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Albinism

Dagmar Fertl and Patricia E. Rosel

Albinism refers to a group of inherited conditions resulting in little or no pigment (hypopigmentation) in the eyes alone or in the eyes, skin, and hair. In humans, all types of albinism exhibit abnormalities in the optic system, including incorrect connections of the optic fibers between the retina and the brain, and incomplete development of the fovea, the area of the retina where the sharpest vision is located (Oetting and King, 1999). It is the presence of these types of eye problems that are best used to define albinism rather than the abnormalities in pigmentation. Inheritance of an altered copy of a gene that does not function correctly is the cause of most types of albinism, and mutations in at least 12 different genes have been identified in different types of albinism in humans (Oetting *et al.*, 2003). Albinistic people most often have white or light skin and hair, and eye color varying from dull gray-blue to brown. In one kind of albinism, only eye color is affected. The "pink" eyes often associated with albinism are due to the reflection from choroid capillaries behind the retina. With pigment lacking in the iris of the eyes, this reflection is visible, similar to red-eye in a flash photograph.

I. Pigmentation

Mammalian color is almost entirely dependent on presence (or absence) of the pigment melanin in the skin, hair, and eyes. Melanin is produced through a stepwise biochemical pathway in which the amino acid tyrosine is converted to melanin. The enzyme tyrosinase plays a critical role in this pathway, and alterations or mutations in the tyrosinase gene can result in a defective enzyme that is unable to produce melanin, or does so at a reduced rate. Currently, as many as 100 different mutations in this gene have been found associated with albinism (Oetting *et al.*, 2003). At the other end of the spectrum, overproduction of the pigment melanin results in melanism—overly dark animals (Visser *et al.*, 2004). Albinism is differentiated from piebaldism (body pigmentation missing in only some areas) and leucism (dark-eyed anomalously white animals) (Fig. 1). Pigmentation patterns should not be the only criterion used to define albinism, as some mutant phenotypes (pseudoalbinism) may be due to the action of genes at other loci.

Figure 1 *Leucistic Antarctic fur seal* (Arctocephalus gazella) *at the isolated subantarctic island, Bouvetøya. Photo by Greg Hofmeyr.*

II. Albinism and Marine Mammals

Albinism is known to affect mammals, birds, fish, reptiles, and amphibians. In marine mammals, anomalously white individuals have been reported for 21 cetacean species (Fertl *et al*., 1999; Fertl *et al*., 2004) and 7 pinniped species (e.g., Rodriguez and Bastida, 1993; Bried and Haubreux, 2000) (Fig. 2). No reports are known of anomalously white sea otters (*Enhydra lutris*) or sirenians. Anomalously white individuals are often presumed to be true albinos. Some of those individuals match the description of true albinism [e.g., there are well-documented reports of albino sperm whales (*Physeter macrocephalus*) and bottlenose dolphins (*Tursiops truncatus*)], but many do not. "Chimo," an anomalously white killer (*Orcinus orca*) captured for display in Canada, was diagnosed postmortem with Chédiak–Higashi Syndrome, (Fig. 3), a type of albinism (Taylor and Farrell, 1973). This inherited disorder is characterized by diluted pigmentation patterns that appear pale gray, eye and white blood cell abnormalities, and a shortened life span. Whales and dolphins also may appear white if extensively scarred, or covered with a fungus, such as Lobo's disease (also known as lobomycosis) (Migaki *et al*., 1971).

III. Problems Associated with Albinism

Humans with albinism are often sensitive to light, have limited visual acuity and may display other vision impairments, such as extreme farsightedness, nearsightedness, and astigmatism. There are unpublished reports of apparent vision problems for albino seals, when they are on shore (King, 1983). Costs of this aberrant pigmentation for marine mammals may include reduced heat absorption in colder waters, increased conspicuousness to predators, increased skin and eye sensitivity to sunlight, and impaired visual communication (Hain and Leatherwood, 1982). Despite the costs, some individuals do reach adult age and breeding status.

See Also the Following Articles

Coloration ■ Hair and Fur ■ Vision

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Figure 2 *Anomalously white humpback whale (*Megaptera novaeangliae*) sighted off Australia. Photo by Paul Forestell, Pacific Whale Foundation.*

Figure 3 *An albino killer whale, "Chimo" (*Orcinus orca*), postmortem diagnosed with Chédiak–Higashi syndrome. Photo by Peter Thomas.*

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Figure 1 *Male Amazon River Dolphin* (Inia geoffrensis) *in the Rio Negro, Brazil. Characterized by pink body color during adulthood; the largest of the river dolphins. Photo courtesy of Anselmo D'Affonseca.*

Amazon River Dolphin
Inia geoffrensis

Vera M.F. da Silva

I. Characteristics and Taxonomy

The Amazon River dolphin is known as boto or boto-vermelho in Brazil; bufeo colorado in Colombia, Ecuador, and Peru; and toninha and delphin Rosado in Venezuela. It is also known in English as pink dolphin and internationally as boto.

It belongs to the family Iniidae (Mead and Brownell, 2005). The genus *Inia* is currently considered monospecific, with three recognized subspecies: *Inia geoffrensis geoffrensis*, *I. g. boliviensis*, and *I. g. humboldtiana*. However, skull morphology (da Silva, 1994) and genetic analysis (Banguera-Hinestroza *et al.*, 2002) suggest that *I. g. boliviensis* could be a separate species.

The boto (Fig. 1) is the largest of the river dolphins with a maximum recorded body length of 255 cm and body mass of 207 kg for males and 225 cm and approximately 153 kg for females. It is also the most sexually dimorphic of the river dolphins, with males 16% longer and 55% heavier than females (Martin and da Silva, 2006). The body is corpulent and heavy but extremely flexible. Nonfused cervical vertebrae allow movements of the head in all directions. The flukes are broad and triangular; the dorsal fin is long, low, and keel-shaped, extending from the mid-body to the strong, laterally flattened caudal peduncle. The flippers are large, broad, and paddle-like and are capable of separate circular movements. Although most of these characteristics restrict speed during swimming, they allow this dolphin to swim backward and to maneuver between trees and submerged vegetation to search for food in the flooded forest. The rostrum and mandible are prominent, long, and robust. Short bristles along the top of the rostrum persist into adulthood. The melon is small and soft, and the shape can be altered by muscular control. The small, round eyes are functional and the vision is good, both under and above water (Best and da Silva, 1989a,b).

Body color varies with age. Fetuses, neonates, and young animals are dark gray. This pigmentation diminishes in intensity through adolescence to a light gray color. Adult botos become pinker as a consequence of severe scarring on the body surface. Males are pinker than females and more heavily scarred due to intermale aggression (Martin and da Silva, 2006). Adult botos can be dark on the dorsum, but the flanks and underside are pinkish. One albino was captured and maintained in captivity for more than a year in an aquarium in Germany.

II. Distribution and Abundance

The boto has a wide distribution, occurring almost everywhere it can physically reach without venturing into marine waters. It occurs in six countries of South America—Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela—in an area of about 7 million km^2. It can be found along the entire Amazon River and its principal tributaries, smaller rivers, and lakes, from the mouth near Belém to its headwaters in the Ucayali and Marañon Rivers in Peru. Its principal limits are impassable falls such as those of the upper Xingú and Tapajós Rivers in Brazil, and very shallow waters. A series of rapids and falls along the Madeira River up to the Abuña falls has isolated a population of boto (*I. g. boliviensis*) in the Beni/Mamoré basin in Bolivia, in the southern part of the Amazon Basin. The boto is also found throughout the Orinoco River basin, with the exception of the Caroni and upper Caura Rivers above Para falls in Venezuela. The only connection between the Orinoco and Amazon River Basins is the Cassiquiare Canal, where botos have being sighted. The boto is the most abundant river dolphin. Its current distribution and abundance apparently do not differ from those in the past, although local relative abundance and density are highly seasonal and appear to vary between rivers. During the dry season the dolphins are concentrated in the main channels of the rivers, whereas during the flooded season they disperse into the flooded forest (igapó) and river floodplains (várzea).

Differences in survey methodology used by various workers make comparisons between the results of the different surveys of abundance