Albinism in Animals! What is it, and How Common is It?

First of, what exactly is "Albinism"!?

Albinism, which may also be known by several other terms such as "amelanistic" ("a" referring to the absence of something, and "melanism" referring to the presence of melanin), or simply just "albinos", is a genetic or congenital condition resulting in the absence (or in some cases partial absence) of the dark pigmentation melanin in the skin (or other parts thereof, such as within the scales, hair, or feathers).

However, there can also be widely varying interpretations and definitions of what is, and isn't actually albinism, or an "albino" animal, and not all "white" animals are necessarily "albinos". In the loosest sense and in theory, any individual organism of any species which lacks the pigment melanin can be albino, whether it otherwise possesses melanin naturally or not. One more specific and defined trait, or characteristic of albinism, however, that most often thought of, are having the red or pink eyes, which is the result of lack of pigmentation in the irises allowing the blood vessels of the retina to be visible. However, even this is not always necessarily the case for an animal to be an albino. Albinism may be caused by a number of different factors, including genetic mutations, the specific living or environmental conditions, diets, or sometimes other factors. However, the most common and well-known cause tends to be genetic, or inheritable conditions.

In most animals, there is what is known as Oculocutaneous albinism (OCAs), which contains a well-defined set of at least seven different types of genetic mutations which can result in reduced or absent pigmentation. Type I oculocutaneous albinism (OCA1a) is the form most commonly recognized as 'albino' as this results in a complete absence of melanin, and is what differentiates other "white" animals that are not "albinos", such as "leucism" or "leucistic" animals, which experience only a partial loss of pigmentation.

Many poikilothermic (or ectothermic) animals have specialized cells in their skin, or other parts called chromatophores, while in birds and mammals, these may be known as melanocytes. In plants, chlorophyll is the pigmentation which normally gives them their green color. In plants, a reduction or interruption in the chlorophyll may also sometimes be known as hypochromia or albiflora. In poikilothermic animals such as fish, reptiles, and amphibians, there are several types of chromatophores, including:

- Xanthophores (yellow): contain yellow pigments in the forms of carotenoids
- Erythrophores (red): contain reddish pigments such as carotenoids and pteridine
- Melanophores (black/brown): contain black and brown pigments such as the melanins
- Cyanophores (blue): Found in a more limited taxonomic range, but may be found in some fish and amphibians.

Some animals can also have structural colors, which tends to be the result of coherent scattering and

iridescence, although these structures themselves are colorless when light is not reflected on them. Iridophores and leucophoes are some of these specific structures, and can result in other "white" animals that are not "albinos" but rather other forms of phenotypic variation, such as white peafowl, white tigers, many species of white waterfowl birds, or even many domesticated breeds of animals which are, or can be white (i.e. many breeds of dogs and cats). Some species of animals are also not necessarily "white" or "yellow" as albinos, which can lead to further scientific ambiguity of the term.

So How Common is Albinism?

To answer this question, in most cases, albinism tends to follow a recessive pattern of Mendelian genetic inheritance, in which the albino phenotype is only visually or outwardly displayed when both copies of alleles on a chromosome carry the recessive gene for albinism. In instances where only one copy is present on an allele, an animal carries the trait genetically for albinism, but is said to be heterozygous, as opposed to homozygous, and still otherwise appears normal in its outward, visual phenotype. For albinism to appear in a clutch or litter, one, or both parents must either be homozygous or heterozygous for albinism, which then influences the theoretical percentages as to the percentage or likelihood of expression. More on Mendelian genetics and inheritance is discussed in further detail in our De-Mystifying Genetics article.

However, in some cases, and in some animals, albinism can be a dominant trait, and in these such cases, may differ in that tyrosinase is still produced, unlike with true, recessive albinism described above. Examples of albinism can occur throughout the plant and animal kingdom, but tends to be most commonly seen in birds, amphibians, and reptiles, and more rarely in mammals. In mammals, it is estimated that albinism occurs within only 1 out of every 10,000 births, although in birds, this estimate is estimated to be 1 in every 1,764 births (HowStuffWorks.com 27 May 2024). So what are some examples of albino, or amelanistic animals from each group within the animal kingdom? Let's explore!

Mammals

In mammals, there can be many different examples of artificially or domesticated strains of albinism which may be commonly seen. These can include "white" rats and mice, rabbits, and ferrets. True albinism can also be seen in domesticated dogs and cats, although it is generally more rare to uncommon. When it comes to naturally occurring mammals, however, there have been many different individual records of different species of albinistic mammals, although eastern gray squirrels are presently thought to be the only mammal species to be able to survive and reproduce successfully in the wild as albinos. Among naturally occurring albinistic mammals, macaques, wild boars, jungle cats, and in many marsupials and monotremes such as koalas, echinidas, wallabies, kangaroos, and wombats have also been documented, although many of these are represented by only single individuals or specimens.

Albinism has also been documented in marine mammals as well, such as dolphins, killer whales (or orcas), and other species of whales, although these cases generally make them more susceptible to sunlight, lesser heat retention in colder waters, and impaired visual communication. There have also been some cases of more famous albino mammals being known, including an inspiration for Herman Melville's novel Moby-Dick, a sperm whale known as Mocha Dick, and "Snowflake", a blue-eyed western

lowland gorilla with Type IV oculocutaneous albinism. Rare, white (leucistic) giraffes have also been the subject of monitoring in Tanzania's Tarangire National Park.

In humans, there have also been seven different types of albinism known, which can affect people across all races and ethnic groups, and accounts for approximately one in every 18,000 to 20,000 people, although in some areas of the world, this ratio may be much more common at about 1 in every 3,ooo people. People affected by albinism can often have increased sensitivity to, or impaired functions of the eyes and their vision, as well as greater sensitivity to light or UV from the sun. People with albinism, as a result, can face greater risk of skin cancer or other skin conditions as well as a result. In people, the pigmentation of the eyes also tends to be reduced, although their eyes may not always be pink or red, as one would characteristically associated with albinism.

Birds

In birds, the most important pigments which determine their feather and plumage coloration are the melanines and carotenoids. Carotenoids are ingested by the food which many birds will eat, which is then transformed or converted into their color pigments by certain enzymes. Many aberrations of pigmentation in birds are subsequently caused by their certain food or dietary deficiencies, and usually do not have genetic inheritance. The best example of this are in flamingos, which derive their red or pinkish coloration of their feathers from the red caratoids in the shrimp and krill they feed on naturally. In cases where these caratoids are in short supply, these birds generally tend to appear white until their next molt.

True genetic mutations causing, or affecting changes in birds tend to occur with their melanin more commonly than these caratoids. Two types of melanin, eumelanin and phaeomelanin, are present in birds. In the skin and eyes, only eumelanin is present. In some bird species, the color is caused completely by eumelanin, however, both types of melanin are found in most species. In birds, albinism has been defined as "a total lack of both melanins in feathers, eyes and skin as a result of an inherited absence of tyrosinase. True albinism has been documented in common house marlins, and in American robins, and there are also a few cases of famous albino birds such as “Snowdrop”, a penguin at the Bristol Zoo. Albino kookaburras are also known.

However, total albinism is relatively rare in birds, accounting for only about 7 % of cases among 1,847 cases of avian albinism. More commonly birds may display forms of Incomplete albinism, when melanin is not simultaneously absent from the skin, feathers, or eyes, Imperfect albinism, where melanin is reduced, or cases of Partial albinism, where albinism is localized only to certain areas of the body. However, cases of partial albinism in otherwise normally white birds has also been questioned as to validity thereof.

Fish

In fish, there are many different cases of artificially or domestically bred fish in the aquaria hobby or industry including zebrafish, many different species of cichlids, catfish, gouramis, pacus, Oscars, Plecostomus, and many others. Most fish generally have three types of chromatophores, including

iridophores, melanophores, and xanthophores, although in at least some fish, albinism may be caused by other dark environmental conditions, as in the Mexican blind cave fish, and some other species of cave-dwelling fish. Where populations of some of these species of fish have evolved to form predominately albino populations as a result.

More naturally occurring albinistic fish, both freshwater and saltwater, or marine, have also been documented, although usually with less frequency than with aquarium fish. In some cases with fish, albinism can also be increased artificially from the exposure of their eggs to certain heavy metals. Some of the fish which have been found naturally as albino specimens or individuals have included many of the Telosti fish, and especially in the flatfish, but more rarely in the cartiligenous fish such as sharks, rays, lampreys, and hagfish. Albino and normally pigmented channel catfish are also well-known, as are albino lungfish as well.

However, in fish, many of the adverse effects commonly associated with albinism, such as in vision, hearing, and skin sensitivity have not been shown to affect them as adversely as in mammals, or other groups of vertebrates.

Insects, Arachnids, and Other Arthropods

Truly albino insects, arachnids, and other arthropods do exist, although they are rare, as they do not produce melanin. In the known cases of albinism in insects, a species of migratory grasshopper or locust, Locusta migratoria, and in Drosophilia pomance flies, or better known as in fruit flies, although in the latter, is actually a yellow mutation which presents itself similarly to albinism.

Other species of de-pigmented arachnids and other arthropods also can occasionally occur, usually in cave populations thereof. "Albino" individuals of normally red citrus red mites (*Panonychus citri*) also occasionally appear in laboratory colonies, however, these still contain green and yellow pigments. Many insects, arachnids, and other arthropods can also often appear white in appearance during certain juvenile, nymph, or larval stages, or just after freshly molting, which can sometimes lead to them being mistaken for albinism; however such is not actually the case.

Amphibians

In amphibians, albinism has a relatively higher rate of occurrence than in other taxa, where it has been estimated that 1 out of every 400 are hatched as albinos. As with reptiles, many amphibians which are often considered “albino” are not necessarily in the truest since, but rather “amelanistic”, and can still have various other pigmentation in their skin. In amphibians, there are six types of chromatophores in their skin; melanophores, xanthophores, erythrophores, leucophores, cyanophores and iridophores. In Europe, and North America, many different species of newts and salamanders have also been found naturally amongst populations as amelanistic individuals.

Genetic studies of albinism in amphibians have focused on mutations in the tyrosinase gene. Some species of amphibians are also widely produced artificially or in captivity for “albino” or “amelanistic” mutations in the scientific, research, and medical fields, as well as for the pet industry. Some well known

examples of these produced for albinism include Pacman, or horned frogs, Axolotls, African clawed frogs, Treefrogs of many various species, American bullfrogs, tiger salamanders, American bullfrogs, and others.

Mollusks, Echinoderms, and Other Invertebrates

Albinism in mollusks such as snails has long been recognized since at least 1900, and which can exist to widely varying degrees in mollusks and other types of invertebrates. There can sometimes be a normally pigmented body, but a shell completely without its normal pigmentation due to a defect in the cells of the mantle. Shells of other mollusk species can also, similarly, appear translucent. Munidopsis polymorpha is a species of squat lobster (also known as the blind albino cave crab, Jameos blind crab or jameito), and is endemic to Lanzarote, Canary Islands. A species of cave-adapted albino shrimp Palaemon antrorum from Texas is also known, so yes, there are albino shrimp as well.

Albino Japanese sea cucumbers are also known and have been studied, and in other types of marine crustaceans and fish, Astaxanthin is the main carotenoid seen in these groups. Pure white octopus and squid, which lack pigmentation, thereby giving them a ghost-like appearance, have also been documented, but are rare, but are also not truly “albinos”. Other purely white, or albino crabs and lobsters are also known, but are very rare, being estimated at about 1 in 100 million. A sea star's skeleton is made up of many calcium carbonate plates (ossicles) that move like flexible joints. (In sea urchins and sand dollars, their skeletal plates are fused.) These skeletons may often appear to be white, but are not the actual color of the living sea star or urchin.

The Giant Palouse earthworm, *Driloleirus americanus* inhabits the Palouse region of Eastern Washington and North Idaho, in the United States, and is albino in appearance, although little is known of their genetics. Among annelids, the term “white worms” is sometimes also applied to the genus Enchytraeus, although these worms are not albinos. Albino earthworms might be possible, but due to their very thin skin, and presence of haemoglobins only, they would be difficult to verify.

Reptiles

Last, but certainly not least! Reptiles, as with amphibians, are another group of taxa in which albinism, or more accurately speaking, “amelanism” is widely known and documented, both in artificial or captive settings for laboratory, research, and for the pet industry, as well as wild, or naturally occurring individuals or specimens which occasionally are found. In most amelanistic reptiles, the eyes are indeed a classic pink or red in color, although in several species, there can also be several different domestically bred strains of amelanistic animals, which may or may not be lacking entirely in pigmentation of the irises. In most cases in reptiles, albinism is a simple recessive genetic trait, as described earlier.

Amelanistic, or leucistic American alligators, and occasionally other crocodilians, are widely seen and kept in public and private zoos and other exhibition institutions. In many snakes, a partial absence of pigments tends to be more commonly seen (hence the term “amelanistic”). In most reptiles, there are at least two types of color pigments, among the most common are xanthin (yellows) and erythrin (reds). An amelanistic reptile therefore, may still have pale yellow, orange, or red pigmentation as a result.

Some widely kept and known species of amelanistic snakes can include corn snakes and other ratsnakes, garter snakes, kingsnakes, milksnakes, ball pythons, Boa constrictors, and many other species of pythons and boas, as well as other snakes. Among venomous reptiles, amelanistic viperids, such as several species of rattlesnakes, Gaboon vipers, elapids such as several species of cobras, and others have also been produced or discovered as amelanistic specimens. Among venomous reptile keeping, amelanistic Moncocled cobras are common (*Naja kaothia*).

Amelanistic turtles and tortoises are also known, but tend to be relatively more uncommon, and are unable to achieve a pure white color, instead having a more yellow coloration, as in amelanistic African spurred tortoises, red-eared sliders, and other turtle and tortoise species. Several domestically bred strains of leopard geckos are also well represented, as well as other amelanistic lizard species including green iguanas, tegus, anoles, blue tongued and shingleback skinks, several species of monitors, and other species of geckos.

Plants

What about plants? Well, in plants, albinism is characterized by a partial or complete loss of chlorophyll pigments which give plants their green coloration. Albinism greatly affects a plant's ability to photosynthesize, thus greatly reducing its survivability. Many plant variations or cultivars can have white flowers, or other parts of the plant, however, they are not completely devoid of chlorophyll. Some plants that are naturally pale in appearance due to dark or low-light environments which they grow in may also sometimes be referred to as etiolateds.

Albino trees, most notably Albino Redwood trees, are also known, and in which some cases can grow as parasites to normally pigmented trees, usually at the base, and which account for about 1 in 60 redwoods. Additionally, some trees, although much more rarely, can be "chimeric", having both albinistic and normally pigmented leaves or needles. Albinism has also been seen in a few other types of ornamental or cultivated trees as well. Furthermore, some types of herbicides can also cause a partial chlorosis, or draining of the chlorophylls in plants, causing them to appear white.

How About Fungi, Viruses, Bacteria, or Other Micro-Organisms? How about Dinosaurs and Other Prehistoric Life?

Well, to answer the first part of this question, if, applied in a very loose sense in that these organisms are lacking in the pigment melanin, then yes, these other organisms, such as viruses, bacteria, protozoans, and other single-celled micro-organisms could, by default, be considered "albino". In fungi, carotenoids, melanin, polyketides, and azaphilones are the known pigments, and so if the pigment melanin is missing, then, yes, theoretically, mushrooms and other fungi could also be "albino".

As for dinosaurs and other prehistoric life, albinism certainly could have been possible, and there certainly could have been albino dinosaurs! However, when it comes to paleontology, albinism is only skin-deep, and we simply have no way of knowing for sure. However, when it comes to science and theories, there certainly should be no reason to believe that albinism *didn't* exist some-60 to 65 million years ago, or earlier! We can only be left to wonder and speculate as to the possibility!