretion, sex-hormone sensitive) Gland of Moll cell in eyelid (specialized sweat gland) Sebaceous gland cell (lipid-rich sebum secretion) Bowman's gland cell in nose (washes olfactory epithelium) Corticotropes Hormone-secreting cells Anterior/Intermediate pituitary cells Gonadotropes Anterior/Intermediate pituitary cells Lactotropes Anterior/Intermediate pituitary cells Melanotropes Anterior/Intermediate pituitary cells Somatotropes Anterior/Intermediate pituitary cells Thyrotropes Anterior/Intermediate pituitary cells Magnocellular neurosecretory cells secrete oxytocin and vasopressin Parvocellular neurosecretory cells secrete thyrotropin-releasing hormone (TRH), corticotropin-releasing hormone (CRH), vasopressin, oxytocin, neurotensin, and prolactin Chromaffin cells (adrenal gland) Keratinocyte Epithelial cells Epidermal basal cell (stem cell) Melanocyte Trichocyte Medullary hair shaft cell Trichocyte Cortical hair shaft cell Trichocyte Cuticular hair shaft cell Trichocyte Huxley's layer hair root sheath cell Trichocyte Henle's layer hair root sheath cell Trichocyte Outer root sheath hair cell Trichocyte Surface epithelial cell cornea, tongue, mouth, nasal cavity, distal anal canal, distal urethra, and distal vagina basal cell (stem cell) cornea, tongue, mouth, nasal cavity, distal anal canal, distal urethra, and distal vagina Striated duct cell (salivary glands) Lactiferous duct cell (mammary glands) Ameloblast (deposit tooth enamel) Odontoblast (tooth dentin formation) Oral cells Cementoblast (tooth cementum formation) Auditory inner hair cells of organ of Corti Sensory transducer cells Auditory outer hair cells of organ of Corti Basal cells of olfactory epithelium Cold-sensitive primary sensory neurons Heat-sensitive primary sensory neurons Merkel cells of epidermis Olfactory receptor neurons Pain-sensitive primary sensory neurons Photoreceptor rod cells Photoreceptor cells of retina in eye Photoreceptor blue-sensitive cone cells of eye Photoreceptor cells of retina in eye Photoreceptor green-sensitive cone cells of eye Photoreceptor cells of retina in eye Photoreceptor red-sensitive cone cells of eye Photoreceptor cells of retina in eye Proprioceptive primary sensory neurons Touch-sensitive primary sensory neurons Chemoreceptor glomus cells of carotid body cell (blood pH sensor) Outer hair cells of vestibular system of ear (acceleration and gravity) Inner hair cells of vestibular system of ear Taste receptor cells of taste bud Cholinergic neurons (various types) Autonomic neuron cells Adrenergic neural cells (various types) Peptidergic neural cells (various types) Inner pillar cells of organ of Corti Sense organ and peripheral neuron supporting cells Outer pillar cells of the organ of Corti Inner phalangeal cells of organ of Corti Outer phalangeal cells of organ of Corti Border cells of organ of Corti Hensen's cells of organ of Corti Vestibular apparatus supporting cells Taste bud supporting cells Olfactory epithelium supporting cells Olfactory ensheathing cells Schwann cells Satellite glial cells Enteric glial cells Basket cells Central nervous system neurons and glial cells Neuron Interneurons Cartwheel cells Interneurons Stellate cells Interneurons Golgi cells Interneurons Granule cells Interneurons Lugaro cells Interneurons Unipolar brush cells Interneurons Martinotti cells Interneurons Chandelier cells Interneurons Cajal–Retzius cells Interneurons Double-bouquet cells Interneurons Neurogliaform cells Interneurons Retina horizontal cells Interneurons Starburst amacrine cells Interneurons - > Amacrine cells Renshaw cells Interneurons - >Spinal interneurons Spindle neurons Principal cells Fork cells Principal cells Place cells Principal cells-> Pyramidal cells Grid cells Principal cells-> Pyramidal cells Speed cells Principal cells-> Pyramidal cells Head direction cells Principal cells-> Pyramidal cells Betz cells Principal cells-> Pyramidal cells Boundary cells Principal cells->Stellate cells Bushy cells Principal cells Purkinje cells Principal cells Medium spiny neurons Principal cells Astrocytes Oligodendrocytes Tanycytes Ependymal cells Pituicytes Anterior lens epithelial cell Lens cells Crystallin-containing lens fiber cell White fat cell Right atrium, atrioventricular junction, left atrium, left ventricle, right ventricle, epicardium Myocardium, atriventricular node Metabolism and storage cells Adipocytes Mesoderm (gene:)FASN, GPAM, LEP,[30] Brown fat cell Liver lipocyte Cells of the Zona glomerulosa produce mineralocorticoids Secretory cells Cells of the adrenal cortex Cells of the Zona fasciculata produce glucocorticoids Cells of the zona reticularis produce androgens Theca Interna cell ovarian follicle secreting estrogen Corpus luteum cell ruptured ovarian follicle secreting progesterone Granulosa lutein cells Corpus luteum cell Theca lutein cells Leydig cell testes secreting testosterone Seminal vesicle cell (secretes seminal fluid components, including fructose for swimming sperm) Prostate gland cell (secretes seminal fluid components) Bulbourethral gland cell (mucus secretion) Bartholin's gland cell (vaginal lubricant secretion) Gland of Littré cell (mucus secretion) Uterus endometrium cell (carbohydrate secretion) Juxtaglomerular cell (renin secretion) Macula densa cell kidney Peripolar cell Mesangial cell Parietal epithelial cell Urinary system Barrier cells Podocyte Proximal tubule brush border cell Loop of Henle thin segment cell Kidney distal tubule cell Principal cell Kidney collecting duct cell Intercalated cell Epithelial / Barrier cells Mesoderm Transitional epithelium urinary bladder Barrier cells Mesoderm Duct cell seminal vesicle, prostate gland, and similar Reproductive system Barrier cells Efferent ducts cell Epididymal principal cell Epididymal basal cell Endothelial cells circulatory system ABCC9, KCNJ8, RGS5 Planum semilunar epithelial cell of vestibular system of ear (proteoglycan secretion) Extracellular matrix cells Organ of Corti interdental epithelial cell (secreting tectorial membrane covering hair cells) Loose connective tissue fibroblasts Corneal fibroblasts (corneal keratocytes) Tendon fibroblasts Bone marrow reticular tissue fibroblasts Other nonepithelial fibroblasts Hepatic stellate cell (Ito cell) liver Pericyte Nucleus pulposus cell intervertebral disc Hyaline cartilage chondrocyte Fibrocartilage chondrocyte Elastic cartilage chondrocyte Osteoblast/osteocyte Osteoprogenitor cell Hyalocyte vitreous body of eye Stellate cell Pancreatic stellate cell Red skeletal muscle cell (slow twitch) Contractile cells Skeletal muscle cells White skeletal muscle cell (fast twitch) Intermediate skeletal muscle cell Nuclear bag cell muscle spindle Nuclear chain cell muscle spindle Myosatellite cell (stem cell) Cardiac muscle cell Cardiac muscle cells SA node cell Purkinje fiber cell Smooth muscle cell (various types) iris Myoepithelial cell exocrine glands Erythrocyte (red blood cell) erythroblasts Blood and immune system cells Megakaryocyte Platelets if considered distinct cells, currently there's debate on the subject. Monocyte (white blood cell) Connective tissue macrophage (various types) Epidermal Langerhans cell Osteoclast in bone Dendritic cell Microglial cell central nervous system Neutrophil granulocyte myeloblast, promyelocyte, myelocyte, metamyelocyte Eosinophil granulocyte myeloblast, promyelocyte, myelocyte, metamyelocyte Basophil granulocyte myeloblast, promyelocyte, myelocyte, metamyelocyte Mast cell Helper T cell Regulatory T cell Cytotoxic T cell Natural killer T cell B cell(/lymphocyte) Left atrium, left ventricle, septum, right ventricle, epicardium Myocardium Plasma cell Natural killer cell Hematopoietic stem cells and committed progenitors for the blood and immune system (various types) Oogonium/oocyte Germ cells Spermatid Spermatocyte Spermatogonium cell Spermatozoon Granulosa cell In the ovaries Nurse cells Sertoli cell In the testis Epithelial reticular cell In the thymus Interstitial kidney cells Kidney Interstitial cells The above dataset provides a nested list of cell groups with over 400 human cell types with cell count, cell size, and aggregate cell mass (biomass). See Dataset S1, Cell Group by Subgroup Tab, in this reference.[3] Name Provider Sources of revenue/sponsors Scope Amount of cells identified so far HubMap[31] A series of US based universities Unknown ~1200 Human Cell Atlas Columbia University Medical Center at Columbia University Chan Zuckerberg Initiative 37 trillion cells CellXgene[32] Chan Zuckerberg Initiative[33] The endodermal cells primarily generate the lining and glands of the digestive tube.[34] There are nerve cells, also known as neurons, present in the human body. They are branched out. These cells make up nervous tissue. A neuron consists of a cell body with a nucleus and cytoplasm, from which long thin hair-like parts arise.[citation needed] List of human cell types derived from the germ layers Human Cell Atlas Cell Ontology List of organs of the human body List of human microbiota

^ Zeng H (July 2022). "What is a cell type and how to define it?". Cell. 185 (15): 2739–2755. doi:10.1016/j.cell.2022.06.031. PMC 9342916. PMID 35868277. ^ Khan YS, Farhana A (May 2023). "Histology, Cell". StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. PMID 32119269. ^ a b Hatton IA, Galbraith ED, Merleau NS, Miettinen TP, Smith BM, Shander JA (September 2023). "The human cell count and size distribution". Proceedings of the National Academy of Sciences of the United States of America. 120 (39): e2303077120. Bibcode:2023PNAS..12003077H. doi:10.1073/pnas.2303077120. PMC 10523466. PMID 37722043. ^ a b "Mapping the human body one cell at a time: New study reveals the intricate relationship between cell size and count". News-Medical.net. 2023-09-19. Retrieved 2023-10-18. ^ Max Planck Society. "Cellular cartography: Charting the sizes and abundance of our body's cells reveals mathematical order underlying life". medicalxpress.com. Retrieved 2023-10-18. ^ a b Sender R, Fuchs S, Milo R (August 2016). "Revised Estimates for the Number of Human and Bacteria Cells in the Body". PLOS Biology. 14 (8): e1002533. doi:10.1371/journal.pbio.1002533. PMC 4991899. PMID 27541692. ^ Hewings-Martin Y (12 July 2017). "How many cells are in the human body?". Medical News Today. Retrieved 28 June 2023. ^ Zimmer C (23 October 2013). "How Many Cells Are In Your Body?". National Geographic. Archived from the original on April 3, 2021. Retrieved 29 June 2023. ^ Martinez-Martin D (2022-02-15). "Dynamics of cell mass and size control in multicellular systems and the human body". Journal of Biological Research - Thessaloniki: Vol 29 (2022). doi:10.26262/JBRT.V29I0.8600. ^ a b Quake SR (December 2021). "The cell as a bag of RNA". Trends in Genetics. 37 (12): 1064–1068. doi:10.1016/j.tig.2021.08.003. PMID 34462156. ^ a b Vickaryous MK, Hall BK (August 2006). "Human cell type diversity, evolution, development, and classification with special reference to cells derived from the neural crest". Biological Reviews of the Cambridge Philosophical Society. 81 (3): 425–455. doi:10.1017/S1464793106007068. PMID 16790079. ^ "What Is Your Conceptual Definition of 'Cell Type' in the Context of a Mature Organism?". Cell Systems. 4 (3): 255–259. March 2017. doi:10.1016/j.cels.2017.03.006. PMID 28334573. ^ a b "HCA – Human Cell Atlas". 2022-10-01. Archived from the original on 2022-10-01. Retrieved 2024-06-14. ^ "Human Cell Atlas - Human Cell Atlas". 2018-08-29. Archived from the original on 2018-08-29. Retrieved 2024-06-14. ^ "The Human Transcript Map". www.ncbi.nlm.nih.gov. Retrieved 2024-04-23. ^ Amaral P, Carbonell-Sala S, De La Vega FM, Faial T, Frankish A, Gingeras T, et al. (October 2023). "The status of the human gene catalogue". Nature. 622 (7981): 41–47. arXiv:2303.13996. Bibcode:2023Natur.622...41A. doi:10.1038/s41586-023-06490-x. PMC 10575709. PMID 37794265. ^ "Why the human genome was never completed". www.bbc.com. Retrieved 2024-04-23. ^ "Home". humancellatlas.org. Retrieved 5 May 2023. ^ "NIH to build a detailed map of cells within the human body". National Institutes of Health (NIH). 26 September 2018. Retrieved 5 May 2023. ^ Davis D. "The ambitious quest to map every cell in our body". BBC. Retrieved 5 May 2023. ^ "The HuBMAP Human BioMolecular Atlas Program". HuBMAP Consortium. Retrieved 5 May 2023. ^ "The Human Protein Atlas". www.proteinatlas.org. Retrieved 19 July 2023. ^ "Siibra Explorer". atlases.ebrains.eu. Retrieved 2023-07-02. ^ "Medical Data Analytics". The Human Brain Project. Retrieved 2 July 2023. ^ Lubiana T, Roncaglia P, Mungall CJ, Quardokus EM, Fortriede JD, Osumi-Sutherland D, et al. (2022). Guidelines for reporting cell types: the MIRACL standard (Preprint). arXiv:2204.09673. ^ Ascoli GA, Alonso-Nanclares L, Anderson SA, Barrionuevo G, Benavides-Piccione R, Burkhalter A, et al. (July 2008). "Petilla terminology: nomenclature of features of GABAergic interneurons of the cerebral cortex". Nature Reviews. Neuroscience. 9 (7): 557–568. doi:10.1038/nrn2402. hdl:10261/36813. PMC 2868386. PMID 18568015. ^ "Home". www.humancellatlas.org. Retrieved 2024-04-23. ^ Osumi-Sutherland D, Xu C, Keays M, Levine AP, Kharchenko PV, Regev A, et al. (November 2021). "Cell type ontologies of the Human Cell Atlas". Nature Cell Biology. 23 (11): 1129–1135. arXiv:2106.14443. doi:10.1038/s41556-021-00787-7. PMID 34750578. ^ The organization of the cell types in a hierarchy of groups and subgroups is done for organization purposes and does not conform to any particular standard. ^ "CCF ASCT+B Reporter". Hubmap Consortium. ^ "The Human BioMolecular Atlas Program (HuBMAP)". commonfund.nih.gov. 5 January 2017. Retrieved 2023-07-12. ^ "CellGuide Cell Types and Cell Tissues - CZ CELLxGENE". Cellxgene Data Portal. Retrieved 2024-07-05. ^ "Behind the scenes of Chan Zuckerberg CELLxGENE". Chan Zuckerberg Initiative. Retrieved 2024-07-05. ^ Gilbert SF (2000). "Endoderm". Developmental Biology (6th ed.). Sinauer Associates. ISBN 978-0-87893-243-6. Wikimedia Commons has media related to Human cells. Human Cell Tree Map Human Cell Atlas Retrieved from " Chances are, at this point in your courses you're oh-so-familiar with the structure of eukaryotic cells – and if not, here's a fantastic primer for you. What you may have noticed, though, is that most cell-structure diagrams look pretty basic. You've got your circular animal cells, your more angular plant cells and all the organelles within the cell membrane. Well, not surprisingly, those diagrams – while accurate! – don't tell the whole story. The truth is that cells come in all different shapes and sizes. And, especially in multicellular organisms like animals and plants, cells can look (and act) drastically different from each other. Makes sense, right? You wouldn't expect the cells that make up a flower petal, for instance, to look and act the same as the cells that make up the plant's roots. Similarly, your skin cells, for example, would look drastically different than, say, your liver cells – because those two cells have very different functions in the human body. That's where _cell specialization_ comes in. Cell specialization allows new cells to develop into a range of different tissues, all of which work together to make living organisms function as a whole. The process of cell specialization – exactly how cells develop into their diverse forms – is complex. There are hundreds of specific cell types in the body that arise from the very basic and general type cells called stem cells. All of the specialized cells in the body come from the same originating tissue: the group of _stem cells_ that make up the earliest stages of an embryo. Stem cells are a unique type of cell, because, while they're immature cells without any specialization, they can follow a developmental "blueprint" to develop into the thousands of unique cell types found throughout your body. There are different types of stem cells, separated by how many tissues they can develop into. The stem cells found in an embryo, for instance, can develop into any tissue type – which is how you go from a single stem cell to a fully formed human baby. Adult stem cells, like the stem cells found in your bone marrow, can only develop into a handful of mature cell types. But the bottom line is that all stem cells are non-specialized "precursor" cells that can develop into at least one mature cell type. Stem cells develop into mature tissues through a process called differentiation. To understand how differentiation works, think back to the cell-communication concepts you learned in your biology classes. Cell communication works in three stages. A reception phase, in which special receptors on the cell's surface receive some kind of signal from the environment; a transduction phase, which relays that message from the cell surface to the inside of the cell; and a response phase, where the cell changes its behavior based on that signal. So how does that work in cell differentiation? Well, let's say your body needs more red blood cells. It sends a signal to your blood stem cells that you need more red blood cells. This signal is received on the cell's surface. The stem cell transmits (or transduces) that message to the nucleus, so the cell knows your body needs more red blood cells. Then the stem cells respond by activating the genes that'll help it develop into a red blood cell, and voilà – the cell becomes a red blood cell. While scientists know the human body contains trillions of cells, exactly how many cell types make up the body is still an active field of study. The most recent estimate notes that there are at least 200 unique cell types in the human body, at least based on appearance. Some scientists think that estimate is low, though, and new cell types are still being discovered regularly. The bottom line? You're looking at hundreds of different cell specialization pathways that your stem cells can take. However, human cells all belong to one of four overall categories: **Epithelial tissue:** Epithelial cells line your tissues, and they're important for protecting the underlying tissues as well as helping with absorption. You'll find epithelial tissues in your skin, glandular tissue and more. **Connective tissue:** Connective tissue, well, connects and secures your tissues. It provides structural support to your body. This tissue type includes bones, cartilage, tendons, ligaments and fascia. **Nervous tissue:** Your nervous system helps transmit information throughout your body. It's composed of your central nervous system (or CNS), which includes your brain and spinal cord, and your peripheral nervous system (PNS), which includes the nerves throughout the rest of your body. **Muscle tissue:** This type is probably the easiest to picture – you know what muscles are! But you'll also find special types of muscle cells in your blood vessels, as well as your heart. All of the 200 (or more) types of cells that make up the human body are found in one of those four tissue types – a lot more manageable to learn than memorizing hundreds of cell types, right? Now, let's check in one some of the special cell types you're likely to come across in your biology classes – the ones you'll need to know a little more in-depth. Your circulatory system is one of the ones you're most likely to cover in biology class – so now's the time to get to know it! Your circulatory system is made up of a series of blood vessels – arteries, veins and capillaries – as well as a few specialized blood cell types: **Red blood cells:** These red, disc-shaped cells are the ones responsible for carrying oxygen throughout your body. They contain hemoglobin, a special protein that can bind to the oxygen from the air you breathe, and then release it back into the tissues that need it. **White blood cells:** Need help fighting off a cold or flu? Your white blood cells are there to help you! White blood cells make up a key component of your immune system. They help your body identify dangerous pathogens, and destroy them to keep you from getting too sick. **Platelets:** The smallest cell type within your blood, platelets play a key role in blood clot formation. Once platelets sense damage or torn tissue, they start to clump together, forming a blood clot to slow or stop the bleeding. Your body constantly churns out fresh blood cells to replace older or damaged ones. And all your blood cells are "born" within your bone marrow, from a population of stem cells that specialize in creating blood cells. You'll also likely come across the cells of the nervous system in your body. But don't worry – while the brain might seem complicated, learning about your nerves is likely easier than you think. For one, there are only two major classifications of nerve cells: neurons and glia. **Neurons** are nerves – the cells you're probably picturing when you think of your nervous system. They transmit information to control all the "thinking" in your brain, and also control muscle movement and other basic body functions. Also, nerves throughout your body send signals back to your spinal cord and brain. Pain-sensing nerves, for instance, tell your brain when you're hurt, so you can avoid whatever caused the pain. **Glia** are the supporting cells that help your nerves function properly. There are a few major types of glia, and all play a role in helping your brain, spinal cord and other nerves communicate efficiently. Some glial cells produce myelin, a waxy substance that "insulates" your neurons for better communication. Others act as the immune cells of the brain, helping fight off infections that would otherwise harm your nerves. And still others help keep your neurons supplied with nutrients so that your nervous system has the energy to work properly. The third major cell types you're likely to study are your muscle cells. And, thankfully, the three muscle cell types are easy to learn. First, you've got skeletal muscle cells – the cells that make up virtually all of the muscles in your body. Skeletal muscle is the kind of muscle that – surprise – is anchored to your skeleton. It contracts to move your bones. So, say, when you contract your bicep, you'll bend your elbow. Skeletal muscle cells are, in part, voluntarily controlled by your brain. That means you can decide to move your leg, for instance, and your brain will send a signal that corresponds with that movement. Next, you've got cardiac muscle cells. These are the cells that make up your heart and contract to pump blood through your body. Cardiac muscle cell contraction is not voluntarily controlled – instead, your body maintains a steady heart rhythm without you having to think about it. Finally, there are smooth muscle cells. Smooth muscle makes up the linings of certain blood vessels, as well as some organs, like your stomach. Smooth muscle is important for helping your organs move. For example, smooth muscle contraction helps move food through your digestive tract to allow for proper digestion. Like cardiac muscle, smooth muscle contraction is not voluntarily controlled. So, for instance, you don't need to think about moving food from your stomach into your intestines because your body just does it for you. Here's the gist of what you need to know about cell specialization: Cells develop from immature stem cells into mature, highly functional cells by a process called differentiation. Differentiation allows developing cells to take on unique structures, and it allows the cell to carry out specialized functions. The process of differentiation is triggered by signals from the environment and results in changes in gene expression that guide the cell's development. Differentiation allows cells to develop into the four major tissue types: epithelial tissue, nervous tissue, connective tissue and muscle tissue. There are at least 200 different cell types in the human body. Some that you'll need to know best include specialized blood cells, specialized nerve cells and specialized muscle cells. Tremblay, Sylvie. "Specialized Cells: Definition, Types & Examples" sciencing.com, . 29 March 2019. APA Tremblay, Sylvie. (2019, March 29). Specialized Cells: Definition, Types & Examples. sciencing.com. Retrieved from Chicago Tremblay, Sylvie. Specialized Cells: Definition, Types & Examples last modified August 30, 2022.