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Whale Evolution: A Whale of a Tale

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Abstract

A review of the evolution of whales from terrestrial land animals finds that the evidence used to support the current theory is either wrong or very questionable. A focus is on the hip bone and fetal teeth evidence because they are commonly used as proof for the land mammal-to-whale evolution theory. The putative fossil evidence for whale evolution from terrestrial animals is also evaluated, concluding that the examples used are likely all extinct mammals and not transitional forms.

Introduction

The term "whale" is a common noun that can refer to all marine mammals called *cetaceans* (members of order cetacea), including dolphins and porpoises. In this paper the term "whales" excludes both dolphins and porpoises. Classification of whales divides them into two groups; toothed whales and baleen whales, the latter of which use large brush-like structures to filter food from the ocean.

Toothed (odontoceti) whales are divided into six main families: pilot whales, fin whales, minke whales, blue whales, humpback whales, narwhal whales, and delphinidae, such as dolphins and killer whales (orca). Baleen whales (suborder *Mysticeti*) are divided into three main families, right whales, rorqual whales, and gray whales. Of the 76 known whale species, 66 are toothed whales, and 10 are baleen whales. Some species grow to be only about 20 feet long, but baleen and blue whales can grow up to 100 feet long. Toothed whales are, on average, smaller then baleen whales, ranging from 3 to 32 feet long, although most are from 10 to 30 feet long. Blue whales can weigh up to 150 tons.

The Origin of Whales

The evolution of whales is one of the most difficult evolutionary enigmas, and numerous theories have been proposed. Historically, whales were classified as fish. It was only when Linnaeus changed his original classification and reclassified them as mammals that their origin became an issue (Slijper, 1962). One current theory is that marine animals evolved into terrestrial animals; then whales evolved from a terrestrial ungulate ancestor (or from some extinct wolf-like animal) back into a marine animal.

A major problem has been determining which terrestrial animal whales evolved from. Charles Darwin proposed one of the first theories of whale evolution, suggesting they evolved from bears. He wrote, "I can see no difficulty in a race of bears being rendered, by natural selection, more and more aquatic in their structure and habits, with larger and larger mouths, till a creature was produced as monstrous as a whale" (Darwin, 1859, p. 184). Other theories include proposals that whales evolved from a cow-like animal, a hippopotamus-like animal, a hyena-like animal called a pachyaena, a wolf-like animal called pakicetid, a primitive group of hoofed animals called mesonychids, or even a catlike animal called a sinonyx.

The hippo theory, long the leading candidate because of its DNA similarities with whales, has recently lost favor because the proposed hippo precursor lived too recently and in the wrong part of the world to be a whale ancestor. Since the 1960s, another popular proposal (based on dental similarities and molecular data) has been that whales evolved from hoofed, carnivo-

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rous mammals called mesonychians, specifically an extinct archaic ungulate (e.g., Thewissen et al., 1998; Harder, 2001). New findings, though, have placed mesonychians in the artiodacty family (even-toed ungulates including camels, hippos, pigs, and ruminants) based on *Artiocetus clavis* and *Rodhocetus balochistanems* fossils (Milinkovich and Thewissen, 1997). Others argue that mesonychians cannot be ancestor to whales for several reasons, including all "phylogenetic studies indicate that pakicetids are more closely related to living cetaceans than to artiodactyls and mesonychians" (Thewissen et al., 2001).

The latest theory, proposed in 2007 (see Figure 1), is that whales evolved from an Indohyus, a putative 48 million-year-old terrestrial animal the size of a small raccoon that looked like an antler-less African mouse long-tailed deer (Thewissen, et al., 2007). Some have even described this animal as an overgrown, long-legged rat, looking nothing like a whale. The main evidence it was a whale ancestor is Indohyus's thickened ear bone, a feature that so far has been seen only in Indohyus and cetaceans (Thewissen, et al., 2007).

All of these proposed theories have some support but also problems. For example, whale evolution from artiodactyls is supported mainly by DNA sequences yet this is problematic because all artiodactyl teeth have three lobes, a trait lacking in both cetaceans and mesonychians. Thus, this lineage would require a complicated tooth evolution that "includes reversals, convergences or both" (Milinkovich and Thewissen, 1997, p. 623). Ellis (1987, p. 8) concluded that "all known fossil whales seem to be fully developed aquatic mammals; we do not know the steps that led to their return to the sea." This conclusion still holds true.

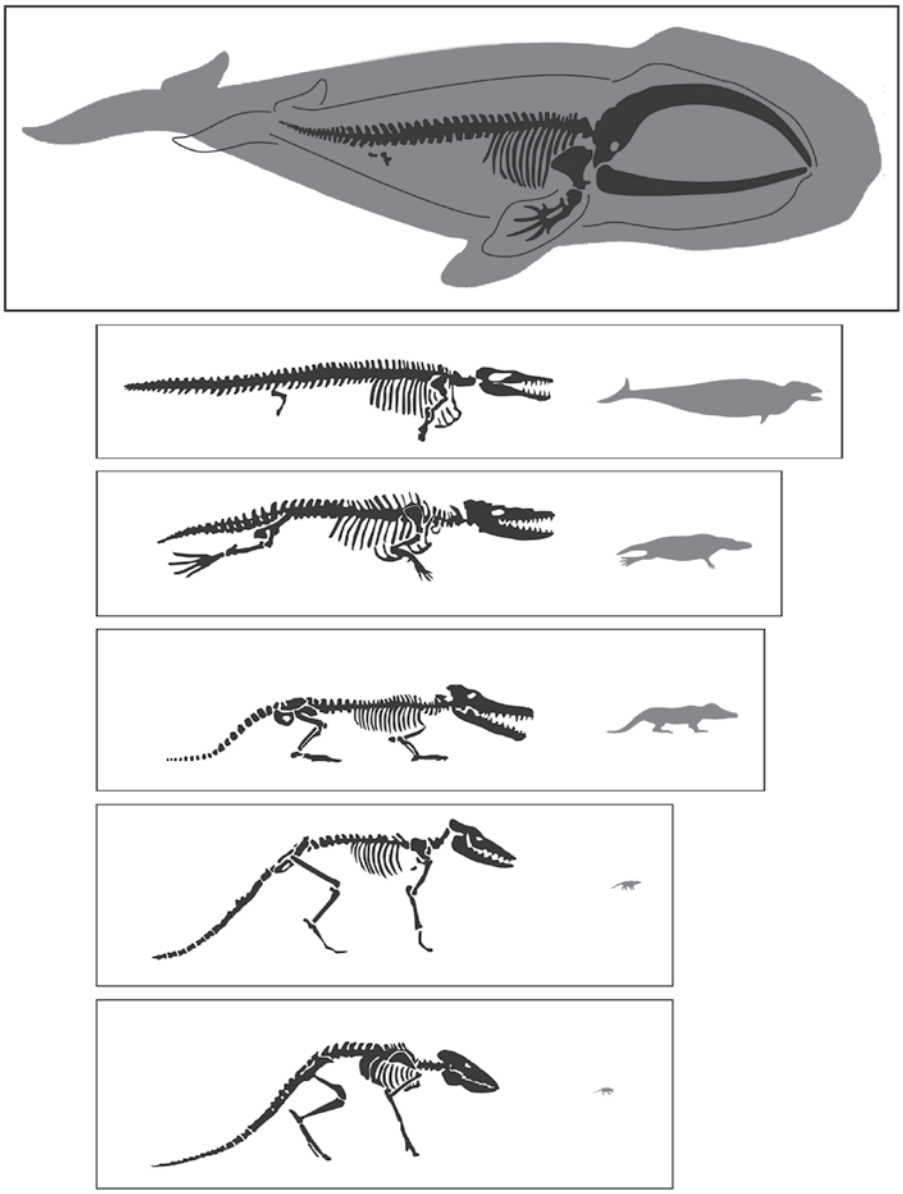

Figure 1. Drawings of the skeletons of one proposal of whale evolution from the first putative whale to the modern whale. The skeletons are shown on the right. On the left is the approximate proportions of the animals themselves. The modern Baleen whale superimposes the skeleton on the size illustration to save space. Note the first putative animals in the evolution of whales are extremely small compared to modern-day whales, a fact obscured when the fossils are shown as a set. This is also a major problem for the theory of whale evolution. The animals, starting from the bottom, are Indohyus, Pakicetus, Ambulocetus, Rodhocetus, Dorudon, and at the top, the modern whale Balaena. (Illustration courtesy of Richard Geer)

Evolution from Terrestrial Mammals

Evolutionists have always faced the problem that whales are mammals. Thus, evolutionists typically hypothesize that they evolved from some type of terrestrial mammal. A problem with this view is that transformation of a land tetrapod into a sea mammal requires virtually all of the tetrapod's hundreds of major

land-adapted traits to be converted into sea-adapted designs. Nonetheless, whale evolution directly from a fish appears even less probable because of the enormous differences between fish and whale anatomy and physiology. As example, fish use gills for breathing while whales use lungs; fish typically lay eggs, and whales breastfeed and give birth to live young.

Other problems with current proposal of whale evolution include the radical changes required in the integument system, lactation, breathing, diving, feeding methods, nervous system, eyes (they must be protected in water) and hearing, and transformation from a walking to a swimming mode of life. Some additional examples include loss of body hair, body streamlining, transformation of forelimbs into flippers, loss of hind limbs, evolution of flukes for swimming, and backward movement of nostrils. Thousands of changes are required to convert a land tetrapod to a fishlike mammal. All of these systems are interrelated and function as a unit, requiring altering the interrelationships of the whole system. Yet other changes required for a large dog-sized tetrapod animal to evolve into a whale include the following:

1. **Body Size**: The body size changes required to evolve from a terrestrial mammal to a whale are enormous—from a 100-pound dog-sized animal to up to a 150-ton sea animal, and from a few feet long to up to a 100-foot-long animal. The tongue of a blue whale alone weighs as much as an elephant. The size changes require evolving a heart from the size of a human fist to one about the size of a Volkswagen Beetle. The heart valves would have to evolve from around the size of a dime to the size of an automobile tire rim. Each tooth would have to evolve from a few ounces to over a kilogram (2.2 pounds) in weight. These changes require not only size modifications, but also major design changes in every body organ and structure.

2. **Weight-bearing**: Land-dwelling animals consume about 40 percent of their energy just to move their bodies, but sea-dwelling creatures use water for support (Zahn, 1988, p. 28). For this reason the transition from land to water requires major muscular and skeletal system design changes. Whales must not only lose their legs but also evolve flippers, pectoral fins, a fluke, and an aerodynamic design, plus a brain and an appropriate nervous system to meet the needs of these many new structures and their requirements.

3. **Heat Retention**: Land temperatures often change rapidly and can fluctuate over a wide range. For this reason, land-dwelling organisms must possess a physical mechanism that can withstand enormous temperature fluctuations. Not only do the temperature changes in the sea occur very slowly and within a much narrower range, but the water is also much colder, and water has high thermal conductivity, a major problem for warm-blooded mammals (Heyning and Mead, 1997, p. 1138). Organisms with a body system regulated according to land temperature demands would need to evolve a whole new protective system to deal with very cold ocean water temperatures. Whales, as warm-blooded animals, have various heat conservation structures, such as countercurrent heat exchangers to minimize heat loss. In contrast to land mammals, whales also largely lack hair and sweat glands and have a thick layer of fibrous fat called *blubber* to insulate them from the icy cold water, all of which involve major marine environment adaptations (Heyning and Mead, 1997, p. 1138).

4. **Water**: Water, essential to metabolism, must be used economically due to its relative scarcity on land. Land animals require skin designed to permit regulation of water loss while, at the same time, also prevent excessive evaporation. Because the skin of land-dwelling animals is not suitable for an aquatic habitat, land-dwelling creatures experience thirst, a sensory system not needed by sea-dwelling creatures. In contrast, marine animals also need to regulate body water, but they must do so in very different ways than terrestrial animals.

5. **Kidneys**: Because water has to be used economically by terrestrial animals, they require an efficient kidney system. The body's protein metabolism system either excretes or converts wastes. The metabolic breakdown of protein produces ammonia, which is toxic and is therefore converted into urea, in the end reducing the amount of water excreted. In addition, a system of ducts and other structures are required for the kidney's functioning. Sea-dwelling organisms, in contrast, discharge waste materials, including ammonia, directly into their aquatic environment. In short, in order to evolve from water to land, living things would have had to develop whole new organ systems to deal with water regulation. Then, to evolve back into aquatic animals, another entirely new system must be evolved especially to deal with salt removal, since whales live in a toxic saltwater world.

6. **Breathing Opening**: Terrestrial animals breathe through their nose and mouth. In contrast, whales have a unique nostril called a blowhole complex (some whales, such as a humpback, have two) on the top of their head in order to take in air. Each breath takes in thousands of times as much air as humans do—enough air to remain submerged for as long as an hour. Whales would have to evolve a hole on top of their head that connects directly to the lungs and a strong muscular flap that covers their blowhole to prevent seawater from flooding into their lungs when they descend below the saltwater surface.

7. **Respiratory system**: Fish "breathe" by removing the oxygen dissolved in water by means of gills. Consequently, they cannot live for more than a few minutes out of the water. In order to survive on land, they would have to acquire a complex lung system. To evolve

back into a sea animal, they would need to re-evolve a new gill system or evolve a new means of taking in oxygen from the water, as a whale does, via a lung system very different from land animals. The orthodox theory teaches that fish evolved a gill system, then a lung system when they evolved to live on land, then a whole new lung system design when the pre-whale land animal transformed back into a marine organism. One of these major adaptations is the whale's enormous lung capacity and a very efficient oxygen exchanger system that allows the whale to stay under the water for long periods of time.

8. **Pressure**: Terrestrial animals must deal with only about 14.71 PSI on land, but deep-diving whales dive as much as 1,640 feet below the water surface and must deal with the enormous pressure levels existing at this depth. Its enormously thick muscular body and its strong frame skeleton are both designed to withstand this pressure level (Zahn, 1988, p. 28). Some whales also can remain submerged for as long as two hours. This feat is achieved due to its ability to reduce its lung volume as the pressure increases, significantly slowing down of the heart rate to reduce oxygen use, and the ability to store large amounts of oxygen in the muscle hemoglobin (Ellis, 1987, p. 8). It also shuts down blood circulation to unessential areas. When on the water surface, the whale takes in enormous amounts of air that is compressed, countering the deep-sea pressure. The blowhole is closed with a special muscle plug, allowing the animal to maintain the internal pressure.

9. **Hearing**: The whale must have a very different hearing design than terrestrial animals. For evolution from land to marine, the animal's external ears must evolve into an internal hearing system that can function under water with eardrums that can withstand the very high pressure existing in water as deep as 1,640 feet. The ears would have to completely disappear and then re-evolve to a system that functions in an aqueous environment.

10. **Vision**: The eyes and lenses not only must evolve to become far larger in a whale, but they also must withstand the enormous pressures of the deep ocean and have a far higher refractive index for water vision. Whales are one of the very few mammals that shed tears, which is one of several mechanisms they use to protect their eyes from the high salt concentration in seawater.

Other major changes required to evolve a whale from a terrestrial animal would include evolution of a "tail," actually a powerful dorsal fin called a "fluke," and its accessory structures. A fluke is a very different structure than that used by either fish or mammals. Fish tails use bones that move from side-to-side by muscles; in contrast, flukes are wide, cartilaginous structures lacking bones that are moved by powerful muscles connected to the whale's spine. The fluke's up-and-down movement can push the whale at speeds of over 30 mph. From tip to tip, a fluke can be longer than six feet. The whale forelimbs, called flippers, are also essential for steering and turning.

Whales give birth to one live young calf at a time. The mother has specially designed nipples that allow her calf to lock onto her with its specially designed mouth and allow the mother to pressure-force her milk into it. The calf must drink two to three gallons of milk in just a few seconds to allow it to surface for air. A calf may drink up to 100 gallons of fat-rich milk in a single day.

The blue whale, in contrast to bottom feeders, swims along the sea surface with its mouth open wide. In one gulp it can suck in as much as 50 tons of water, enough to ingest four tons (about 40 million) of krill. Humpbacks send out clouds of bubbles in a circle below schools of small fish. The bubbles trap the fish, and the whale then lunges up with its open mouth and its throat expands to make room for the food and water that was ingested.

These are just a few of the hundreds of major changes required to evolve a whale from a small terrestrial mammal. The likelihood that all these many dramatic physiological and anatomical changes could have developed in the same organism at the same time when evolving from land to water is a serious challenge to any evolutionary scenario.

Baleen Whales

One of the most striking adaptations in the evolution of baleen whales is the requirement of a major transformation in the teeth of a land animal into the hundreds of comb-like baleen structures. These structures are used to give a whale the unique ability to obtain nourishment by straining zooplankton from seawater. The two- to seven-feet-long combs spaced one-quarter of an inch apart overlap and are fringed on one side, a design feature that functions to effectively catch plankton such as krill, a shrimp-like animal as large as the human little finger.

Baleen whales have two blowholes. They pull in seawater that contains plankton; then their throat contracts, forcing the water out and retaining the plankton on the baleen, which are then swallowed. Whales filter thousands of gallons of seawater and swallow over two tons of krill daily. Gray baleen whales swim at the sea bottom and suck up the sediment to exploit sediment life. They then rise to the surface to rinse their mouths and swallow their catch.

The Evolution of Whales

Up until 1993 the fossil evidence for whale evolution consisted of partial skulls with no postcranial material (Miller, 2003). The amount of evidence for whale evolution is now considered by evolutionists one of the best in the entire fossil record.

> One of the most remarkable series of transitional fossils documents the

> amazing story of whale evolution. From about sixty-five to thirty-seven million years ago in the Paleocene and Eocene Periods, there lived a group of land-dwelling mammals, which, though they were ungulates (hoofed animals), were carnivorous and may have behaved like hyenas. Called "mesonychids," these creatures would not be anyone's first guess as a likely ancestor of the sperm whale. Yet in 1979 ... in Pakistan ... Phillip Gingerich made a remarkable find: an animal that, though only coyote-sized, had the distinctive anatomical traits of a whale, and so was named "*Pakicetus*" (Parsons, 2004, p. 160).

Discussions of whale origins assume various extinct creatures were whale ancestors, an assumption often disproved as a result of more fossil finds. One example is mesonychids, which was shown not to be a viable whale transition after *Archeocetes* was discovered in Eocene strata. Another example is the whale putative ancestor, *Basilosaurus*, which was initially thought to be a serpent-like reptile but was later reclassified as a "whale-like" mammal (Evans, 1987, p. 2). This animal does not provide support for whale evolution, though, because no clear fossil connections exist between *Basilosaurus* and the *Archeocetes* and modern whales, whether toothed (Odontoceti) or baleen, a fact put bluntly by Gaskin.

> Archaeoceti could not be considered as direct ancestors of either modern baleen whales or modern toothed whales…. It was unlikely that they gave rise to the ancestral forms of either group. The Archaeoceti may be regarded as a less successful independent line which died out perhaps 10 million years ago (Gaskin, 1972, p. 3).

Other evidence supports the conclusion that the archeocetes are members of another mammal category unrelated to modern whales.

The Whale Fossil Record

Over 26 fossil species have been claimed by one or more researchers as whale ancestors; proving the evolution of whales from a fully terrestrial to a fully aquatic life. They have been assigned by some researchers to four families: Pakidetide, Ambuloceticae, Remingtonocetidae, and Protocetidae. Depending on the authority, the major skeletal finds claimed to demonstrate whale evolution include the *Mesonychids*, *Pakicetus*, *Ambulocetus*, *Rodhocetus*, *Prozeuglodon*, and *Protocetids*. All of these animals were, judging from their teeth and other features, evidently active, hunting carnivores. In contrast, all whales consume krill, small fish, and other small marine organisms.

1. *Family Pakicetidae* (genera Pakicetus, Nalacetus, and Ichthyolestes) is a fully terrestrial, even-toed ungulate artiodactyl tetrapod. *Pakicetus* was as large as a wolf, *Ichthyolestes* the size of a fox, and *Nalacetus* an in-between size. A major reason for considering this dog-like animal a whale ancestor are certain inner ear traits judged as cetacean from the animal's skull characteristics. The first Pakicetus find was a lone skull and a relatively complete skeleton found in 2001. Although Pakicetus had a few whale characteristics, most of its traits were very different from a whale. For example, the teeth of this wolf-sized land animal "closely resemble those of land-dwelling mesonychids—so closely that paleontologists ... had always regarded such teeth as belonging to mesonychids until they found the jaws those teeth came from" (Parsons, 2004, p. 160). One study of Pakicetus ankle bones determined that it had many similarities to artiodactyls (Thewissen, et al., 2001).

Pakicetidae nostrils were in the same anatomical location as that of dog nostrils, and significantly different than the location of the modern whale blowhole. In fact, artist reconstructions picture Pakicetidae as looking very similar to a medium-sized dog. A major evidence for its whale ancestry is its ears, which are dissimilar to the ears of both terrestrial and aquatic animals. This dissimilarity is cited as evidence of its intermediate transitional status. Based largely on this conclusion, the whole animal is interpreted as an intermediate whale transition. Evidence, though, has established that, except for one small bone, it lacks the sensitive auditory components of marine animals such as whales. Thewissen, et al. (2001) in a study of the bones and structures, found the Pakicetidae's auditory system is well developed for airborne sound, but not underwater hearing.

2. *Ambulocetus nations* (walking whale) is an otter-sized mammal. Enough of the skeleton has been uncovered to conclude that it had tiny front limbs and longer hind limbs with hoofs, large feet, and a strong tail. In spite of being named "walking whale," reconstructions of it look nothing like a whale. It had a long non-whale tail and did not have a fluke, as do all whales. Nor did it display evidence of a whale's posterior, flippers, blowhole, or most of the other unique whale traits. It was actually an amphibious, carnivorous animal with legs and a body that looked very much like a nine-foot-long crocodile. Its eyes were also in the wrong place—on top of its crocodile-like head, and not on the side of its head as is the case of whales. It also had tiny webbed feet like a crocodile and likely could walk on land. Its fossil spine indicated that it could undulate like a modern otter.

Further research has forced the discoverer, University of Michigan Professor Philip Gingerich, to express his doubts that *Ambulocetus* is in the direct line of whale evolution (Werner, 2007, p. 144). In short, he now thinks it is not a whale ancestor, but on a different part of the evolutionary tree. It is not considered a crocodile ancestor either because modern crocodiles date contemporaneously with *Ambulocetus*, indicating its likely was a member of the crocodile

family. Evidence does exist that *Ambulocetus nations* had anklebones similar to those of artiodactyla, but this does "not unambiguously support either of the predominant hypotheses of cetacean relationships" (Thewissen, et al., 1998, p. 452). This finding only confuses whale evolution because it requires "extensive convergence or reversals" to account for the contradictory evidence (Thewissen, et al., 1998, p. 452).

3. *Remingtonocetidae* were similar to the *Ambulocetids*, which may be an evolutionary dead end (Miller, 2003). The cranial anatomy is well documented, but so far only one complete upper molar and a complete lower premolar and molar are known (Thewissen and Bajpai, 2001). This evidence indicates that the animal had a long, slender crocodile morphology and may be a member of the ambulocetus, or crocodile family.

4. *Protocetids* are a diverse group of cetacea, and one of the best known is Genus *Rodhocetus* (Chadwick, 2001). Although dolphin-appearing, judging by the fossils, the animal also looked very much like a crocodile/dolphin hybrid. It had very small hind legs and was once believed to have a fluke-like tail similar to the whale fluke, an assumption that has not been supported by fossil evidence—no evidence of any fluke structure exists on any of the known Rodhocetus fossils. It even lacks a ball vertebrae required for a fluke, a significant problem because all cetaceans have ball vertebrae and flukes.

Furthermore, no evidence exists for the bone structure that is required for the flippers that exist on all whales. It did have nostrils that were located slightly higher on the skull than that of a crocodile, but not near the location of the whale blowhole. No evidence exists that they functioned like a blowhole. Its skull is much closer to that of a crocodile and very dissimilar to that of a whale.

5. The *Archeocete* class is an extinct mammal, and there is no evidence of an evolutionary link between it and any fossil whales. Unlike modern toothed whales, the Odontoceti archeocete fossils had teeth that were differentiated into incisors, canines, and molars called polyform teeth (thus they were heterodonts), which indicates that they were terrestrial mammals. All whales have monoform teeth (only one tooth type exists in a single animal). No evidence of a fossil connection has been found between either the Archeocete teeth or pelvic structures and Odontoceti, toothed whales.

6. *Basilosaurus* (king lizard) was a serpent-like creature that measured up to 70 feet in length. It was a fully aquatic crustacean with sturdy front flippers and small well-developed hind legs complete with jointed knees and toes that were possibly used as copulatory organs. Originally discovered in the late 1800s in the United States, *Basilosaurus* was named "king lizard" because of its resemblance to a large lizard. Stahl (1974, p. 489) concluded that *Basilosaurus* "could not possibly have been ancestoral to any of the modern whales" for numerous reasons, including its serpentine body form and the shape of its teeth, often an important means of classification. Lawrence Barnes, of the National History Museum, noted that *Basilosaurus* lived contemporaneously with modern baleen whales (mysticetes) and toothed whales (odontocetesl) and thus could not be ancestral to modern whales (cited in Werner, 2007, p. 144). *Basilosaurus* was likely an extinct marine animal and not a transitional form.

7. *Dorudon atrox*, a 20-foot-long cetacean with a fluke and small back legs, is another putative whale link. The animal is very similar to a small *Basilosaurus*, and for this reason is thought by some to be a juvenile *Basilosaurus*. The most complete skeleton shows small hind limbs, feet, and toes very similar to those of *Basilosaurus*, indicating that *Dorudon* is a juvenile Basilosaurus.

The Toothed Whales

Fossil teeth are central to the whale fossil record. Unfortunately, this evidence is very problematic. For example, Pakicetus teeth resemble those of Protocetus and Indocetus (Berta, 1995; Bajpai and Gingerich, 1998). Toothed whales first appeared in the fossil record in the Eocene, estimated by evolutionists to be 30 million geological years after the Archeocetes became extinct (Evans, 1987; Alexander, 1975). Evans concluded that the Eocene archeocete fossils were "replaced" by members of four different fossil whale orders in strata judged to be Oligocene. Two separate types of Odontoceti—those with polyform teeth, such as the *Squalodontidae*, and others with no dental differentiation (monoform teeth)—may have existed. Only the monoform dentition groups still exist today.

Darwinists claim that whale teeth evolved from the "differentiated" condition found in fossil whales, to the "undifferentiated" teeth found in modern Odontoceti. This evolution scenario requires a series of fossils linking a long serpent-like creature with tiny back legs (such as the *Basilosaurus)* to modern toothed whales. Furthermore, the comparison of these unrelated and unlinked life-forms is not based on scientific data, and evidence exists that they were contemporary with whales, thus could not be a whale precursor.

The claim that true polyform teeth exist in certain fossil Odontoceti requires more study (Ridgway, 1972). Toothed *Squalodontidae* fossils found in the late Oligocene possessed teeth grouped into functional incisors, canines, premolars, and molars. For this reason evolutionists are forced to claim that teeth became more numerous and *less* specialized as the pre-whales evolved into modern Odontoceti whales (Gaskin, 1972).

In addition, when the fossils are compared, one type of whale fossil is found almost exclusively, or exclusively, in only one part of the world, such as Pakistan, and another transitional form is found

exclusively, or almost exclusively, in a different part of the world (Thewissen, 1998).

Summary of the Fossil Record

Although many evolutionists believe the fossil record for the evolution of whales represents a strong documentation for evolution, valid fossil evidence has been completely lacking to fill the important void between land mammals and whales with valid evidence. This is true in spite of the fact that over two million putative fossil whalebones have been discovered. None of the proposed fossils is a viable transitional fossil, and all are problematic. The best example of a transitional form is the modern-day dolphin, but since they are contemporary with modern whales, they cannot be ancestors of whales.

As Gaskin (1972, p. 5) concluded, there exists "near unanimity among specialists that the ancestors of the Cetaceans were also the ancestors of the land mammals known as the Artiodactyla, of which modern representatives are the camels and rhinoceros." Yet no clear fossil lineage exists between the Artiodactyla and modern whales: "The fossil record which could confirm the origin of the cetaceans from terrestrial or freshwater mammals *still has many gaps*" (Gaskin, 1972, p. 5, emphasis mine). Banister and Campbell (1985, p. 294) summarized the fossil record, accurately noting, "The origins of present-day cetaceans are poorly known." More than two decades later this is still true.

The origin of the first baleen whales is also obscure, and they first appear in the fossil record in the Middle Oligocene as fully formed whales (Gaskin, 1972). There is no fossil evidence linking land-dwelling mammals with teeth to Baleen whales in spite of the fact that the teeth that distinguish them preserve better in the fossil record than any other body part. In view of the problems with the above-proposed transitional forms, it appears that, as Colbert concluded, "whales ... appear suddenly in early Tertiary times, fully adapted ... for a highly specialized mode of life" (Colbert et al., 2001, p. 392). Professor Slijper's statement made in 1962 is still true: "We do not possess a single fossil of the transitional forms between the aforementioned land animals [carnivores and ungulates] and the whales" (Slijper, 1962, p. 17). The lack of transitional forms is explained by some evolutionists by assuming that whales "enjoyed at the outset a series of extraordinarily rapid evolutionary changes that by middle Eocene times made them well adapted for life in the ocean" (Colbert et al., 2001, p. 392).

Whale Skeletal Structures

Whale Pelvis Bones

The so-called "pelvic girdle" of whales and porpoises is located in the general region where hip bones exist in land mammals (Bejder and Hall, 2002). Scheffer (1976, p. 8) described these whale hips as "a pair of slender bones floating in the muscles near the sex organs." Actually, the whale pelvic bones are "freely floating in muscle tissue just in front of the anus" (Evans, 1987, p. 4).

The evolutionary explanation for the whale pelvic bones is that they are the useless vestigial remains of the pelvic girdle and the hind legs that existed when the whale ancestor was a terrestrial tetrapod (Young, 1962; Ridgway, 1972; Alexander, 1975; Watson, 1981; Evans, 1987). Certain extinct whales did have pelvic bones, but this alone does not prove that whale ancestors were terrestrial. An enormous number of major features separate whales from terrestrial animals, and we have no evidence for transitional forms. Many extinct animals have existed with a wide variety of features that cannot be used to prove anything about evolution.

Bejder and Hall (2002, p. 445) conclude simple evolutionary changes in *Hox* gene expression or *Hox* gene regulation are unlikely to have caused hind limb loss, but selection "acting on a wide range of developmental processes and adult traits other than the limbs are likely to have driven the loss of hind limbs in whales." They argue that hind limbs likely "began to regress only after the ancestors of whales entered the aquatic environment" (Bejder and Hall, 2002, p. 445).

Before the limbs could regress, the pre-whale would have needed an effective method of swimming—and once it did, why would the limbs regress? Many Darwinists argue that these bones prove that whales evolved from a terrestrial animal with functional hind legs. Chadwick (2001, p. 69) wrote that, as the "rear limbs dwindled, so did the hip bones that supported them." An example of this line of reasoning from an online discussion group is as follows.

> Whales' hip-bones prove (or suggest strongly) that an "intelligent designer" did not create whales.... an "intelligent" design uses functioning parts for rational purposes. Hip bones have a function: to support legs. Whales have no legs. Whales have no use, function, nor need for hip bones. And yet they have hip bones ... ergo ... the "ID" notion can't explain it. It can only beg the question. "Maybe there is a use we are unable to perceive." Maybe. But "Maybe" is not an explanation; the ID concept has no explanatory value. Evolution, on the other hand, is easily capable of embracing the concept of vestigial organs and structures, and "explains" the mystery.... Whales are descended from animals that had legs ("Silas," 2002).

Crapo (Crapo, 1984, p. 6) concludes, "It is clear that the empirical data fit neatly within an evolutionary argument while posing an unresolved problem for creationists." Russian zoologist Alexy

Yablokov (1974, p. 233) wrote that from the

> time of Charles Darwin to the present, the two small bones in whales in the place of the well-developed posterior extremities of terrestrial mammals, have been considered to be a fine example of vestigial organs.

Awbrey (1983, p. 6) asserts (but cites no evidence) that the fossil record of whales supports the pelvic bone degeneration theory because not two, as seen today, but rather three whale pelvic elements are discernible in the fossil record. But if the fossils demonstrate a modification from three bones in whales' hips to two, this would not in itself demonstrate that the whale pelvis is now a useless structure. Although Awbrey (1983, p. 6) asserts that the pelvis has been reduced by evolution and "no longer connects the hind legs to the axial skeleton," he admits that the two small bones have a function—"to support the reproductive and rectal muscles." Their support role fits either the design, or the descent-with-modification view, but either way they are not vestigial. Creationists also once effectively explained the whale hip bones as evidence of degeneration, but this view is no longer valid because a clear function has now been determined for the bones.

Far less is known about cetaceans than about many other animals. This creates a problem for any analysis. It is partly for this reason why

> the exact identity and development of the elements of the pelvic vestige of extant cetaceans [i.e., are they the ischium, ileum or pubis?] have not been established. Such identification is critical to fully understand the events underlying the evolution of the cetacean pelvis (Pabst et al., 1998, p. 393).

The whale hip bones may not correspond to any of the bones Pabst et al. (1998) listed, and may serve a different function entirely.

The Function of the Hip Bones of Whales

It is now known that the whale hip bones have a function similar to the hyoid bone in humans—to serve as an anchor for various muscles and other structures. As an example, North Sea Beaked Whale has a putative "pelvis" found only in males and serves to anchor the muscle set attached to the penis (Watson, 1981, p. 33). In other whales, the whale "pelvis" bones, together with the separate putative limb bones, serve as an attachment for the penis corpora cavernosa (Young, 1962, p. 667). Tajima et al. (2004, p. 761) concluded from an anatomical study of the porpoise pelvic bone that its function in male finless porpoises is to support the penis.

Work by Yablokov (1974, pp. 234–235) documents that the whale pelvic bones serve a critical copulation function, and the "pelvis" in toothed whales is differentially located in males compared to females in order to make "penis erection possible in the male" and aid in "effective contraction of the vagina in the female." These bones also support certain internal organs and also serve as points of attachment for several muscles, as does the coccyx in humans (Williams, 1970). Thus, like the human hyoid bone, the two small pubic bones in the whale function in a support role for various organs and muscles (Awbrey, 1983, p. 6).

Interestingly, Darwinists now acknowledge that these "formerly held vestiges" play "important functions" in the whale, yet they argue that the bones "still demonstrate descent with modification" (Conrad, 1983, p. 9). Of course, if Darwinism is true, all organs and structures would demonstrate descent with modification because evolution teaches that *all* organs evolved from other simpler organs.

Like the human hyoid bone, the two small whale pubic bones provide structural support for various organs and muscles (e.g., Awbrey, 1983, p. 6). This creates a contradiction for the evolutionists in that they once argued that the whale hip is a vestigial leftover from when its ancestors were terrestrial—just as predicted by evolution. Then when a function was realized, they immediately argue that this proves the whale hip was derived from the terrestrial ancestor's hip—just as predicted by evolution. Hence, this demonstrates the 'just so story' nature of evolution—nothing is explained, just adjustments of the "story" (often without even acknowledging the story has changed).

The Whale Limb Bones

In addition to the small but functional whale hip bones, some whales also have structures resembling limb bones. In some whale species, anterior to the tail exist "rudiments of a femur and even a tibia," both of which are attached to the girdle (Alexander, 1975, p. 431). Blue whales often have a "pelvis" with tiny bones attached to it. In addition, a tiny tibia-like bone is sometimes found in the bowhead whale (Watson, 1981, p. 33). Young described the whale hind legs as "bony nodules … representing limb bones" (1962, p. 667). Andrews (1921, p. 2) described the case of a 31-inch-long whale hind limb, which he concluded shows a "remarkable reversion to the primitive quadripedal condition."

A major problem is explaining why the whale lost most of its limbs—many aquatic animals such as crocodiles have fully functional limbs that serve as both paddles to swim and feet to walk. Awbrey (1983) claimed these whale leg bones are atavisms that can be explained only in terms of mega-evolution, and offered that:

> In many cetacean species, an occasional individual also has one or more poorly formed leg bones that form no joint with the pelvis. When present, these bones are arranged in the typical tetrapod order of femur, tibia and tarsus, and metatarsal. The paired protrusions enclosing these leg bones range from tiny bumps to

> cylindrical structures up to four feet long (Awbrey, 1983, p. 6).

As we have seen, no clear fossil data supports Awbrey's claim that these small bones indicate the descent of whales from an ancestor that possessed fully formed legs. Byers (1983, p. 2) summarized the lack of fossil data for loss of legs in whales:

> The oldest Cetacean fossils are found in Upper Eocene deposits, and in none of these fossils are leg bones better developed than they are in modern specimens. There is nothing aberrant or unusual in these fossils. I have yet to find anything in the fossil record that is surprising or difficult for a creationist to explain.

One explanation for these whale "leg" bones (and similar abnormalities) is they are due to abnormal development caused by mutations or teratogens. Evidence for this includes their rarity in many whale species. The case Awbrey (1983) examined "is the only recorded case" that he knew of among cetaceans, even though "hundreds of thousands of whales have been killed, especially in the last fifty years" (Andrews, 1921, p. 6). If these bones, in fact, are mutational or developmental abnormalities, they tell us little about whale phylogeny. Until more cases are studied, it is difficult to draw firm conclusions about their function or origin.

Conversely, in some species of whale the "leg" bones are very common, if not universal. The most plausible explanation is that the "limb" bones are part of a structure that serve as copulatory guides and provide an anchor for the genital muscles (Chadwick, 2001, p. 73). Such a contemporary function does not support any evolutionists' conclusions that these bones are vestigial evidence of legs.

An example is a *Basilosaurus*, as discussed above, this giant aquatic marine animal had a serpent-like body, flippers, and very small hind limbs. The "well-developed" hind limbs of *Basilosaurus* have been considered evidence that it was a late transitional stage to the legless modern whale (Chadwick, 2001, p. 73).

Gingerich, et al. (1990) discovered several new skeletons of *Basilosaurus* in Egypt that contained comparatively well-preserved examples of the limb and foot bones. From their research on these skeletons, they concluded that they function as copulatory guides to assist the animal in sexual reproduction—obviously a critical role for *Basilosaurus* (Gingerich et al., 1990). One reason for this conclusion is the fact that the putative hind limbs of *Basilosaurus* appear too small relative to body size to have much use in swimming, or to support the body on land, but

> maintenance of some function is likely for several reasons: most bones are present; some elements are fused, but remaining joints are well-formed with *little suggestion of degeneracy; the patella and calcaneal tuber are large for insertion of powerful muscles; and the knee has a complex locking mechanism*. ... The pelvis of modern whales serves to anchor reproductive organs, even though functional hind limbs are lacking. Thus hind limbs of *Basilosaurus* are *most plausibly interpreted as accessories facilitating reproduction*. Abduction of the femur and plantar flexion of the foot, with the knee locked in extension, probably enabled hind limbs to be *used as guides during copulation, which may otherwise have been difficult in a serpentine aquatic mammal* (Gingerich et al., 1990, p. 156, emphases added).

Whale Fetus Teeth

As described, modern whales are divided up into toothed whales (*Odotoceti*) and baleen whales (*Mysticeti*), which use the comb-like plates attached to their mouth roof to strain food from seawater. Adult baleen whales lack teeth but, as a fetus, possess tooth buds in the upper and lower jaws. Ever since Darwin (1959, p. 450) wrote about the presence of teeth in fetal whales, which, when grown, "have not a tooth in their heads," the whale fetus tooth-buds have commonly been labeled vestigial. It is assumed this proves that the baleen whales' ancestors had teeth, and that these embryonic "teeth" are unnecessary because they are not present in the adult.

Darwinists today claim that fetal baleen whales' teeth are

> derived from toothed ancestors [and this] is suggested not only by paleontological evidence but also by the fact that teeth are still found in ... [whale] embryos. The teeth are absorbed as the fetus develops the whalebone characteristic of this suborder (Ridgway, 1972, p. 507).

Darwinists argue that these tooth buds in fetal baleen whales can be explained only by evolution and falsify the design model: the whale teeth are "evolutionary leftovers" that "clearly refute design" (Awbrey, 1983, p. 6).

Functions of Whale Tooth Buds

Fetal baleen whale tooth buds are now known to have several documented functions. Vialleton (1930, p. 164) concluded that, although "teeth in the whale do not pierce the gums and function as teeth, they ... actually play an important role in the formation of the bone of the jaws to which they furnish a *point d' apui* on which the bones mold themselves." Kaufmann (1983, p. 4) elaborated on Vialleton's findings about the function of whale teeth, noting that the temporary development of whale teeth

> guides the formation of their jaw. The teeth are multiplied and the length of the jaw is patterned after this multiplication. This could apply to the baleen whale; after the jaw is properly formed, the teeth are completely reabsorbed into the bone structure.

Dewar (1957, p. 171) also elaborated on Vialleton's research, concluding,

> Darwin was wrong and Vialleton was right, [because the] disposition [of these fetal teeth], their form and their number, different from those of other Cetacea, show that in the whalebone whale, far from being merely the relics of an extinct ancestor, they have an individuality and a causality peculiar to them, since they are multiplied and adapted to the length of the jaw.

Dewar (1957, p. 171) further concludes that the claim that "ancestors of the toothless whales first acquired a number of additional teeth, then scrapped them all and developed in their place the extraordinary baleen plates that occur in the mouth" is highly improbable.

Dewar (1957, p. 171) states that Vialleton's (1930) assertion was confirmed in a paper by Dr. John Cameron (*Transactions of the Royal Society of Canada*, Vol. 12, 1918), which showed "one of the functions of the developing teeth is to enable the jaw to be properly molded." This was

> illustrated by a photograph of a microcephalic idiot of whom the jaws recede like those of an ape, because of the poor development of the teeth. "In many of these individuals" he writes (p. 179) "the teeth never develop at all: The effect of this defective dentition is reflected in the corresponding feeble degree of development of the jaws…. The superior and inferior maxillae (jaws) in the early stages of their ossification, it may be recollected, are fragile bony shells enclosing the dental germs. For example, the lower jaw at birth is simply a thin trough of bone enclosing the developing teeth. The cause (of the poorly developed jaws) is a deficiency or actual total failure of development of the dental gums, the effect being that the investing jaws likewise fail to execute their normal growth and evolution" (Dewar, 1957, pp. 171–172).

Several studies using different animals have found that a feeble, poorly developed jaw resulted in improper fetal teeth development. It would be more accurate to term the tooth-like structures a jaw development system instead of teeth that never erupt from the gums. Similar scaffolding systems are actually rather common in embryology. Examples include the webbing between the fingers in humans and certain animals.

In a penetrating analysis of embryonic teeth as supposed evolutionary vestiges, Dubois (1985) reviewed the logical fallacies inherent with this concept. He concluded that, it is "highly unlikely from an evolutionary point of view that the baleen whales would have developed the extra teeth only to begin the process of losing them," and while Darwinists attempt to construct a

> scenario to "explain" such an occurrence, such scenarios are the evolutionary equivalent of the creationist's God could have done it that way; and in terms of actual explanatory value are equally worthless. Further, that the teeth seem to be "adapted to the length of the jaw" militates against the assertion of vestigiality since one of the characteristics of vestigial structures is that *they are no longer* adaptive and therefore in the process of being discarded. I have actually seen one person maintain that *even the degree to which a* structure has not yet been lost is controlled by considerations of adaptive value. I find this incredible. If a structure is useless, how can it be of any adaptive value to maintain it? If it is not useless, then it is not vestigial (Dubois, 1985, p. 14).

Dubois concludes that the vestigiality question in this case would never exist except for two factors. First, the

> evolutionary viewpoint generates certain artifacts—evolutionists must have evolutionary evidence, and "vestiges" are a phenomenon which would seem to supply it—but given the number of structures which have been alleged to be vestigial and are so no longer, it may be said that this viewpoint has generated a "problem" to be "solved" which is entirely spurious. Second, there seems to be some under appreciation of the fact that not all structures are directly useful to adults (Dubois, 1985, p. 14).

In one study of the development and degradation of the temporary tooth buds in baleen whales, Ishakawa and Amasaki (1995, p. 665) found that "the degradation pattern was little different from that of deciduous tooth buds in terrestrial species." The same claim made about whales losing their teeth is also made about chickens, animals believed by many Darwinists to have descended from toothed dinosaurs. If birds descended from toothed ancestors (both fish and many dinosaurs have enamel-protein processing genes), Darwinism would predict that there should be evidence in many birds, such as chickens, of "vestigial" defective and nonfunctioning but still present enamel-protein genes rather than a total absence of these genes, as is found. A study of the chicken genome has found no evidence that this bird has enamel-protein genes.

No living or any known Tertiary bird has teeth except Archaeopteryx, and all known Cretaceous birds had well-developed teeth. If, as the evolutionist supposes, modern birds are derived from toothed ancestors, many, if not all, birds should exhibit fetal teeth as whalebone whales do, but no known bird embryo shows any trace of teeth. The supposed rudimentary teeth that have been described in parrots are not teeth but papillae. Birds lack embryonic teeth because they are not necessary for the molding of their very slender jaw (Dewar, 1957).

The Cetacean Vibrissal Apparatus

The "vibrissal apparatus" (hairs, such as the whiskers cats use as sensors) in cetaceans are assumed to be remnants

of a former total hairy covering of an earlier evolutionary stage. The remaining "hairs" found on the heads of whales are "usually considered a very clear example" of a vestigial organ (Yablokov, 1974, p. 235). Research has shown that these structures are not "vestiges" but rather are very complex functional sensory organs that have a well-developed nerve supply connected to each "hairlet" (Yablokov, 1974, p. 235).

The blue whale (*Balaenoptera musculus*) has about ten thousand nerve fibers combined in large bundles and connected to each vibrissae. New research on the behavior responses of blue whales that resulted from touching their vibrissae has concluded the evolutionary claim that vibrissae are only "remnants of a previous hair cover" is incorrect. The vibrissae actually play a major role as tactile organs, especially for determining the presence of food (Yablokov, 1974, p. 235).

Recent investigations by Yablokov and others have confirmed these observations. The results of detailed histological investigations of vibrissae from five baleen whale species have documented that it is a complex sensory organ (Yablokov, 1974, p. 235). The hair follicle extends deep into the dermal layer of the skin and is embedded in connective tissue fibers that differ considerably in size from similar structures used in the connective tissue of the cetacean dermis. Yablokov (1974, p. 240) concluded that the pelvic bones and vibrissae are two examples that show not only do these putative "vestigial organs have a function … but they are highly specialized structures, perfected for carrying out complex and delicate functions as in the case of the pelvic bones in the present toothed whales, or vibrissae in baleen whales."

Molecular Studies

In addition to anatomy and fossil studies, molecular studies have attempted to determine whale ancestry, with varying results that support some theories and not others. So far, as a whole, there exists a "wide gulf between the morphological and molecular evolutionary studies" on the question of which mammals are the whales' closest cetacean relatives (Luo, 2000, p. 235). In fact, Luo (2000, p. 236) adds, "There is a big disagreement between morphological and molecular studies … on the broad picture of ungulate-cetacean evolution." After evaluating the molecular studies, Naylor and Adams (2001, p. 444) noted that "the phylogenic position of cetecea within the mammalian tree has long been a subject of debate." Spaulding et al (2009) in an evaluation of extinct taxa using both morphological and molecular evidence, found that the fossils closest to whales are Indohyus and similar fossils. Mesonychids were more distantly related. The closest living relative is the hippo. They also found "mesonychia is only distantly related to Artiodactyla" and that when taxon sampling is altered or other criteria are used for comparisons, the taxonomic arrangement may be changed (Spaulding et al., 2009, p. e7062).

Conclusions

In conclusion, I agree with Stahl, who wrote that "ascertaining the terrestrial stock from which the whales came is exceedingly difficult" (Stahl, 1974, p. 486). Colbert et al. (2001, p. 392) further state that, like bats, "whales (using this term in a general and inclusive sense) appear suddenly in early Tertiary times, fully adapted by profound modifications." Furthermore, the fossil and other evidence of whale evolution contradicts Loxton's claim:

> We also have great series of transitional fossils for many of the most dramatic transformations of evolutionary history. For example, we have an amazingly clear record of the evolution of whales, from bear-like land mammal, to river predators that were shaped like giant otters, to primitive whales, to modern whales (Loxton, 2007, p. 85).

Instead, the half-century-old statement of Colbert et al. (1955, p. 303) that "no intermediate forms are apparent in the fossil record between the whales and the ancestral Cretaceous placentals" is closer to the current state of knowledge. The fact is, which terrestrial animal could have evolved into a whale has been, and still is, a "source of spirited debate" (Harder, 2001, p. 180).

One reason for my conclusion is that the various claims postulated for all of the existing transitional animals are very problematic (Camp, 1998). Another reason is no evidence exists for vestigial organs in whales and the enormous gap between whales and their putative ancestors has only widened with further research. The research work on genetic comparisons finds that there exist major conflicts between the existing whale genetic evolutionary tree and the fossil record (Spaulding et al., 2009; Xiong et al, 2009). Furthermore, even the long time periods postulated by evolutionists cannot explain whale evolution: "There is, in short, neither the time nor the mechanism that could begin to account for so rapid and dynamic an evolutionary transformation from that small mammal to the extraordinary whale is so (relatively) short a period as twelve million years" (Fanu, 2009, p. 120).

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