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Dinodang: The Melon Rex Myth

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To reconcile religious doctrine with dental morphology, some young-Earth creationists claim that tyrannosaurs ate melons. The history of this concept is as entertaining as it is absurd.

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We all have our little vices, our guilty pleasures. Enjoying young-Earth creationist (YEC) literature on dinosaurs is one of mine. As a paleontologist with a specialty in dinosaurs, I am familiar with and accept the evidence that dinosaurs and humans were separated by millions of years. In contrast, YEC literature asserts that ancient humans and dinosaurs coexisted. The fun of reading such literature is not in that assertion but in the more tangential claims that often accompany it. Some are so ridiculous that one marvels that their authors take their own claims seriously.

When writing about religious views I usually use wording that is diplomatic and respectful, avoiding ridicule. But dinosaur-related claims of this kind are nearly impossible to relate without betraying mirth. I call such claims "dinodang" (as in "Dang! I can't believe you actually said that!"), and among their number is the Melon Rex Myth.

In the children's book *Dinosaurs and the Bible* (Unfred 1990) we are asked to "examine more closely the teeth and jaws of *Tyrannosaurus rex*. The teeth are long and sharp—they seem to be just right for a terrible killer. But when we look closer, we can see a problem. The teeth have shallow roots. What do you think would happen if *Tyrannosaurus* sunk his teeth into the leg of a five-ton galloping *Triceratops*? He would probably leave a few of his best teeth behind! Although those long, sharp teeth of *Tyrannosaurus* may not have been good for fighting, they would be excellent for ripping the rinds off ripe melons." In the accompanying illustration, a *T. rex* holds a melon in its hands and takes a satisfying chomp. In a photo in a later YEC book a *T. rex* replica holds a watermelon in its mouth; the caption assures the reader that "*T. rex* originally ate vegetables" (McIntosh and Hodge 2006).

Such depictions are not limited to *Tyrannosaurus*, although it often gets special mention (Taylor 1987; Ham et al. 1990; Unfred 1990; Gish 1990, 1992; Ham 1998, 2006, 2009; Larsen 2001; McIntosh and Hodge 2006). In YEC children's books a pair of *Dilophosaurus* munches on leaves (Taylor 1987), a *Compsognathus* bites at a berry (Gish 1990), a *Ceratosaurus* chomps a banana frond (Ham 2001), a *Deinonychus* enjoys a meal of fruit (Ham 2001), and a *Carnotaurus* breakfasts on a bunch of bananas (Ham 2001). All of the above dinosaurs are theropods: members of Theropoda, the group of dinosaurs that includes *T. rex* and kin. The teeth of each are ziphodont—which means pointed, recurved, laterally compressed (flattened from side to side), and serrated on the fore and hind edges—clearly indicating a carnivorous diet (Figure 1). Among today's terrestrial animals, ziphodont teeth are present only in the lizard called the Komodo monitor (*Varanus komodoensis*), a carnivore (Auffenberg 1981). Among recently extinct species, the elongated canines of some saber-toothed cats are also ziphodont (Akersten 1985). The shark families Lamnidae (mackerel sharks, including the great white) and Carcharhinidae (requiem sharks, including the whitetip and bull shark) include members with nearly ziphodont teeth, all of which are carnivores (Compagno et al. 2005). The teeth of *T. rex* itself fit the ziphodont description except that they are wider from side to side (Figure 1). Holtz (2001) introduced the term *incrassate* for such teeth.

Paleontological Evidence

Several lines of evidence reveal that ziphodont-toothed theropods were carnivorous. Dinosaurs, like other reptiles, continuously shed old teeth, which were replaced from beneath by new teeth. As the crown of the replacement tooth developed next to the root of the old tooth, the root of the latter degenerated until the crown was no longer anchored and was shed, after which the replacement tooth would migrate into place (Sander 1997). As with extant reptiles, old tooth crowns were shed during feeding, allowing identification of the feeder. The fossil remains of Mesozoic prey carcasses are often surrounded by shed ziphodont theropod teeth (Bakker and Bir 2004), which indicates that such theropods fed on other animals.

Tooth marks on fossil bones also indicate carnivory for ziphodont-toothed theropods. Because they are thin from side to side, to avoid breakage ziphodont teeth must approach bone at an acute angle, and because of this angle such teeth often leave serration marks (Erickson and Olson 1996). The serration marks can often be matched with the serration size and shape of specific theropods, so the feeder can be identified. Tyrannosaurids (members of Tyrannosauridae, the family that includes *Tyrannosaurus rex* and its closest kin) left their tooth marks on the bones of hadrosaurs (the wide-snouted herbivorous dinosaurs commonly called "duckbills"), ceratopsians (horned herbivorous dinosaurs like the popular *Triceratops*), and even other tyrannosaurids (Jacobsen 2001; Fowler and Sullivan 2006). Tooth marks on North American sauropods (long-necked, herbivorous dinosaurs) from sites of the Jurassic age match the shed teeth of the theropod *Allosaurus* that surround the sauropod bones (Bakker and Bir 2004). *Deinonychus*, a close relative of the well-known *Velociraptor*, also left identifiable bite marks on the bones of its prey (Gignac et al. 2010). The distinctive tooth marks of the Madagascan theropod *Majungatholus* appear on bones of various Madagascan dinosaurs, including other *Majungatholus* (Rogers et al. 2003).

The thickened teeth of *T. rex* leave conclusively identifiable marks. Incrassate teeth can take a more dead-on approach to bone than ziphodont teeth can; although the angle of approach does not leave serration marks, molds of certain bite marks match the unique shape of *T. rex* teeth (Erickson and Olson 1996). Such marks are known from specimens of *Triceratops*, the hadrosaur *Edmontosaurus*, and even other *T. rex*es (Erickson and Olson 1996; Longrich et al. 2010).

Some evidence for theropod carnivory is more direct. Stomach contents within articulated skeletons of ziphodont theropods include a lizard (Ostrom 1978), a small mammal (Currie and Chen 2001), and a small dinosaur (Ji et al. 2007). Occasionally a ziphodont theropod tooth is found embedded in prey bone (Currie and Jacobsen 1995).

Obviously, then, *Tyrannosaurus rex* and its ziphodont-toothed counterparts were carnivores. So how could they handle this lifestyle with the shallow roots described by Unfred (1990)? They didn't have to, because Unfred is incorrect. Theropod teeth, including those of *T. rex*, had very deep roots (Figure 1), anchoring each firmly in the jaw until the replacement tooth began to develop beneath it.

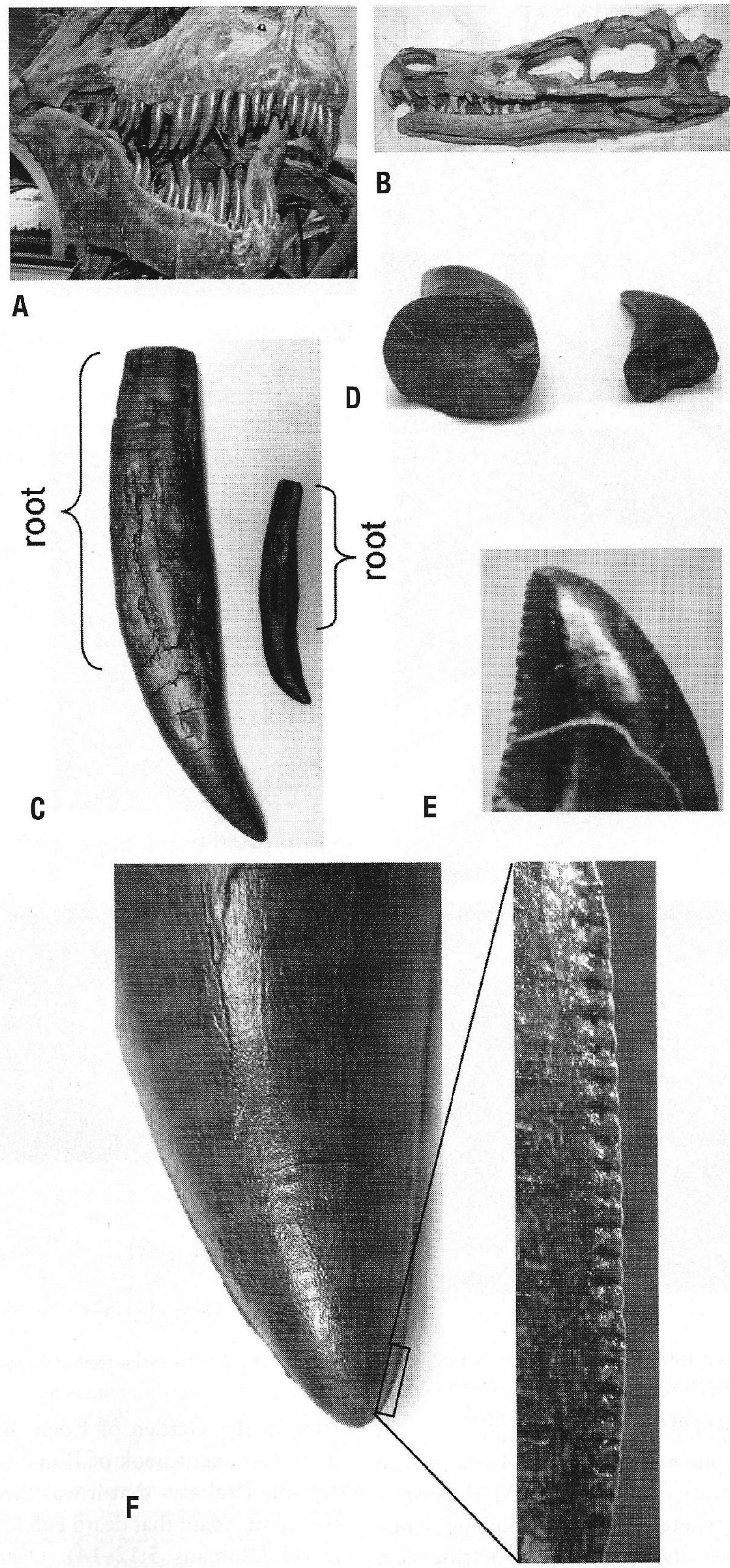

Figure 1. Teeth of carnivorous dinosaurs. (a) Incrassate teeth (cast of *Tyrannosaurus rex*). (b) Ziphodont teeth (*Velociraptor mongoliensis*). (c) Casts of an incrassate tooth (*Tyrannosaurus rex*, left) and a ziphodont tooth (*Allosaurus fragilis*, right), showing deep roots. (d) Casts of an incrassate tooth (*T. rex*, left) and a ziphodont tooth (*Gorgosaurus libratus*, right), showing the difference in cross-section between the two tooth types. (e) Ziphodont tooth (*Deinonychus antirrhopus*) showing serrations. (f) Cast of *T. rex* tooth with enlargement showing serrations.

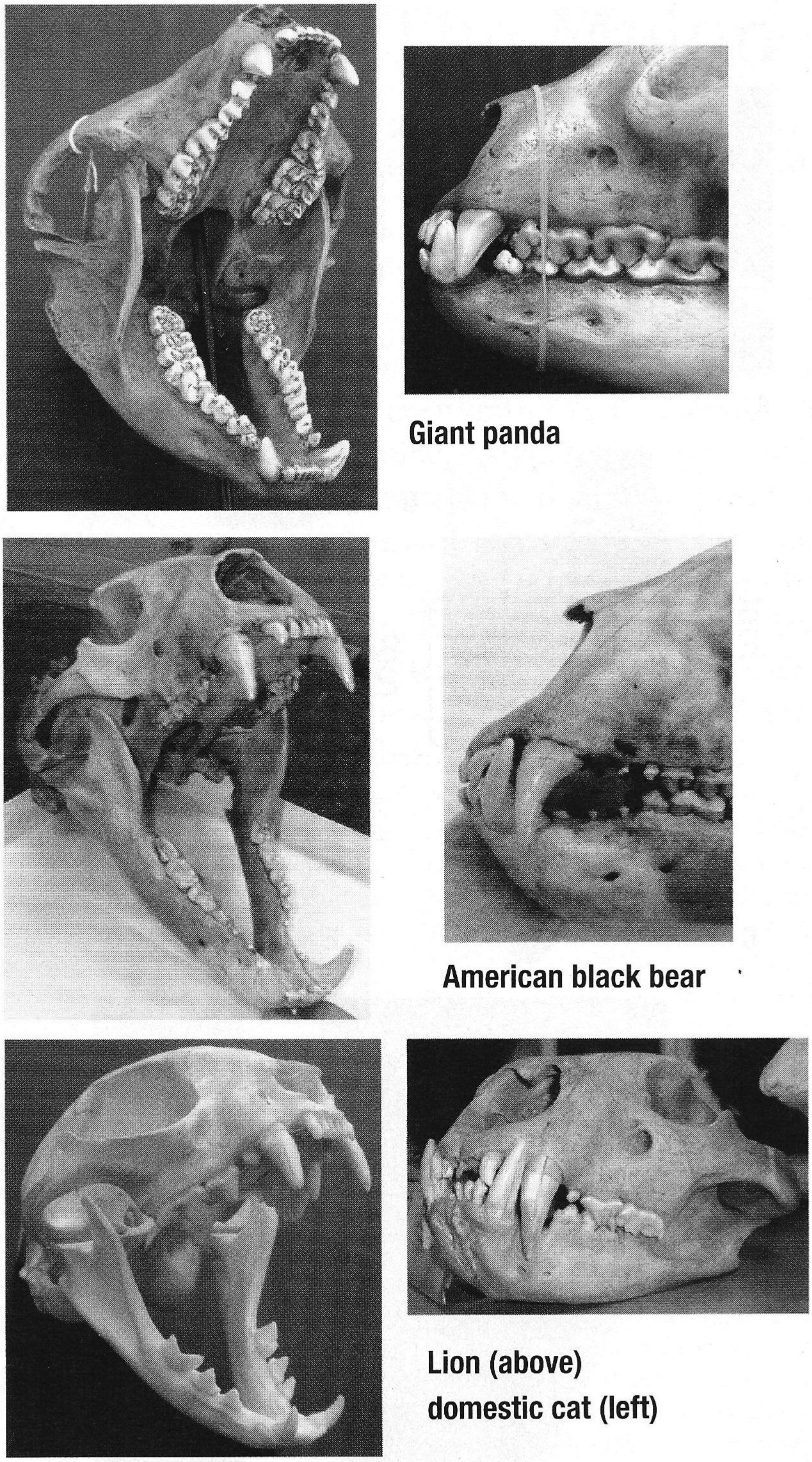

Figure 2. Teeth of a panda and three carnivores showing how short and blunt the canine teeth of the panda are in contrast with the longer, sharper canines of the carnivores.

History of the Myth

Despite a mountain of evidence to the contrary, the Melon Rex Myth persists. So where did this dinodang come from? Its root is the doctrine that death—hence also killing and therefore carnivory—did not exist before Adam and Eve sinned by eating the forbidden fruit in the Garden of Eden. In the New Testament book of Romans, the Apostle Paul says that it was through the sin of Adam that death entered the world (Romans 5:12–14). Death is therefore part of the Curse, the penalty for Adam's sin. Early Christian church leaders interpreted this to mean that the sin of Adam brought spiritual, not physical, death (Bray 1998). However, many of today's YECs insist that Adam's sin brought physical death. Without death there can be no carnivory, so all the animals that God created were originally herbivores. Herbivory does kill plants, but according to proponents of the doctrine of original herbivory (hereafter abbreviated DOH), the semantics of biblical Hebrew indicate that plants are not considered alive in the same sense that animals are, so the Curse introduced only animal death (e.g., Ham et al. 1990; Mitchell 2006).

DOH proponents often claim that tyrannosaurs and other theropods were originally herbivores. In two children's books on dinosaurs, Duane Gish (1977, 1992) acknowledged that theropod teeth, claws, and jaws suggest carnivory—but he also insisted that all animals were created herbivorous. "Whether these animals were able to change naturally into meat-eaters merely by a change in the kind of food they liked, or whether God had to change them, we do not know," he wrote (Gish 1977), essentially asking whether God created theropods with apparent weaponry for some peaceful purpose or whether he created them without the weaponry that appeared only in later generations. In a dinosaur book for adults, Ken Ham (1998) posed the same question, this time specifically about the teeth of *T. rex*.

So far no YEC author has expressed a preference for the second answer (that theropod teeth changed in later generations) over the first (that theropods were created with their characteristic teeth), possibly because the second answer introduces limited acknowledgement of evolution. The first answer raises another question: if theropods originally had ziphodont or incrassate teeth, then on what were those teeth used if not meat? So far the only concrete proposals are Unfred's (1990) melon rind suggestion, Gish's (1990) suggestion that the teeth and claws of *T. rex* "were used to eat tough roots and bark, etc.," Ham's (2009) suggestion that theropods ate pumpkins and watermelons, and this bizarre tidbit from children's author Larry Dye "The Creation Guy": *T. rex* teeth "were designed to rip apart branches. Like a tree saw, God designed T-Rex [*sic*] teeth with serrated edges so the animal could easily cut through branches. Animals like a brachiosaur would keep leaf foliage under control, and a T-Rex would keep branch growth under control" (Dye 2008).

Unfortunately for the pumpkin and watermelon suggestions, pumpkins did not leave their native South America until after the time of Columbus (Sanjur et al. 2002). Watermelons are native to southern Africa and did not leave the continent until the first millennium BCE (Dane and Liu 2007). Theropods in the rest of the world would have starved until then if these items were their staples. Poor *T. rex* could not have eaten watermelons because they did not arrive in its North American home until four centuries ago (Dane and Liu 2007).

In another children's book, Taylor (1987) lists several reasons to doubt theropod carnivory. Taylor claims that *T. rex* could not have been a predator because it moved too slowly, walked in a "stooped-over" position, had poorly rooted teeth, and had weak forelimbs. The thin head crests of *Dilophosaurus* were too delicate to escape harm while the animal tore into the insides of carcasses; the "long, delicate spines attached to the back bone" of *Spinosaurus* would have broken easily during violent encounters; and unworn teeth in an adult specimen of the tyrannosaur *Albertosaurus* suggest a lack of contact with bone.

None of Taylor's arguments holds water. The limb proportions of *T. rex* are no worse for speed than those of its known ceratopsian and hadrosaur prey. Walking "stooped-over" with its mouth low put the mouth at a perfect height to bite prey (Senter 2007). As mentioned above, the teeth were rooted well. The forelimbs of *T. rex*, despite their shortness, were powerfully muscled (Carpenter and Smith 2001). Thin crests on the top of a head are in no danger if prey is approached from above. The dorsal spines of *Spinosaurus* were not delicate at all but quite robust (Stromer 1915). Lack of wear on teeth indicates only that they were new teeth in a mouth that constantly replaced old teeth with new; it does not indicate that the old, replaced teeth had never contacted bone.

In support of the idea that theropod teeth were designed for herbivory, some YEC authors have offered examples of putative extant analogs. Several authors name the giant panda as an example of an herbivore with "sharp teeth" (Taylor 1987; Ham et al. 1990; Gish 1992; Ham 2001, 2006, 2009; McIntosh and Hodge 2006). Some also list fruit bats (Taylor 1987; Ham et al. 1990; Gish 1992; McIntosh and Hodge 2006; Ham 2009), bears (Taylor 1987; Ham 2001, 2009), camels (Ham 1998), spider monkeys (Unfred 1990), and apes (Taylor, 1987; Gish 1992) as examples of herbivores with "sharp teeth."

There are problems with all these examples. First, *none of these animals has ziphodont teeth*! Their "long, sharp" teeth (the canine teeth) are therefore not applicable to the question of what theropods ate. In all these animals the teeth that process food are the cheek teeth, which are flattened with low cusps. The canines are not typically used for herbivory except in fruit bats, which use the canines to grip fruit (Neuweiler 2000). Also, in pandas the canines are not sharp but quite blunt, especially in comparison with those of other bears (Figure 2).

Second, bears and apes are not strict herbivores. Vertebrate prey and carrion make up significant portions of the diets of most bear species. Grizzlies even hunt big game like elk, and the polar bear is almost exclusively carnivorous (Nowak and Paradiso 1983; Kurt et al. 1990). Cannibalism is common in the brown bear, the polar bear, and the American black bear (Kurt et al. 1990). Among the apes, Sumatran orangutans regularly hunt and eat the smaller primates called lorises (van Schaik et al. 2003); chimpanzees hunt and eat antelope, wild pigs, rodents, and other primates (Uehara 1997); and bonobos eat rodents and juvenile antelope (Uehara 1997).

Furthermore, in spider monkeys and apes, the canines are long and sharp only in the males. The canines are unimportant in food processing, and in

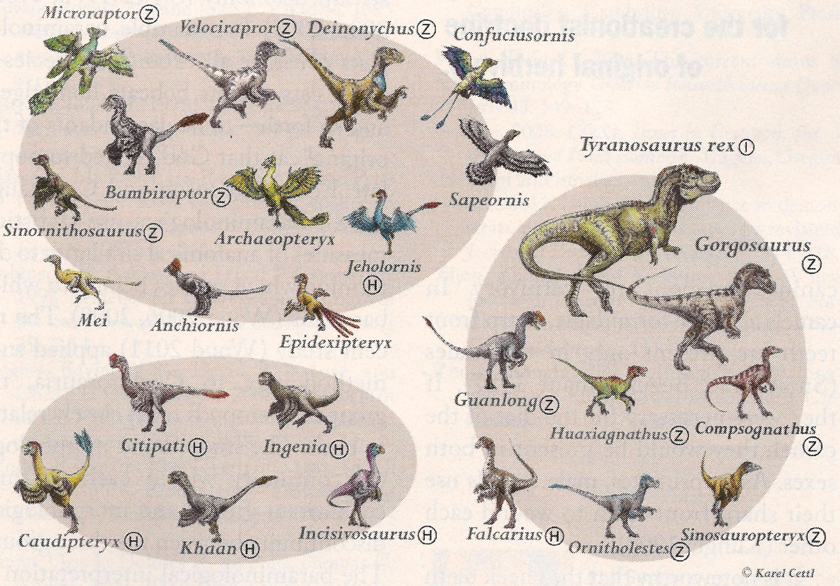

Figure 3. Members of three separate "created kinds" of coelurosaurian theropod dinosaurs (not drawn to scale), according to Wood (2011). The lower left group is composed of oviraptorosaurs. The upper left group includes early birds (*Epidexipteryx*, *Archaeopteryx*, *Jeholornis*, *Sapeornis*, *Confuciusornis*), troodontids (*Mei*, *Anchiornis*), and dromaeosaurids (the rest). The group on the right includes *Falcarius*, the herbivorous ornithomimosaurs (not shown), *Ornitholestes*, tyrannosaurs (*Guanlong*, *Gorgosaurus*, *T. rex*), and compsognathids (the rest). Note that although two of the groups include members with carnivory-indicating ziphodont (Z) or incrassate (I) teeth, each group also contains herbivores (H). This shows that there was never a need for young-Earth creationists (YECs) to postulate that ziphodont- and incrassate-toothed theropods were herbivores, because they are related to herbivores even according to YEC criteria. It is therefore consistent with the YEC paradigm to postulate that the original members of each "created kind" were herbivores, and their descendants acquired ziphodont or incrassate teeth only after turning carnivorous as a result of the Curse.

primate species that do use canines on food the minuscule canines of the females are sufficient (Greenfield 1992). If long, sharp canines were needed for processing plant food, then the canines would be long and sharp in both sexes. In fact, the males use them as instruments of aggression and often death (Plavcan et al. 1995). In spider monkeys, other monkeys, gorillas, and chimpanzees, males use their canines to wound and often kill rival males and the infant offspring of other males (Collins et al. 1984; Fossey 1984; Shimooka et al. 2008; Vick 2008). The males sometimes cannibalize the infants that they have killed (Collins et al. 1984; Fossey 1984), which makes their canines weapons for carnivory. In camels also, the formidable, sharp front teeth are present only in the males (Smuts and Bezuidenhaut 1987). If they were necessary for the diet of the camel, they would be present in both sexes. As in primates, male camels use their sharp front teeth to wound each other (Klingel 1990).

As it happens, insistence that tyrannosaurs and ziphodont theropods were herbivores is not necessary for the creationist doctrine of original herbivory.

It is noteworthy that the cheek teeth of all these herbivores are of a crushing type that indicates herbivory and that such teeth are absent in *T. rex* and ziphodont theropods. A "very good" creation would not include teeth that are unnecessary for food processing and instead used for violence. It is more consistent with the YEC worldview to suppose that the long, sharp, wounding teeth of today's bears, primates, and camels were absent in their created forebears and appeared in later generations as a result of the Curse, as some YEC authors have postulated for other biological attack/defense structures (McIntosh and Hodge 2006).

Why the Melon Rex Myth Is Unnecessary

As it happens, insistence that tyrannosaurs and ziphodont theropods were herbivores is not necessary for the creationist doctrine of original herbivory. This is because some theropods had teeth that indicate a diet of plants, and the results of a new study (Wood 2011) indicate that those theropods are genetically related to carnivorous theropods, even according to YEC criteria (Figure 3). YECs could therefore rescue the DOH by claiming that carnivorous theropods are degenerate descendants of ancestors that were created herbivorous.

YECs have long recognized that each baramin ("created kind" of organism) has diversified into many species since it was created. Recognized diversity within a given baramin often meets or exceeds the level of family in mainstream taxonomy (Sigler 1978; Wood 2006, 2008). For example, baraminologists consider all extant cat species—house cats, ocelots, bobcats, lions, tigers, and so forth—to be descendants of the original cat that God created to populate Eden (Robinson and Cavanaugh 1998). Baraminologists use statistical measures of anatomical similarity to determine which species belong to which baramins (Wood 2006, 2008). The recent study (Wood 2011) applied such methodology to Coelurosauria, the group of theropods most closely related to birds. The study found morphological continuity within each of three coelurosaur groups and morphological discontinuity between the three groups. The baraminological interpretation of this is that three baramins had been identified (Figure 3). One of the three groups is composed of the beaked oviraptorosaurs, which were herbivores (Smith 1992; Zhou and Wang 2000). Another includes the seed-eating (Zhou and Zhang 2002) early bird *Jeholornis*, other early birds such as *Archaeopteryx*, and the birdlike theropod families Dromaeosauridae (carnivores such as *Velociraptor*) and Troodontidae (some of which, according to one study, may have been herbivorous [Holtz et al. 1998]). The third includes tyrannosaurs, compsognathids, ornithomimosaurs, and *Falcarius*. *Falcarius* and the ornithomimosaurs were herbivores (Barrett 2005; Kirkland et al. 2005).

In two of the three groups, ziphodont theropods are connected, via a continuous series of intermediate forms, to herbivores. It is consistent with the YEC worldview to infer that God originally created theropods with herbivore-style teeth like those of *Falcarius* and *Jeholornis* and that ziphodont and incrassate teeth arose in later generations as a result of the Curse. A shrewd creationist could therefore rescue the DOH by claiming that both baramins began with herbivorous forms, and some of their descendants became carnivores after the Curse and gained the teeth to match the diet.

Of course, for the DOH to be rescued in this manner YECs would have to recognize that *T. rex* and ziphodont theropods were carnivorous. The Melon Rex Myth would therefore have to be discarded. To me, this is a little saddening. The Melon Rex Myth is by far my favorite dinodang. It has given me countless hours of joyous chuckling, and once it finally becomes extinct I will miss it very much. ■

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