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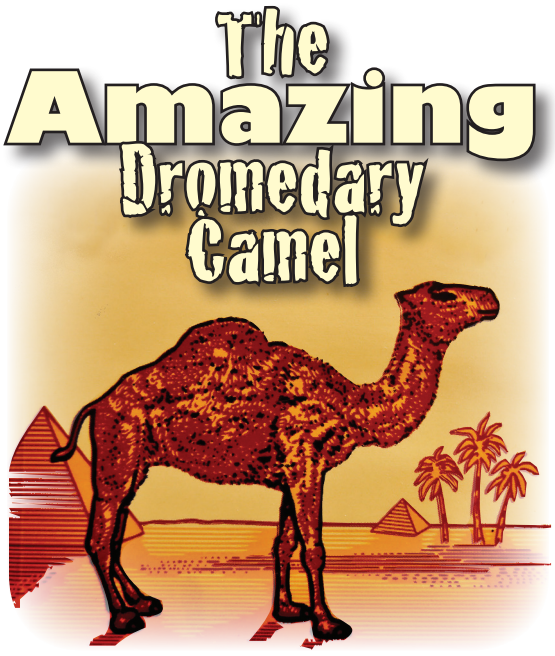
The Amazing Dromedary Camel

Camels are one of the most amazing animals known to humans. They are the workhorse of the desert and a gift to generations of people. The Bible mentions camels over 60 times, indicating their central importance in Biblical times. The Bible notes two



kinds of camels, the two humped Bactrian camel, and the larger one hump dromedary camel, *Camelus dromedarius*, family Camelidae. Both kinds now live in the hot dry deserts of the Middle East.

Dromedary camels are mammals expertly designed for desert life and have worked closely with humans for close to five thousand years (Grzimek's Animal Encyclopedia. 1972.Vol. 13. Van Nostrand p. 138). Although their main diet is grass and other plants, they can eat almost anything. Their mouths are so tough that they can even munch on a thorny cactus plant or a pair of shoes.

Its eighty-pound hump is filled with fat, not water as some people assume. Its body uses the fat stored in the hump to survive long periods without food, enabling it to travel across the hot barren desert sands of the Arab world (Grzimek's Animal Encyclopedia. 2004. Vol. 15. Thomas-Gale p. 314). In an eight-hour day it can carry a four hundred pound load a hundred miles across a hot, dry desert without stopping once for water or food. After crossing the desert, when it begins to consume food again, the hump soon builds up back to its healthy size.

A camel can survive for eight days without drinking water, causing it to lose as much as 220 pounds. As a result, it becomes very thin and boney. Because many of its billions of cells have lost their water content, its ribs now show through its skin (Grzimek, 1972, pp. 141-142). After camels reach a water hole, they will drink up to twenty-seven gallons of water (135 liters) – about ten buckets full of water in about ten minutes (Grzimek, 1972, p. 143). They can then continue on their desert journey.

In camels the water first travels into its stomach, allowing its blood vessels to absorb and carry the water to every other part of its body. In a matter of minutes most of the water camels have swallowed travels to the many billions of cells that make up its flesh, changing its skinny body almost immediately. After drinking twenty gallons of water its stomach empties after only about ten minutes. Humans require several hours of spaced drinking before they can replace all of the water lost in a day spent in the desert.

By Jerry Bergman

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Animal Tails

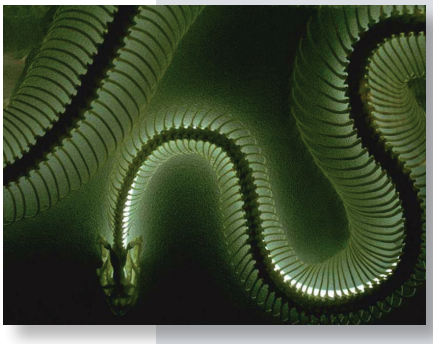
Wonder Tools for Wonder Animals

A tail is a distinct, flexible appendage attached to the torso of the rear section of an animal's body. It is the body part that corresponds roughly to the coccyx in mammals, reptiles, and birds. Tails are primarily a feature of vertebrates, although some invertebrates, including scorpions and springtails, have tails. Even snails and slugs have tail-like appendages sometimes referred to as tails.

Animal tails have numerous functions. For fish and other marine life forms they provide a locomotive force and function as a rudder to enable them to smoothly glide through their watery world. A whale's tail is called a fluke, which moves up and down instead of side to side as fish tails do (Fielding, 2011, p 24). The fluke propels the bus-sized whale rapidly through the water. Without it, the whale could not swim. Snakes are actually a very long tail with a head.

By Jerry Bergman

The tails of grazing animals, such as horses, zebras, lions, giraffes, cows, and elephants, are indispensable to sweep away insects that bother them. Called fly-swatter tails, they are usually long and thin with a thick fur tuft at the end similar to a fly swatter (Fielding, 2011, p. 7).



Tails are also used to effectively communicate an animal's physical and emotional state. The best example of a talking tail is that of dogs, most of which communicate quite well by wagging their tails to convey their friendship, mood, feelings, wants, and disappointments. All canids, including domestic dogs, indicate emotions both by positioning and by movement of their tails. Dog lovers claim they can tell a dog's mood just by studying the tail.

Tails are also used for social signaling. Some deer species flash the white underside of their tails to warn others of possible danger. Some species' tails are armored, others, such as scorpion tails, contain venom.

Continued on Page 2

Animal Tails Wonder Tools for Wonder Animals

Some animals, including kangaroos, use their tails as a third leg to sit on while competing for mates, to munch on leaves on tall branches, and to help them balance while carrying their joey's (babies). Others, such as New World monkeys and opossums, have prehensile tails that allow them to swing from one tree branch to another, hanging only by their hand like tail that can firmly grip tree branches. They also can anchor to a small tree branch while they sleep on a larger tree branch (Fielding, 2011, p. 10).

Many other primates have tails, including lemurs, which they can use as an extra hand to hold on to their mother––or to branches, to help them balance while transversing the arboreal world, or even to help them obtain food (Fielding, 2010, p. 11).

The tails of some animals are used to keep the herd from separating as they travel. Elephants will hold on to each other's tails when they travel long distances to help insure the herd stays together (Fielding, 2011, p. 7). The young on many animals such as elephants hold their mother's tail when they feel stressed or threatened.

Some lizard species can detach their tails from their bodies (called "casting") to escape predators. Once detached, their predators are either distracted by the wriggling detached tail, or are left with only the tail while the lizard flees to safety. Tails cast in this manner usually soon grow back, though the replacement tail is typically darker in color than the original.

The tails of most birds end in long feathers called rectrices that are used as a rudder to help the bird maneuver when in flight. Without these long, specially designed tail feathers, they would be unable to fly. Their tails also function as brakes by moving them forward, then spreading them out to act as a windbreaker. The extra-stiff tail feathers of other birds, including woodpeckers and woodcreepers, allow them to brace themselves firmly against tree trunks to enable them to peck wood. Their tails also help the bird to balance while perched. In some species—suchas birds of paradise, lyrebirds and, most notably, peafowl—modified tail feathers play a role in courtship displays.

Some animals, such as squirrels and skunks, have large ostentatious bushy tails that they can curl around themselves in cold weather to help stay warm and keep dry (Fielding, 2011, p. 15). Some animals, such as squirrels and cats, clean and groom their tail by running their front teeth through the fur, similar to how humans use a comb or brush to prep their hair.

Some animal lovers have nominated the chameleon as having the most beautiful tails in the animal kingdom. They can tightly coil up their very colorful jewel like tails, and then, like a whip, spring them open to threaten any provokers that happen to wander by.

Human embryos have a misnamed tail that is about one-sixth of the size of the embryo itself. As the embryo develops into a fetus, the growing body catches up with the tail. This tail-like structure was long claimed to be a vestigial structure, but we know that it has an important function. The long tail-like structure exists because the nervous system, including the brain and spinal chord, develop first to help coordinate the development of other body systems.

Children are occasionally born with a "soft tail," that lacks vertebrae, but has blood vessels, muscles, and nerves. Although a few documented cases of "tails" exist containing cartilage, or even up to five vertebrae, these examples are all developmental abnormalities and are normally excised by a surgeon.

The claim that humans lost their tails, although commonly made, does not make sense in view of the fact that the relevant structure exists only as a platform for the development of an essential part of the body. The beauty of the situation is that we do not need a tail to help us balance or function as a third arm, or communicate. We have been provided with better features to allow us to do all the tasks that tails do so well for many animals.

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New DVD
Most exciting yet!

Illustra Media has produced many excellent DVDs, but the last one ***Flight: the Genius of Birds*** is one of their most awesome! It is certainly one that will appeal to entire families. While the previously released ***Metamorphosis*** (dealing with butterflies) provides amazing scenes and discussion, ***Flight*** not only provides wonderful photography, but also discussion which is easily understood by all. Moreover, even if one could not understand a word of the commentary, the scenes of birds in flight and the graphics still convey a powerful message.

Association producers of the film Drs. Paul Nelson and Timothy Standish provide the bulk of the commentary. Dr. Nelson introduces the whole topic with a reference to his own father, an aeronautical engineer, who used to remark: "If something works, it is not happening by chance!" This is something to keep in mind as we learn about the design features of birds which enable them to fly (just as the design features of aircraft enable them to fly and not to crash!)

Firstly the DVD focuses on embryology, the development of birds in the egg. We are shown an amazing series of real time and time lapse video clips of developing chicken eggs. Next, in logical sequence, we encounter scenes of young birds learning to fly. We are informed that the entire biology of birds is dedicated to their capacity for flight. It seems that the instinctive know-how is rooted in their genetics. Moreover the arrangement of bones, their hollow design (reinforced with girders and struts) and the arrangement of muscles (attached at unexpected angles to the bones) all are essential for flight.

One of the most amazing birds is the humming bird which, unusually for birds, can hover in mid-air, and fly backwards as well as forwards. These birds need lift all the time, not just on the down-stroke of the wing, and they have special design features to accommodate this.

We are next treated to a mid-air ballet, the swooping dance of up to 300,000 starlings in England. These flying flocks, called murmurations, never collide as their flocks merge and separate in endlessly changing flight patterns.

One of the most interesting discussions is the annual migrations of the Arctic tern. This small long-lived bird demonstrates the longest regular migratory route (about 71,000 km annually) of any animal. The report of a research program to establish the details of these bird flights was published in February 2010 in *Proceedings of the National Academy of Sciences* (vol. 107 #5 pp. 2078-2081). Carsten Egevang, the man who describes the research for us on the DVD, with fascinating video clips, is also the lead author of the scientific paper.

Dr. Egevang describes how, in July 2007, his team captured 50 birds at a nesting colony on Greenland. To each one they attached tiny light loggers (geolocators) to plastic leg rings. The next year they managed to re-capture 10 of these birds (an amazing accomplishment) and even more amazing, for 9 of the birds, the tiny retrieved recorders each provided an entire year's worth of data concerning where the birds had been. The records demonstrated that many of the birds followed the African coastline heading south to Antarctica, and the coast of the Americas when heading north. Some birds however traced a figure 8 in their choice of route. It is an amazing coupe, to hear from the lead researcher on this interesting recent project!

In their concluding commentary, Drs. Nelson and Standish declare that birds represent engineering marvels and works of art -- and we know where engineering and art come from! Thus "the biology and behaviours of flying birds offer some of the most compelling evidence for supernatural intelligence, design and purpose to be found anywhere in nature."

Filmed on 3 continents, and featuring dramatic scenes of birds in flight, this 62 minute DVD is certain to delight all viewers.

ONE MORE USE FOR DNA

By Margaret Helder

Over the last decade, everything has become digital. We don't capture images on film anymore, but in digital files. We don't send letters, we send email messages. We don't buy books, we download documents to an e-reader. Every organization has a website. Information is at our fingertips, but the whole system is extremely fragile.

The problems with our digital storage technologies are twofold. The data don't last once they have been laid down and must be transferred to keep them fresh, while the technology for storage and reading keeps changing. An amusing example of this is NASA, which in the early 2000s, found that it was unable to access data from the space program of the 1960s and 1970s. So there they were, scouring internet auction sites to find second hand eight-inch floppy drives which could read their priceless data. Similar events of loss or near loss happen all the time. In 2009 when Yahoo! closed their GeoCities server, a huge amount of data was lost, perhaps "the most amount of history in the shortest amount of time, certainly on purpose, in living memory." Nobody seemed to notice, but if these had been paper documents which were lost from a library, the outcry would have been anguished indeed. The take home lesson is that as a digital society, we need better systems to store and read data. In view of this, some scientists have turned their attention not to a new system, but to a tried and true system, much better than modern devices. Enter DNA to the discussion.

Inside every living cell, there are long strands of a molecule called DNA, which carry information. This information determines how the creature develops from a single cell, and how the creature will function when mature. This molecule, first described in 1953, consists of a chain of sugar molecules joined by phosphate groups. Each sugar molecule has attached to it one or other of four small nitrogen carrying molecules called nucleotides. The order of the nucleotides along the DNA chain, determines the information which the molecule carries. It is also a feature of DNA that it can be exactly copied endless times. This is because of the way the nucleotide bases fit together. DNA therefore is a system which stores and uses digital data.

Turning back to human technology, everyone agrees that we need a high density storage medium for data, one that can be preserved for long periods of time under easily achieved conditions, and one with a proven track record as a bearer of information. According to all these criteria, DNA is a proven winner. This molecule easily stores 2.2 million gigabytes of data per gram of DNA, the equivalent of about 468,000 DVDs in a tiny speck of material. This is superlative information storing capacity! The Large Hadron Collider in Switzerland, for example, generates about 15 million gigabytes of data per year. With this storage capacity of DNA, storage space should be no trouble at all! As to conditions required for best storage, it seems that dry storage at room temperature works perfectly fine. The molecules should remain stable for thousands of years, if required.

The remaining issue is what kind of promise does DNA provide for storing our digital recordings, images, text etc. And how do we extract the information once it has been stored in DNA? These are issues that occupy the attention of some scientists today. A further concern of course is the economics of the technique. In August 2012, three scientists/bioengineers at Harvard's Medical School, published an account of how they stored the entire text (53,000 words

and 11 digital images) of a genetics text in DNA code. An inkjet printer embedded the chemically synthesized DNA onto the surface of a tiny glass chip. Later they re-suspended the DNA in liquid, and fed it into a DNA sequencing machine after which a computer translated the coded information into English text. And there it was! The text of the book restored, with only an error rate of 2 errors per million bits. Since in digital code, there are 8 bits per character or letter, this translated into only a few single-letter typos in the whole book. Not too bad a record!

What the scientists did to convert the book's text into DNA code, was to assign two of the 4 nucleotide choices in DNA to represent a 0 in the binary code, and the other two nucleotide choices to represent a 1. Then the English text was translated into binary code, and then into the equivalent in DNA code. To turn this into physical reality, the DNA code was then (metaphorically) chopped into very short blocks of code, with information added at the end of each short chunk to show where in the large scheme of things, this piece occurs. Everything was just theoretical to this point however.

There are commercial laboratories that are able to piece together (synthesize) short strands of DNA with a specific order of nucleotides . The next step then was to order the synthesizing of about 55,000 different short strands of DNA and to multiply each of these millions of times as well. These were then stored in dry form. Later, to recover the information, the DNA sample consisting of all these different strands, was sequenced and read by special machine/computer systems. It is evident that this is not a cheap process!

Then on February 7, 2012 an article in *Nature* reported on some improvements to the system. One of the main sources of error in retrieving the data in the first study, was when the computer failed to count repeating nucleotides. Thus in a list like TTTT, the computer might miss one of the repeats. As a result, a large team of scientists devised a coding system where there would be no repeats. The rules seem complex, but computers follow whatever rules are programmed into them.

The team of Goldman and others (including Ewan Birney, ENCODE's lead analysis coordinator), stored 5 files in their DNA sample: all Shakespeare's sonnets (in ASCII text), a medium resolution photograph (in JPEG2000 format), a 26-second recording (MP3 format), and a PDF of Watson and Crick's original brief 1953 paper on the structure of DNA, as well as code which converted the data to base-3 digits (in ASCII text). In a cute stunt, they then shipped the dried material at ambient temperature (without any specialized packing), from the USA to Germany via the UK. In Germany the 117 nucleotide long strings of DNA were read by machine and converted back into their original formats.

This study involved only 739 kilobytes of data. However an interesting part of the discussion was economic. At commercial rates, the DNA storage method costs about $12,400 per megabyte stored and a further $220 per megabyte of data read from the system. In a world where the Large Hadron Collider, for example, generates about 15 billion megabytes per year, nobody is going to pay to store the data in DNA! However if one desired to store the data for an interval of between 600-5000 years, then this technique is economic even now, since the data do not have to be frequently transferred. If costs associated with DNA technology fall as expected, within a decade, it might be reasonable to store data for 50 years or more with this method.

The advantages of DNA data storage are its extremely high density, and easy storage requirements (on a shelf at room temperature) and of course its permanence. The disadvantages are the high cost of suitable computer/machine systems needed to encode the data and later to read it. In addition, accessing the data can be a slow process, depending on how fancy the machines are and how many are used. Also there is no random access memory in this system. One has to decode the whole file, and there is no modifying the data once it has been deposited.

So our technological society happily seeks to exploit a system which exhibits capacities far, far beyond our pitifully inadequate methods of data storage. A code that stores information never has, and never will develop by chance. This God-given system with DNA may help us protect some information for generations to come. Once again, our technological society borrows designs which God has provided to us in nature.

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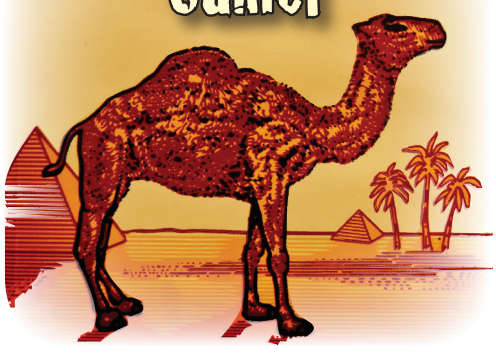
The Amazing Dromedary Camel



Even though it loses a large amount of water when in a desert, its body has several complex built-in mechanisms to conserve it. For example, their body temperature can range from about 34˚C to about 41˚C without any ill effects. In humans only four degrees variation can negatively affect health. Its body temperature can increase up to 40˚C before it begins to perspire, saving a great deal of water. Its body temperature can also drop to 34˚C at night, thus it takes a much longer time to heat up in the day before it needs to perspire, again saving water (Grzimek, 1972, p. 142).

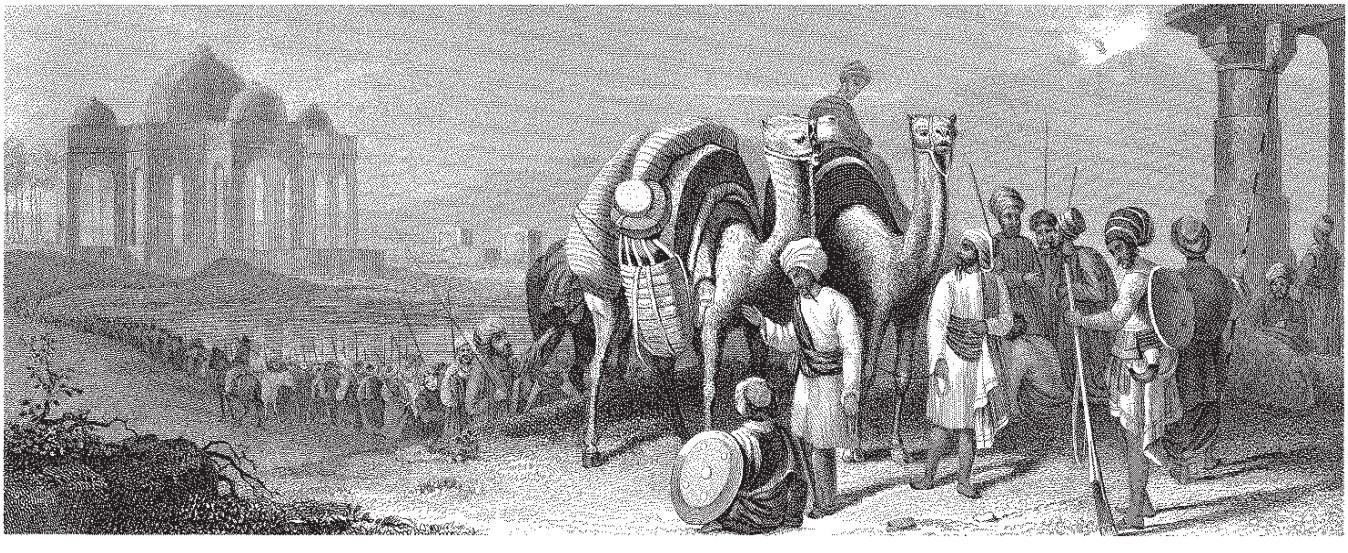
Humans begin to perspire after only a two-degree or so rise in their body temperature. A camel's blood normally is 94 percent water, as also is humans. But when it is unable to drink, the sun's heat gradually causes it to lose water from its blood, and it can safely lose up to 40 percent of the water in its blood without problems.

Human blood must remain very close to 94 percent water. If you lose five percent of your normal water, you lose vision; if ten percent you can no longer hear; if 12 percent your blood becomes as thick as molasses, causing your heart to stop (Grzimek, 1972, p. 141). One of the reasons for camel superiority in this area is that the Dromedary's red blood cells are not donut shaped like those in most mammals, but elongated ovals, which allows them to flow more freely when the Camel is dehydrated. Their blood cells can also handle large swings in water levels without rupturing, which is essential for the blood stream's ability to store extra water.

Dromedaries also have a specially designed nose that retains water. When it exhales, its nose traps the warm, moist air from its lungs and the water is absorbed by its nasal membranes. Because its nose is cooled, the warm moisture in the air coming from its lungs is changed into liquid water. Its nose is as much as 10˚C cooler than the rest of its body, due to breathing in hot dry desert air that produces a cooling effect as it causes the evaporation of the water in its wet nasal passages. The tiny blood vessels in these membranes then recycle the water back into its blood. In contrast to humans, their urine contains very little water. Rather it is a pasty substance about the consistency of syrup.

When windstorms cause sand storms, dromedaries have special muscles in their nostrils that reduce the opening size, thus preventing most sand from entering its nose, but still allowing the camels to take in enough air to survive. Its eyelashes arch down over its eyes like window shades, keeping both the sand and sun out, but still allowing it to see clearly. Its eyebrows are so thick and bushy that they must hold their heads high to see the ground. The eyebrows also shade its eyes from the bright sun. If a grain of sand gets on its eye surface, an inner eyelid called a nictitating membrane automatically wipes the sand off their eyeball.

Dromedaries travel on sand dunes due to their specially engineered "sand shoes." Its hooves are wide, and become even wider when it steps down on the sand. Each foot has two long bony toes with tough, leathery skin between the toes that function like webbed feet to prevent it from sinking down into the soft, drifting sand. Trooping along at about ten miles per hour, they can carry two or more hundred



pounds as far as one hundred miles in a single day of travel.

Camels have been called the ships of the desert because of the way they sway from side to side when they trot. The reason is that both legs on one side move forward simultaneously, elevating one side, then both legs on the other side move forward. This makes the rider feel as if he is in a rocking chair moving sideways. Some riders actually become seasick from the ride.

When camels are about six months old, thick kneepads begin to grow on their front legs that help them lower their close to 1,000 pound body to the ground. Lacking these protective pads, their knees would rapidly become sore and infected, and they would be unable to lie down. It does not develop thick kneepads from falling on their knees like humans would, but they can fall on their knees because their tough pads are designed into their knees by its genes

The mating season is fairly short, from February to March (Grzimek, 1972, p. 144). After a gestation length of from 365 to 440 days, they give birth to only one offspring. The female normally nurses her young for over a year (Grzimek, 2004, p. 317). The female dromedary nourished her young with very rich milk that humans can make into excellent butter and cheese.

The oldest written record of a camel is in the Bible, which tells the story of Abraham sending his servant to transfer ten camels from his homeland to Mesopotamia. When Grzimek first wrote, it was assumed that the "family camelidae originated in North America during the Eocene period 45 million years ago." Rogers, et al., wrote that, though less complete, the evolution of camels resembles that of the horses. He added that as in the case of the horses, most of the evolution of this group occurred in North America" (Rogers, et al., 1942. *Man and the Biological World.* McGraw-Hill p. 398). Rogers added of presumed ancestor *Protylopus* in Eocene rock: "It was the size of a large rabbit; there were 44 teeth in a continuous row, the molars being low-crowned. …the forefoot had 4 separate functional toes, the hind foot 2 functional and 2 reduced toes." (p. 398). Obviously *Protylopus* was a very different animal than a camel, requiring, for this evolution story to be valid, radical changes including the loss of many structures.

One of the richest sites of mammal fossils in the world is the John Day Country of central Oregon. In the most detailed study of these fossils, Mitchell concluded that the camel fossil remains that have been found in the John Day area sediments include: "fossil camel remains for all of the genera from many locations look very similar. The main differences are the sizes of the skulls or bones. The evolutionist taxonomic categories for these fossil camels are based on cladistic analyses that tend to *exaggerate the taxonomic importance of minor differences* in the skulls, teeth and metatarsal bones." (J. D. Mitchell. 2013. *Discovering the Animals of Ancient Oregon.* Leafcutter Press. Chapter 15 p. 193 emphasis in original).

One of the oldest camelid fossils ever found, estimated by evolutionists to be 1.8 to 2.5 millions years old, is "strikingly similar to those of today's" camelids (Merrel, 2013. Prehistoric Alpacas. <http://www.gatewayalpacas.com/alpacas/history-of-alpacas/prehistory.htm>; Meachen, 2005. A new species of Hemiauchenia (Artiodactyla, Camelidae) from the Late Blancan of Florida. *Bulletin of Florida Museum of Natural History.* 45 (4): 435-447).

We therefore can see that Dromedaries were well-designed and highly engineered for desert life. No clear evidence exists in the fossil record for their evolution. So many extinct and living animals look so much like camels, especially in their bone structure, that many animals could be chosen as their close relatives, or near relatives, based on fossils, yet these do not even begin to hint at an evolutionary route. Family Camelidae besides Dromedary and Bactrian, includes guanacos, llamas, alpacas, and vicuñas. In short, as to Camel evolution "paleontologists are not in agreement concerning … the evolution path, and [the] genetic relationships of these animals, due to the fragmentary nature of the fossils that have been found" (Mitchell, 2013, p. 191). The only conclusion from science is that the first Camel was a fully modern Camel and a wonderfully designed one, at that!

Illustra Media

Flight: the Genius of Birds

This DVD demonstrates not only the wonderful design of birds in general, but also the richness and variety that we find among these creatures. Filmed on three continents, and featuring dramatic scenes of birds in flight, and interesting discussion, this is certain to appeal to all.

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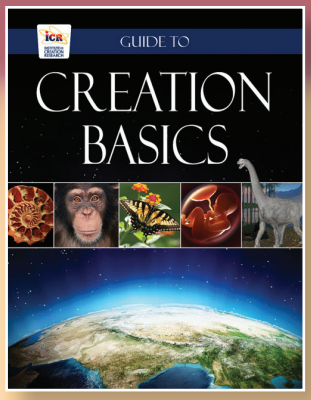

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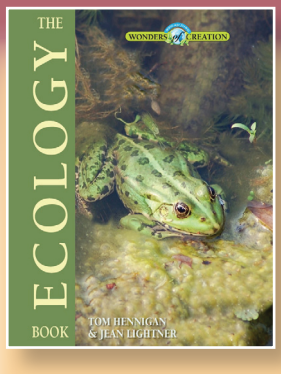

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