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## ALBINISM

DAGMAR FERTL AND PATRICIA E. ROSEL

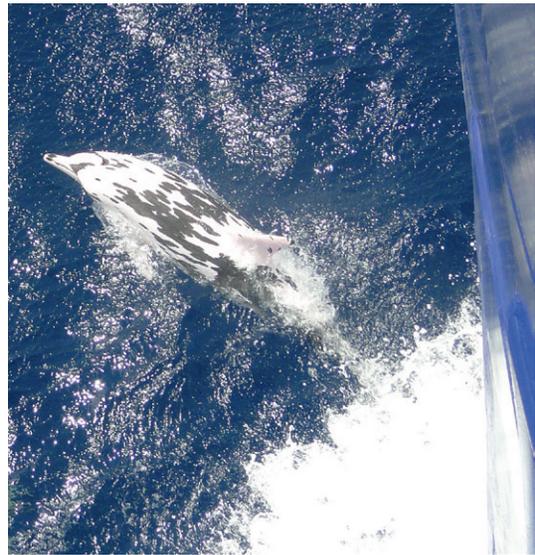
Albinism refers to a group of inherited conditions resulting in little or no pigment (hypopigmentation) in the eyes alone or in the eyes, skin, and hair. In humans, all types of albinism exhibit abnormalities in the optic system, including incorrect connections of the optic fibers between the retina 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 18 different genes have been identified in different types of albinism in humans (Oetting et al., 2003; Montoliu et al., 2014). 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) (Lodi and Borobia, 2013; Fig. 1) and leucism (dark-eyed anomalously white animals) (Fig. 2). Pigmentation patterns should not be the only criterion used to define albinism, as some mutant phenotypes (pseudotalbinism) may be due to the action of genes at other loci.

### 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 25 cetacean species (e.g., Fertl et al., 1999, 2004; Abreu et al., 2013) and 8 pinniped species (e.g., Rodriguez and Bastida, 1993; Bried and Haubreux, 2000) (Fig. 3). 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



**Figure 1** Piebald Atlantic spotted dolphin (*Stenella frontalis*) off southeastern Brazil (Photo by Angelo Lima, courtesy of Liliane Lodi).



**Figure 2** Leucistic Antarctic fur seal (*Arctocephalus gazella*) at the isolated subantarctic island, Bouvetøya (Photo by Greg Hofmeyr).



**Figure 3** Anomalously white humpback whale (*Megaptera novaeangliae*) sighted off Australia (Photo by Paul Forestell, Pacific Whale Foundation).

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 whale (*Orcinus orca*) captured for display in Canada, was diagnosed postmortem with Chédiak–Higashi Syndrome, 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.

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## AMAZON RIVER DOLPHIN

### *Inia geoffrensis*

VERA M.F. DA SILVA AND ANTHONY R. MARTIN

*Inia* is the only genus in the family Iniidae (Odontoceti, Cetacea), one of four families of river dolphins. The Amazon River dolphin is also known as the boto or pink dolphin. In Brazil, it is called boto or Boto-Vermelho and Boto-do-Araguaia in the Tocantins-Araguaia River basin. In Colombia, Ecuador, and Peru the name is bufeo colorado, in Venezuela toninha or dolphin rosado and in Bolivia bufeo da Bolivia.

### I. Characteristics and Taxonomy

Amazon River dolphins (Fig. 1) were until recently considered to be of one species by most authors, *Inia geoffrensis*. The geographical range of this dolphin is vast (Fig. 2), complex and fragmented, with some populations probably isolated for millions of years and having become genetically and morphologically distinct. Whether these differences are sufficient to justify the recognition of multiple subspecies or even species is controversial. Molecular and morphological evidence indicates two populations could be distinct from the core range. The dolphins in the Araguaia river, Brazil and those in a population centered around Bolivia and extending into Brazil along the Madeira River may merit recognition as species or subspecies: *araguaiaensis* and *boliviensis*, respectively (Banguera-Hinestroza et al., 2002; Hrbek et al., 2014; Gravena et al., 2014).



**Figure 1** Amazon River dolphin, *Inia geoffrensis* (Illustrations by Uko Gorter).

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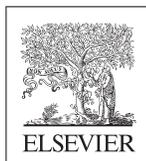
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