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Animal Secrets from High Tech Espionage

By Margaret Helder

Animals display many remarkable behaviours. To better appreciate their talents, how often have we wished that these creatures could communicate with us? We would love to know where they go during migrations, for example. In recent years however, animal ecologists have developed techniques to allow us to track some of these creatures. As a result, these animals communicate with us simply by doing what comes naturally, during the course of which our little espionage devices report where the animals have gone.

During the 1960s radio tracking of some large animals like grizzly bears was tried near Yellowstone National Park in the western United States. These large animals were ideal in that they were large enough not to be inconvenienced by the extra load of radio transmitters with battery packs. Wildlife managers sought to document bear reactions to livestock grazing, logging and recreational activities. Thus during 1975-76, a number of bears were trapped, fitted with radio transmitters and released. A small plane equipped with rotatable antenna was used to track the bears. From the data, it was discovered that the bears exhibited a lot of variety in their behaviours.

The popular habitat types included thick forest and wet meadows and the size of territory they occupied varied from 26 to over 700 square kilometers. Of 16 instrumented bears, 14 routinely crossed into and out of the national park. (Judd and Knight. 1980. *Ursus* 4: 359-367)

Clearly radio tracking had demonstrated that valuable information could be obtained from tagged animals. The trend since then has been to tag and track smaller and smaller animals, many of them in populations whose numbers are threatened, including many migratory birds. In order to mitigate threats to these birds, it would be useful to know their flight paths and destinations. Nevertheless, at first the devices were too large for really small birds.

Aircraft are clearly out of the question as a means of tracking birds that fly long distances over the sea. In the 1980s, a device was developed to track elephant seals. The device, called a geolocator, was designed to regularly measure and record ambient light levels. Such recordings over time can be used to calculate latitude and longitude. Once the recording device is recovered from the animal, computers

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The Venus Flytrap; A Major Enigma for Evolution

By Jerry Bergman

Among the wonders of the natural world are plants that eat animals, and the best known example is the Venus flytrap *Dionaea muscipula*. In Charles Darwin's book on insectivorous plants, he described the plant and its ingenious design in great detail, but did not offer even a clue about its possible evolution (Darwin, 1896, pp. 286-320). He even called the plant "one of the most wonderful plants in the world" (p. 286).

This carnivorous plant is found growing in peaty sandy soil mainly in one small place, the extreme far east coast of North Carolina (Schnell, 2003, p. 85). It catches its prey, mostly ants, beetles, spiders and other crawling arachnids, with a complex, well designed, mitt-shaped trapping mechanism located at the terminal portion of the plant's leaf (Ellison, 2006; Ellison and Gotelli, 2009).

The trap is triggered by tiny hairs on the mitt's surface. When an insect or spider brushes against one of its six hairs, the trap closes, but normally only if a different hair is contacted within twenty to forty seconds of the first one (Schnell, 2003, p. 90). The redundant triggering requirement serves as a safeguard against wasting energy due to closing from stimuli such as rain, dust or wind. Truly, this is a finely tuned system.

The Trapping Mechanism

The Venus flytrap is one of a small group of plants capable of rapid response to stimuli, including the legume *Mimosa* (sensitive plant) which

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Animal Secrets from High Tech Espionage

calculate latitude from the day length, and the light level at mid-time between dawn and dusk is used to calculate longitude. The system requires battery power to store the data, but this can last up to five years. The fact that the system does not broadcast to satellites, means that the devices can be lightweight and cheap.

It was a long way from the tracking of elephant seals to the tracking of small birds. Such new uses were pioneered in the 1990s by the British Antarctic Survey which first used geolocators on juvenile wandering albatrosses. By 2007 such devices had been reduced to 1.4 grams, suitable to track small birds like the artic tern, which weighs about 125 grams.

The traditional way to study bird activities has been bird banding. Based on such studies of recovered bird bands, scientists believed that arctic terns were remarkable long distance travellers. During the summer of 2007, a Danish team trapped and attached plastic leg rings (geolocators) to 50 terns on an island near Greenland and 20 birds on an island near Iceland. The following year, after the birds had completed their outward and return migrations, 11 birds with geolocators were trapped again. Ten of the eleven loggers retrieved, were successfully downloaded, each providing a full year of migration data.

It transpires that the artic tern has amazing talents! The average distance travelled by these birds in one round trip was 71,000 km with average distances of 520 km per day. Since Arctic terns often live 30 years, the total distance traveled in a lifetime may exceed 2.4 million km. (Egevang et al. 2009. *Proceedings of the National Academy of Sciences* 107 #5 pp. 2078-2081) Not only did the tagged birds travel so far, but they even returned to the same nesting site as the previous year. This is how the Danish team knew where to find the returning birds.

Scientists continue to develop ever smaller tracking devices. Obviously moist frog skins do not provide good anchorage, so scientists in Australia in 2012 surgically implanted tiny devices into three species of tree frog. However when the scientists recaptured the frogs about three weeks later, with the objective to recover the devices, they found that three quarters had entirely lost the devices! Others had the devices now located in the bladder, preparatory to being eliminated in the urine. Subsequent testing revealed that the frogs developed extensions from the bladder that engulfed foreign objects in the body cavity and drew them into the bladder. Who knew research could be so fraught with hazards?

The tracking of young snowy owls was the item which first attracted my attention. These birds were forced by population pressure south from the Arctic into central North America. Some of these animals were then tagged with solar-powered GPS transmitters that sent a data point every half hour to cellphone towers. What the scientists discovered is that these huge predatory birds displayed highly individualized behaviour and food preferences. (Pat Leonard. 2014 *Living Bird* 33 # 2 pp. 20 - 27)

Biologists hope to recover more interesting data from various animals. The work is never easy or cheap however. Nevertheless the insights that we gain always remind us of the children's hymn "All things bright and beautiful/All creatures great and small/All things wise and wonderful/ The Lord God made them all!"

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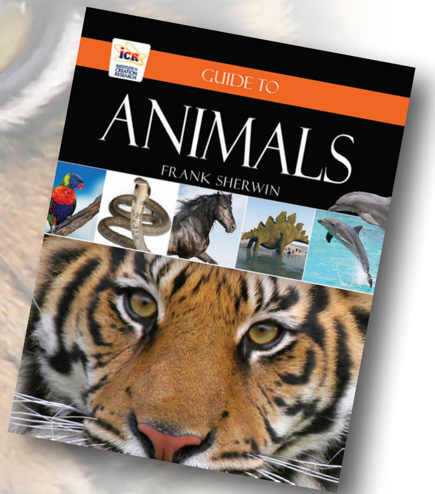


Elementary, My Dear Readers

The author, Frank Sherwin has organized his introduction to animals in interesting ways. The message is conveyed partly by the text, partly by his organization of topics, but also by the amazing variety of beautiful illustrations. In style, this book closely resembles its sister publication *Guide to Creation Basics.*

Mr. Sherwin begins by introducing us to animals. We learn what animals are and where they come from. He does not actually say it, but the common feature of animals is that they can move (obvious from the text and pictures). And the origin of animals was their creation on days 5 and 6 of the creation week.

To the question why there are so many animal designs, the author introduces us to the major body plans. We also see variety within kinds, but there are limits to this variation (so one kind cannot change into another kind.)

Firstly then we meet some swimming designs created on day five. Here we find jellyfish, sharks, rays and skates, and dolphins, whales and porpoises (but for some reason no ordinary bony fish). Then we encounter several day five flying designs including dragonflies, bees and birds. Among both the creatures of the air, and creatures of the sea, we see a variety of body plans.

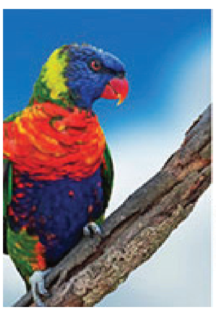
Thirdly we discover animals that live and move on land (created on day 6). These include tigers, elephants, horses, dogs, cats, monkeys, apes and sheep (all mammals the elementary readers are familiar with), as well as snakes (reptiles), ants (insects), spiders (arachnids), and penguins (birds). Note that penguins are included on the day 6 list but other birds are listed for day 5.

A section follows on extinct creatures including flying, marine and land dwelling creatures. Here we meet pterosaurs, ichthyosaurs and dinosaurs, respectively.

So what are some of the design features which provide for the lifestyles of these animals? Differences in diet, breathing apparatus, vision, hearing, communication styles, reproduction (eggs) and structural support are all discussed. Then we are introduced to special talents such as echolocation, migration and speed which some animals exhibit.

One might exclaim "Wow! All this for elementary age readers?" The fact is that this book is a wonderful introduction which will draw the young reader into a deeper consideration of the topics as time goes on. For now, each topic has amazing illustrations and only a small amount of user friendly text. Highly recommended.

Frank Sherwin. 2013. *Guide to Animals*. ICR. Dallas, Texas. Pp. 117.





WHERE DID THEY ALL COME FROM?

By Margaret Helder

It was in 1909 that Charles Walcott of the Smithsonian Institution, noticed an unusual fossil in Canada's Rocky Mountains in Yoho National Park. It was the discoloured, extremely thin remains of a soft-bodied marine creature. Now wait a minute, he must have thought! What we normally find as fossils are the hard parts such as shell or bone from once living creatures. Naturally intrigued, Walcott returned to British Columbia for several summers. He found a whole collection of soft bodied creatures previously unknown to science.

The fossils were astonishing in their character when first discovered, and now a century later, they are even more amazing. In connection with the Burgess Shale (Walcott's quarry), scientists coined the term "Cambrian Explosion." The nature of an "explosion" is "sudden and powerful." So what was there about the Burgess Shale that seems similar to an explosion? It was not the nature of the soft-bodied fossils, squashed so flat, that was explosive but details surrounding their occurrence.

Cambrian rocks are the first layer in which you encounter traces of many-celled animals as you move up from the lowest deposited rocks toward more recent sediments. Below Cambrian rocks are sediments which contain only microbes. It is not surprising that Cambrian rocks should contain many-celled animals rather than just microbes, but it is the sudden appearance in these rock layers of a vast array of different kinds of animal which attracts attention. According to evolutionary expectations, these complicated creatures should have slowly descended from simpler organisms. These simpler ancestors should have been preserved in the rocks lower down (older) than the Cambrian rocks. Yet these ancestors are not there. Thus we wonder why we find this amazing collection of different body plans all at once. (A body plan is a pattern of organization of the creature's body. Fruit flies, flat worms and fish, for example,

Charles Doolittle Walcott, along with two other men, is shown excavating the Burgess Shale in British Columbia, Canada. Walcott is the man with the wide brim hat.
© Smithsonian Archives website (siarchives.si.edu)

all have very different body plans.)

Various scientists have described how surprising the Cambrian Explosion is (as discovered initially from the Burgess Shale). Naturally scientists like to speculate about what could have caused an evolutionary process to go into astonishing overdrive and then stall. Stephen Jay Gould articulated this in his book *Wonderful Life* (which was about the Burgess Shale). He declared: "Since then, more than 500 million years of wonderful stories, triumphs and tragedies, but not a single new phylum, or basic anatomical design, added to the Burgess complement." (p. 60) What we actually see in the Burgess Shale, Gould says is the opposite of evolutionary expectations. (p. 62) He didn't abandon his support for evolution however.

The Burgess Shale was the first discovery of soft-bodied fossils of fantastic descriptions. Now we know about several more sites. It was in Australia in the 1950s that the next Burgess Shale community of marine organisms was found fossilized at Emu Bay on Kangaroo Island. However the community was judged to have been deposited earlier. This site included a typical collection of Burgess Shale type organisms including the large predator *Anomalocaris* (1 metre or more long).

Then in 1984 two amazing sites

were discovered with similar Burgess Shale communities of marine fossils. These were Chengjiang in Yunnan Province, China and Sirius Passet in Greenland. Both these communities lie at a very low level in the rocks compared to the Burgess community. Both contain similar communities but with new types as well. At Chengjiang there was *Myllokunmingia* (possibly a jawless fish), and another similar organism with a backbone. Sirius Passet, for its part, exhibited a moderate number of arthropods (including trilobites and crustaceans), and sponges and worms with spiny exteriors. These worms are found at Burgess too, but not at other similar sites.

In the late 1990s, several sites were found in southeastern Morocco, called the Fezouata community. The interesting thing about the Moroccan fossils is that they lie at a much higher level. The rock in Morocco is not even considered Cambrian, but a higher lying category called Ordovician. The interesting thing is that the Burgess creatures were believed to have become extinct, missing from any rocks above mid-Cambrian levels. But here many were found along with other newly occurring Ordovician creatures like horseshoe crabs. These latter animals are famous as "living fossils", occurring today along sea shores such as the Atlantic coast in the United States. Interestingly, no animal with a backbone was found in the Moroccan deposits although some are found at lower levels at other sites.

But the discoveries just keep coming!! In 2012 a Burgess type community was found at Marble Canyon, in Kootenay National Park, about 40 km from the original Walcott quarry. Scientists consider the Marble Canyon fossils only slightly younger than Burgess, but "shockingly" different in what is present. One of the key differences between the Walcott Burgess community and Marble Canyon is that the latter contains creatures found in the much lower lying fossil community in China. For example the arthropods *Misszhouia* and *Primicaris* were previously known only from China.

As far as animals with backbones are concerned, the Burgess Shale exhibits much lower diversity than the lower lying Chinese beds. The Marble Canyon site however has yielded many specimens of *Metaspriggina* (with backbone), previously known only from two poorly preserved specimens from the Walcott quarry. Overall, the preservation and appearance of the fossils at Marble Canyon are remarkably similar to the Chinese fossils which lie at a much lower level.

It is evident that the various characteristics of these Burgess type communities do not fit with evolutionary expectations. As expert Desmond Collins declared in 2009, the centenary of the discovery of Walcott's quarry: "Additional Cambrian material is now coming from the Chenjiang fauna in China (particularly new chordates, the group that includes humans), and the Sirius Passet fauna in Greenland. Along with the Burgess Shale animals, they demonstrate that **virtually all animal groups alive today were present in Cambrian seas**." (emphasis mine)(*Nature* 460 Aug. 20 p. 953)

Up until the late 1990s, no Burgess type creatures had been found at levels higher than the Walcott quarry. Scientists believed that these creatures were extinct above this point. But now similar creatures have been found along with organisms which were supposed to have evolved long after the middle Cambrian layers. This meant that absence from the fossil record did not necessarily mean that organisms were extinct. So Burgess and the much higher Fezouata community included some types of organism in common. Marble Canyon and the much lower Chenjiang communities were similar. In addition, chordates (animals with backbones), common in the lowest Chinese deposits, but missing from the highest Moroccan deposits, and pitifully few in the Walcott quarry, were well represented at Marble Canyon. The take home lesson is that it is extremely difficult to draw conclusions about the fossil record based on presence or absence of particular specimens or collections of specimens. There is no sign that marine communities ever evolved. They were created with sophisticated organisms and ecology, and some of their members were suddenly engulfed in sediments deposited in the flood!

The Venus Flytrap; A Major Enigma for Evolution

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folds its compound leaves inward in response to touch , the legume *Desmodium motorium* (telegraph plant) which moves small lateral leaflets in order to sample the sun's intensity so that an associated large leaf can orient itself in the best light, *Drosera* (sundews) which catch insects with sticky fluid and then bends projecting tentacles around the prey to hold it fast and digest it, and *Utricularia* (bladderworts) which develop tiny bladders under water. When attached trigger hairs are brushed by a tiny aquatic animal, a trap door swings up and the victim is sucked in by the vacuum in the interior cavity. The trap door snaps shut and the victim is digested.

The trap closing mechanism in Venus flytrap involves a complex interaction between elasticity, turgor, and growth. To help attract prey, the plant's flytrap secretes sugars and other attractants. In the open, un-tripped state, the trap lobes are convex (bent outwards) but concave (bent inwards) in the closed state, forming a small cavity (Williams, 2002). The complex mechanism and biochemistry used to trigger the rapid closing—about a tenth of a second—is still poorly understood (Sarfati, 2007).

It is known that when the trigger hairs are stimulated, an action potential, mostly involving calcium ions, is generated. A threshold of ion buildup is required for the Venus flytrap to react (Ueda, 2010). To cause rapid closure of their trap walls hydrogen ions are moved into the individual cells, lowering the pH. This causes them to swell rapidly by allowing water to flow into the cells, which changes the trap lobe's shape, resulting in the trap's closure.

One extensive Harvard University study of the trapping mechanism concluded the question that motivated Darwin's life work, namely how did the mechanism evolve, is still unresolved. The study documented that these plants are nature's ultimate hydraulic engineers (Forterre, et. al, 2005, p. 421).

Proposed Evolutionary History

The carnivorous diet, a very specialized form of feeding, is used by only a very few plant kinds living in soil poor in nutrients. Evolutionists theorize that their carnivorous traps evolved to allow these organisms to survive in harsh environments. The "snap trap" mechanism characteristic of Venus flytrap is shared with only one other carnivorous plant genus, the aquatic and unusual *Aldrovanda*, a relationship thought by evolutionists to be due to convergent evolution. Another proposal is that both Venus flytrap and *Aldrovanda* snap traps evolved from a flypaper trap similar to the living *Drosera regia*.

The model proposes that plant snap-traps evolved from the flypaper traps driven by natural selection for larger prey size, thereby providing the plant with more nutrients. The problem is that large insects can more easily escape the sticky mucilage of flypaper traps. Evolution of the snap-trap mechanism would prevent both escape and kleptoparasitism, theft of captured prey from the plant before it can derive benefits from it. It would also permit a more complete digestion (Gibson and Waller, 2009).

Faster closing allows less reliance on the flypaper model, thus larger insects, instead of flying to the trap, usually walk over to the traps, and are

more likely to break free from sticky glands. Therefore, a plant with wider leaves, like *Drosera falconeri*, is theorized to have evolved a trap design that maximizes its chance of capturing and retaining such prey. Once adequately "wrapped," escape is far more difficult.

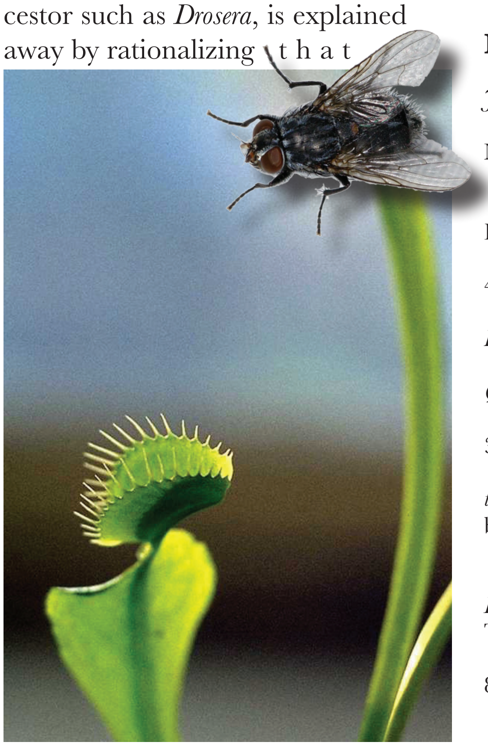
Ultimately, the plant relied more in closing around the insect rather than using stickiness. Thus something like sundew might eventually lose its original function altogether, and in so doing develop the trap "teeth" and trigger hairs, which evolutionists claim are examples of natural selection hijacking pre-existing structures for new functions. At some point in its evolutionary history, the plant would have to develop the complex digestive gland system inside the trap, rather than using dew on the stalks for this purpose, further differentiating it from the *Drosera* genus.

The theory that Venus flytrap evolved from an ancestral carnivorous plant that used a sticky trap instead of a snap trap seems logical, but is not based on evidence. The theory is the sticky leaf traps consume many smaller, aerial insects, and the Venus flytrap consumes a few larger terrestrial bugs, which then allow it to extract more nutrients from these larger bugs. The claim is this gives *Dionaea* an advantage over their ancestral sticky trap form (Gibson and Waller, 2009). The problem with this theory is that both plants survive quite well, and both obtain close to the same total amount of needed nutrients. Another problem is the plant would have to, not only evolve the trapping mechanism, but also would have to completely redesign the flypaper system, including loss of the complex adhesive used to trap the insects.

Some molecular evidence indicates a close relationship between snap traps and fly-paper traps (Cameron, et al., 2002, p. 1503). However, evaluation of a few genes, as used in this study, tells us very little about evolutionary relationships. Scores of genes are normally regulated as a set to produce a trait, requiring both comparisons of hundreds of genes as well as comparisons of many plants. This entire account is a just-so story which is not based on fossil or other evidence. The split second nature of the trapping method is too precise to have developed spontaneously.

The major difficulty for evolution is the trap system would not allow for obtaining food until *all* of the essential parts were functional and in place. It would seem that, given the Venus flytrap's very short root system, natural selection would select for a much larger and deeper root system rather than evolve an enormously complex trapping system that is still not fully understood today in spite of decades of scientific research.

The total lack of fossil evidence concerning the many steps that would link Venus flytrap and their common ancestor such as *Drosera*, is explained away by rationalizing that



carnivorous plants are generally herbs that do not readily form fossilizable structures, such as thick bark or wood. Therefore, evolutionists must extrapolate an evolutionary history from studies of extant genera (Gibson and Waller, 2009). The problem with this speculation is the soft parts of plants, such as leaves, are very abundant in the fossil record (Zhou, 2003).

A major dilemma for evolution is that the Venus flytrap plant can thrive quite well in its natural habitat of moist peat moss without ever consuming insects. Botanist George Howe regulated their diet by using large glass jars to prevent the plant's accidental consumption of insects (Howe, 1978, p. 40). Since the plant is able to obtain all of the nutrients it requires from the soil and atmosphere, Charles Darwin's idea for the natural selection mechanism essential to his concept of evolution is, in this case, based on a totally erroneous foundation. Obviously the Venus flytrap did not evolve, but was beautifully designed for its role in the ecosystem.

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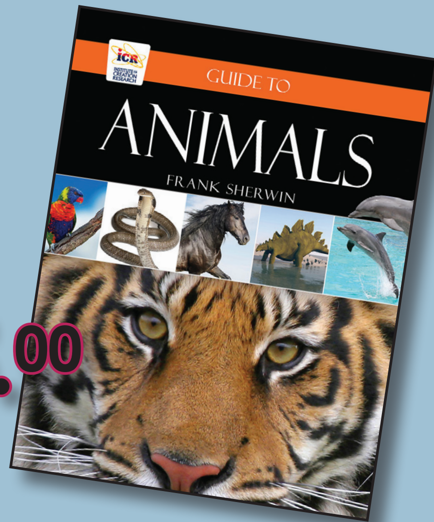

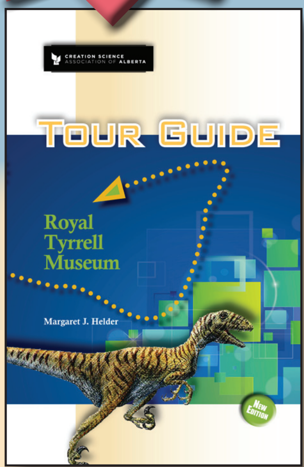

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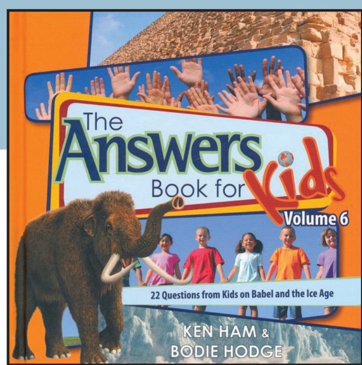

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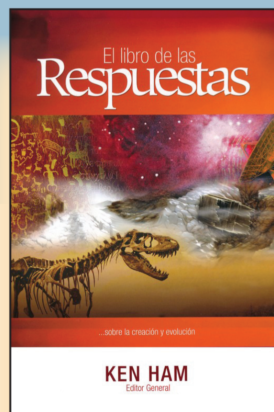

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