What Fossils Can't Tell Us

Are Evolutionary Transitional Forms Possible?

Dr. Raúl Esperante
Geoscience Research Institute

Darwin and the Fossil Record

- Darwin and other evolutionists before suggested that life forms have appeared through gradual evolution.
- He turned to the fossil record in support for his theory.
- If Darwin's theory is right, we can predict to find countless fossils showing transitional stages from less complex to more complex forms.
- He hoped to find many transitional forms showing the 'finely graduated organic chain'.

- But Darwin could not show cases of transitional forms.
- Darwin asked:
  - “Innumerable transitional forms must have existed but why do we not find them embedded in countless numbers in the crust of the earth?”
- He thought that the reason was the ‘extreme imperfection’ of the fossil record.
- He thought that as more search continued, transitional fossils would show up and his theory would be confirmed.

Fossil Transitional Forms

- Evolutionary scientists claim that the fossil record shows evidence for at least some transitional forms, for example,
  - *Archaeopteryx*
  - Mammal-like reptiles.
- Therefore, they claim, it is reasonable to think that others will be found.
- Critics of evolutionary theory say that even though some fossils may seem to be intermediate forms, they do not lead us to connect the separate lines of descent into a single Common Ancestor.

Gaps in the Fossil Record

- Despite the claim that there are good examples of transitional forms, many reputable paleontologists acknowledge that there are gaps in the fossil record in the most important evolutionary stages:
  - “The fossils go missing in all the important places. When you look for links between major groups of animals, they simply aren’t there; at least, not in enough numbers to put their status beyond doubt. Either they don’t exist at all, or they are so rare that endless argument goes on about whether a particular fossil is or isn’t, or might be, transitional between this group or that. Yet there are lengthy periods of history when there is every reason to expect plenty of intermediates.” (Hitching 1982, p. 19).

- “One would expect the fossils to blend so gently into one another that it would be difficult to tell where the invertebrates ended and vertebrates began.” (Hitching 1982, p. 20)
- **But that is not the case.**
- The fossil record does not offer such record of smooth transitions.

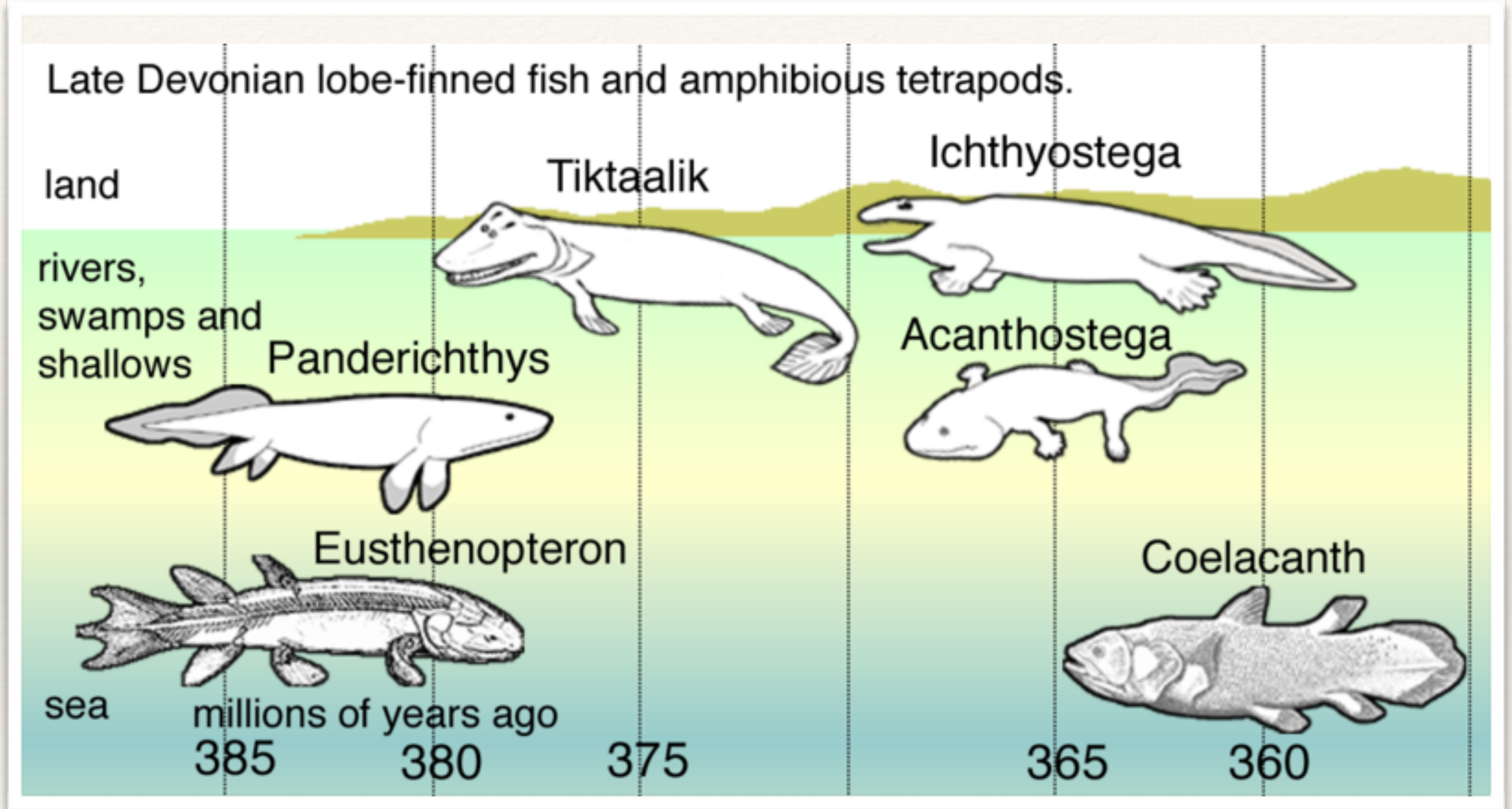
Fossil Record and Gradualism

- One would expect the fossil record to support the Darwinian idea of gradual change.
- However, most paleontologists agree that the opposite is the case.
- T. S. Kemp, the famous University of Oxford paleontologist, asserted in his book *Fossils and Evolution* (1999, p. 15-16) that,
    - "If, for example, all fossils fell into finely graded sequences exhibiting gradual changes in character up the stratigraphic column, and if simple neo-Darwinian natural selection was the only known cause of evolutionary change, then the explanatory theory that would not doubt emerge would that these various lineages of species form a series of named groups, within each of which the members are evolutionarily related to one another, having been produced by natural selection. The groups would form an evolutionary classification that offered an explanation for the existence and nature of those particular fossils. Unfortunately the situation is not so simple, for *the observed fossil pattern is invariably not compatible with a gradualistic evolutionary process*. Fossils only extremely rarely come as lineages of finely graded intermediate forms connecting ancestors with descendants. It transpires that either the pattern as perceived or the processes as invoked (or indeed both) must be in some sense 'wrong'. (Emphasis added)

Major Transitions

- The fossil record should show evidence of the major transitions in fauna and flora:
  - From non-shelly to shelly invertebrates.
  - From land-dwelling arthropods to flying arthropods.
  - From invertebrates to vertebrates.
  - The origin of fish.
  - From fish to amphibians.
  - From amphibians to reptiles.
  - From reptiles to mammals and birds.
  - The origin of marsupial mammals.
  - The origin of angiosperms (flowering plants)

From Fish to Amphibians (Tetrapods)



http://upload.wikimedia.org/wikipedia/commons/4/42/Fishapods.png

Eusthenopteron. Own photo. Denver Museum of Science

Panderichthys. https://upload.wikimedia.org/wikipedia/commons/7/7e/Panderichthys12DB.jpg

Acanthostega. Own photo. American Museum of Natural History

Icthyostega. https://upload.wikimedia.org/wikipedia/commons/3/34/Ichthyostega_model.jpg

Tiktaalik. Own photos. Harvard Museum of Natural History

From Fish to Tetrapod—*Tiktaalik*

- Flattened body, gills, bony scales, fins with rays
- Large snout, long ribs, small gill slit, lack a bony gill cover
- Described as "fishopod"
- Morphological and stratigraphic intermediate

Mosaic Morphologies

- However, paleontologists say that *Tiktaalik* exhibit a *mosaic distribution of traits*: a mixture of fish-like features and tetrapod-like features.
- For example, it has an unossified vertebral column with an unusual number of vertebrae, more than in its presumed ancestors or descendants.
- Those features do not show a progression of acquisition of tetrapod morphology.
- Many organisms, both living and fossil, exhibit a mosaic distribution of traits.
    - Living example: the duck-billed platypus, with features of both
        - Mammals: hair, milk production.
        - Reptiles: egg-laying.
        - Nevertheless biologists consider the platypus as a mammal.

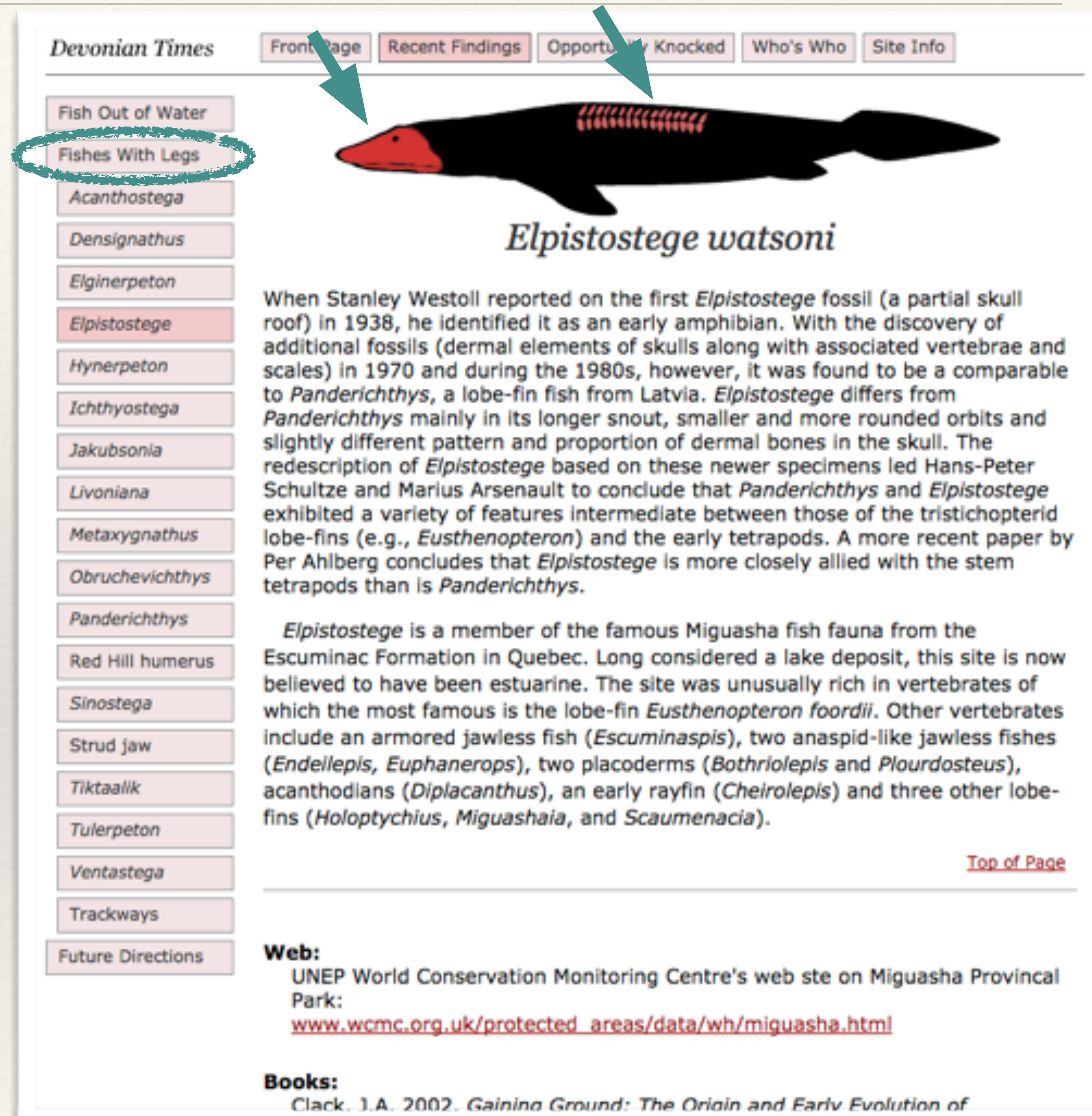
https://upload.wikimedia.org/wikipedia/commons/7/7e/Platypus-sketch.jpg

- When those mosaic forms occur in the right part of the fossil record, they are interpreted as evolutionary intermediates between major groups.
- Mosaic patterns pose a problem for evolutionary scenarios:
  - They make it difficult to identify organisms or groups of organisms that possess the ‘right’ combination of characters to be considered part of an evolutionary lineage.

- Consider tetrapod-like lobe-fins *Panderichthys* and *Elpistostege*
- Despite their appearance, these fish have unique characters (such as the design of the vertebrae) that rule them out as tetrapod ancestors.
- Evolutionists can only claim that these fish are only a model of the kind of fish that must have served as the ancestor.

Little Data, Much Interpretation

- This web page shows a typical example of extrapolation.
- The only remains found of this animal are the skull and a section of the vertebral column.
- However, paleontologists infer that the fish had lobe-fins, and they call it "fish with legs".
- Why?
- Because of the stratigraphic order in which it was found.
- And the requirement of the evolutionary line from fish to amphibians.


Devonian Times

Front Page | Recent Findings | Opportunity Knocked | Who's Who | Site Info

Fish Out of Water
Fishes With Legs
Acanthostega
Densignathus
Elginerpeton
Elpistostege
Hynerpeton
Ichthyostega
Jakubsonia
Livoniana
Metaxygnathus
Obruchevichthys
Panderichthys
Red Hill humerus
Sinostega
Strud jaw
Tiktaalik
Tulerpeton
Ventastega
Trackways
Future Directions

Elpistostege watsoni

When Stanley Westoll reported on the first *Elpistostege* fossil (a partial skull roof) in 1938, he identified it as an early amphibian. With the discovery of additional fossils (dermal elements of skulls along with associated vertebrae and scales) in 1970 and during the 1980s, however, it was found to be a comparable to *Panderichthys*, a lobe-fin fish from Latvia. *Elpistostege* differs from *Panderichthys* mainly in its longer snout, smaller and more rounded orbits and slightly different pattern and proportion of dermal bones in the skull. The redescription of *Elpistostege* based on these newer specimens led Hans-Peter Schultze and Marius Arsenault to conclude that *Panderichthys* and *Elpistostege* exhibited a variety of features intermediate between those of the tristichopterid lobe-fins (e.g., *Eusthenopteron*) and the early tetrapods. A more recent paper by Per Ahlberg concludes that *Elpistostege* is more closely allied with the stem tetrapods than is *Panderichthys*.

Elpistostege is a member of the famous Miguasha fish fauna from the Escuminac Formation in Quebec. Long considered a lake deposit, this site is now believed to have been estuarine. The site was unusually rich in vertebrates of which the most famous is the lobe-fin *Eusthenopteron foordii*. Other vertebrates include an armored jawless fish (*Escuminaspis*), two anaspid-like jawless fishes (*Endeliepis, Euphanerops*), two placoderms (*Bothriolepis* and *Plourdosteus*), acanthodians (*Diplacanthus*), an early rayfin (*Cheirolepis*) and three other lobe-fins (*Holoptychius, Miguashaia*, and *Scaumenacia*).

Top of Page

Web:
UNEP World Conservation Monitoring Centre's web ste on Miguasha Provincal Park:
www.wcmc.org.uk/protected_areas/data/wh/miguasha.html

Books:
Clack, J.A. 2002. *Gaining Ground: The Origin and Early Evolution of*

(June 2, 2016, photo of the web page, http://www.deviontimes.org/Order/re-elipistostege.html

Tiktaalik

- Paleontologists suggest that many of the fish-like tetrapods and tetrapod-like fish (like *Tiktaalik*) found in Devonian sediments were ambush predators living in shallow waters.
- They shared these features:
  - They were well designed for life in an shallow aquatic habitat.
  - Equipped with characteristics appropriate to that habitat.
  - Crocodile-like morphology:
    - Dorsally-placed eyes
    - Limbs and tails made for swimming.
    - Internal gills
    - Lateral line systems (not fossilized).
  - These traits gave them the ability to function both in the water and, to some extent, on land

From Fish to Amphibians—Missing Links

- The connection between the different forms is unknown.
- There are many missing links between fish and tetrapods.
- The evolutionary tree is a speculation.

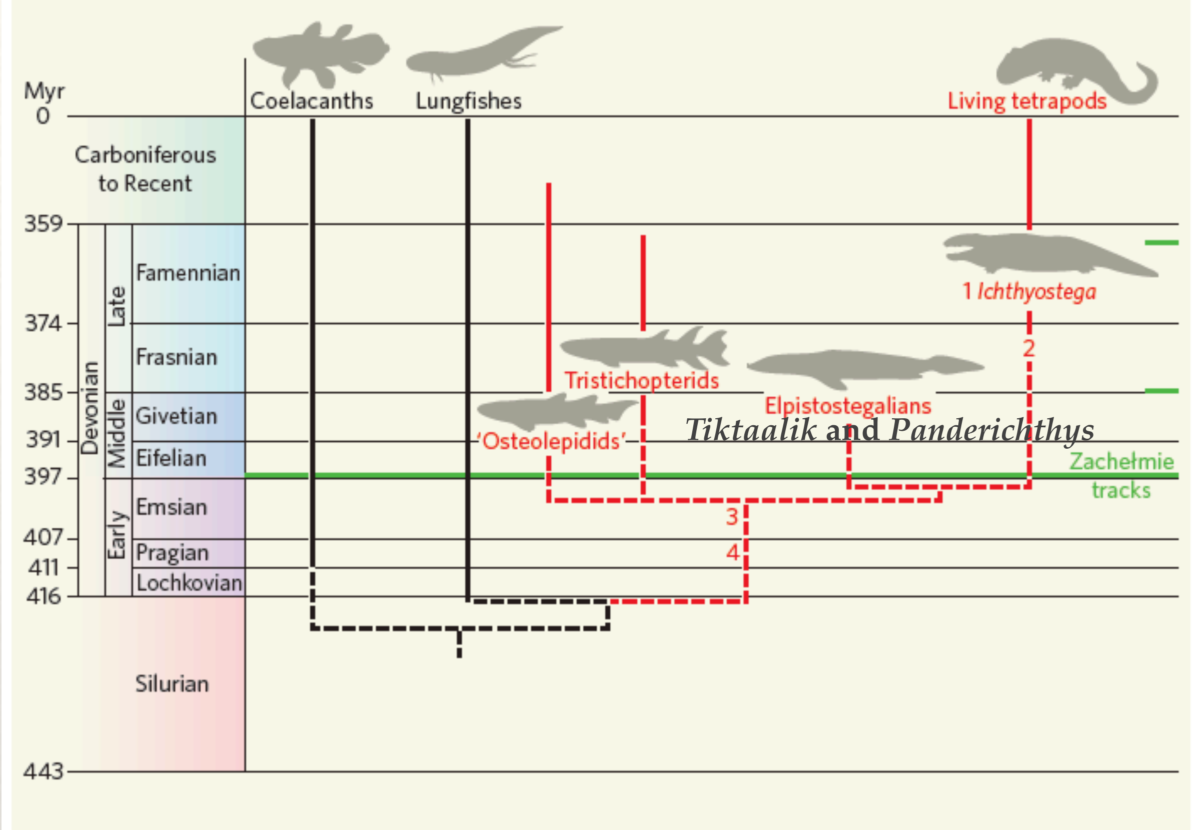
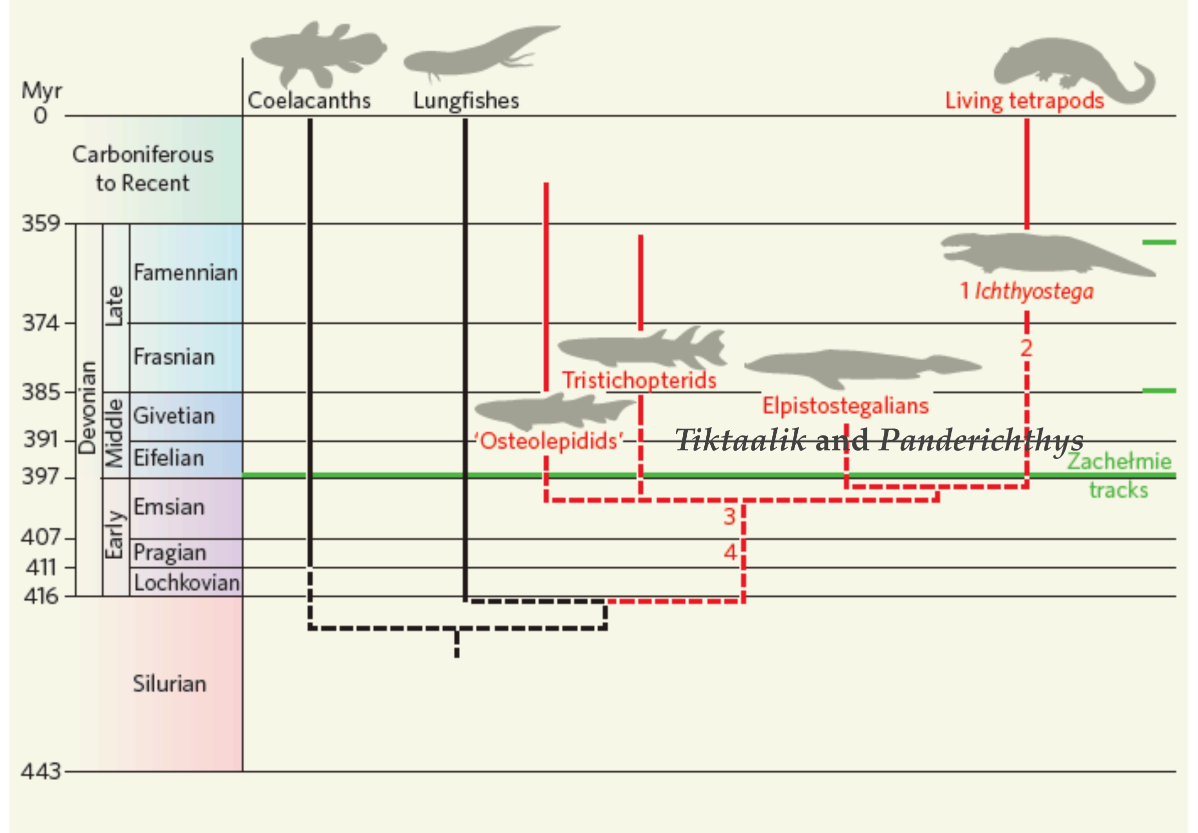


Figure 1 | Simplified evolutionary tree of the living and fossil lobe-finned fishes and tetrapods. The age of the previously identified Devonian tetrapod trackways (short green bars) contrasts with the 397-Myr-old Zachełmie tracks identified by Niedźwiedzki and colleagues[1]. These newly discovered tracks generate a mismatch between the currently accepted tree of tetrapodomorph fishes (lobe-finned fishes with internal nostrils) and its timing based on the body-fossil record (shown by solid red lines). The temporal mismatch implies the existence of long 'ghost ranges' (dashed red lines) among Devonian tetrapodomorphs. The divergence between elpistostegalian fishes and tetrapods with limbs and digits must have occurred much earlier than previously thought, perhaps during the 10-Myr-long Emsian stage, from which only few tetrapodomorph fishes are recorded. 1, Earliest articulated tetrapod skeletons with limbs and digits (*Ichthyostega*, *Acanthostega*)[2]; 2, earliest isolated tetrapod bones; 3, earliest tetrapodomorph fish (*Kenichthys*)[5]; 4, possible earlier tetrapodomorph fish[6].

P. Janvier & G. Clément, *Nature* 463, 40-41(7 January 2010)

- Moreover, distinctive tetrapod footprints (The *Zachelmie tracks* in Poland) have been found that are approximately 10 million years older (according to the evolutionary time scale) than the 'oldest' elpistotegids.
- That means that fully tetrapods were walking on earth before their alleged transitional forms from fish to amphibians appeared!



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- *Tiktaalik* appeared superficially to be an excellent example of a transitional form between fish and tetrapod.
- However, the specimen still does not provide a clear picture about the evolution of a soft anatomy suitable for land life.
- The fossil is a fish with strong ossified fins.
- The succession of alleged intermediates are not transitional forms in an evolutionary sequence, but a series of animals adapted to living in a transitional environment.
- They did not have legs because they were evolving from an aquatic to a terrestrial environment, but because they were inhabitants of the transitional environment.
- The environment was transitional, not the fossils.

- Moreover, what changes would be necessary to bring about a land-dwelling animal from an aquatic creature?
- Many significant changes would be necessary:
  - Skeletal changes in the skull, ear, vertebral column, pelvis, limbs.
  - Heat regulation
  - Skin
  - Blood circulation
  - Reproduction
  - Breathing, etc.

From Fish to Amphibians

	FISH	AMPHIBIANS
Skin	Bony scales	Smooth, moist skin
Heart	Two-chambered heart	Two-chambered heart in larval (tadpole) stage; three-chambered heart in adults
Body heat	Cold-blooded exotherms	Cold-blooded exotherms
Breathing	Breath with gills	Gills in larval (tadpole) stage; lungs and epidermal gas exchange in adults
Locomotion	Exclusively water-based. Swim with fins	First water based, then land-based. Walk with legs. Have pectoral girdles
Reproduction	Eggs	Eggs
Fertilization	External fertilization without physical contact between male and female	External fertilization but physical contact between male and female
Egg	A soft gelatinous unprotected egg with inner and outer chorion layer	A soft gelatinous egg with chorion and an additional vitalize envelope to give protection

From Reptiles to Mammals

- There are many specimens of mammal-like reptiles in the Triassic layers.
- It is difficult to order the sequence if actual transition happened.
- The features that the emergent mammals were supposed to get (hair, warm blood, four-chambered heart, mammalian glands, live birth, etc.) do not fossilize.

From Reptiles to Mammals

	REPTILES	MAMMALS
Skin	Epidermis covered with scales	Epidermis covered with hair
Heart	Most with three-chambered heart	All with four-chambered heart
Ventilation	Most with no diaphragm	Diaphragm for respiration
Metabolism	Low metabolic rate	High metabolic rate, homeotherms
Reproduction	Most are oviparous (they lay eggs)	Viviparous (young develop within the
Nursing	Little or no care of the young	Care of the young with milk
Growth	Growth continues through life	Growth limited after adulthood
Skull	Skull with small brain case	Skull with expanded brain case
Jaw	Jaw consists of several bones	Jaw consists of one single bone
Teeth	Teeth continually replaced with simple cheek teeth	Two sets of teeth only with complex
Brain	Cerebrum (anterior brain) relatively small	Cerebrum (anterior brain) larger and
Skull	Skull with one occipital condyle	Skull with two occipital condyles
Ear bones	Single middle ear bone	Three middle ear bones
Pelvis	Pelvic bones separate	Pelvic bones fused
Gait	Sprawling gait with limbs emerging horizontally from body	Upright stance with limbs directly

From Reptiles to Birds

	REPTILES	BIRDS
Heart	Three-chambered heart	Four-chambered heart with sac-like lungs operated by body movement
Body heat	Cold-blooded exotherms	Warm-blooded exotherms
Reproduction	Eggs with leathery protective cover	Eggs with hard shell giving oviparous birth
Fertilization	Internal with physical contact of male and female, some instances of courtship	Internal with physical contact of male and female, courtship is frequent
Skin	Scales	Feathers
Ecology	Exclusively land-based, except some aquatic snakes	Land, air, water

- According to evolutionary theory both mammals and birds are thought to have descended from reptiles.
- And that evolution entailed more than just anatomical modification.
- New organs, new functions, and new physiology had to be created in the transition from reptiles to mammals and/or birds.
- Critics of evolutionary theory question the feasibility of transitional forms.

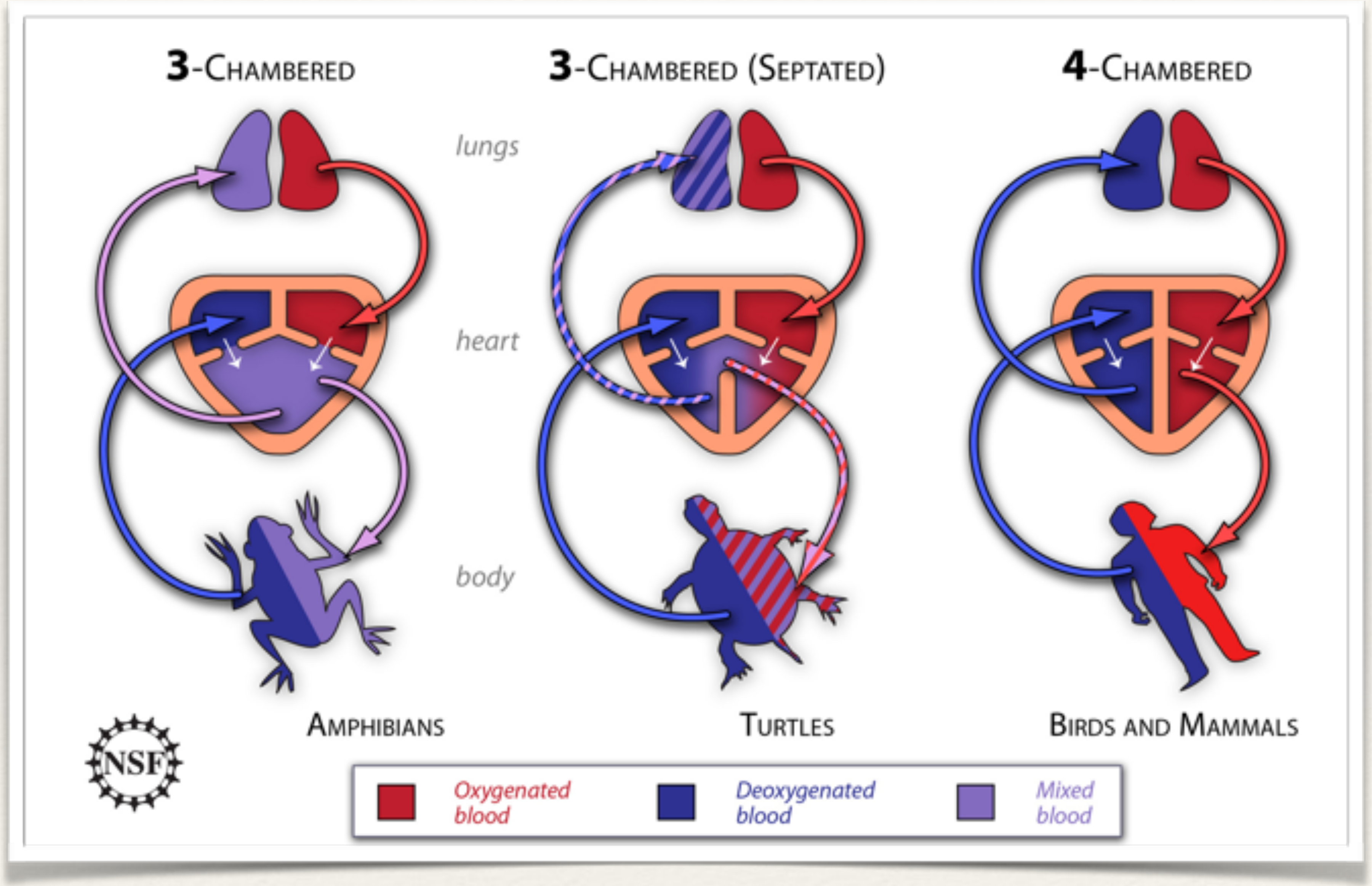
- First, there is the difficulty of producing complex systems.
    - Could unguided mutations and natural selection coordinate all the changes to transform a reptile into a mammal or bird?
- Let’s look at how these animals are built and see if a transformation of such degree would be feasible.
- Fossils only preserve skeletons, but animals are systems, not just skeletons.
- The transformation of a reptile into a mammal would take much more than just modifications of the skeleton.
- Profound changes in organs and systems would be necessary.

Reptiles and Mammals—Reproduction

- Mammals and Reptiles reproduce very differently.
  - Most reptiles lay eggs. When the babies hatch, they must immediately fend and forage for themselves.
  - Mammals carry fertilized eggs and bear live young. When the babies are born the mother nourishes them by lactation.

Reptiles and Mammals-The Heart

- Three chambers
  - 2 atria
  - 1 ventricle
- Four chambers
  - 2 auricle
  - 2 ventricle



- Could small and unguided modifications transform a three-chambered heart onto a four-chambered heart?
- How would the alleged intermediate forms, if they existed, work?
- Would they be feasible?
- What would be the intermediate stages from an oviparous to a viviparous reproduction?

Designed, Not Evolved

- Both the alleged fish-to-tetrapod and the reptile-to-mammal forms with intermediate characters can be understood as highly efficient designs for life in the marginal shallow water environments in which they lived.
- These animals were designed for the transitional environments.
- The environments were transitional, not the organisms.

Pre-Adaptation: Evolutionists' New Argument

- Still, evolutionists claim that transitional forms with intermediate characters would be possible.
- To explain the alleged evolutionary novelties they have invoked a process called *pre-adaptation*, or *co-option*.
- Pre-adaptation or co-option means that It has two meanings:
  - Organisms are pre-adapted to face changes in their environment.
  - Intermediate characters or organs may serve different purposes over the span of time of the evolution species—organisms may be lucky to inherit an organ that can be put to some different purpose later.

- Evolutionists say that incipient or intermediate organs do not work or function in the same way as their more developed descendants.
- But those organs still have a function; they are not useless and that's why natural selection does not do away with them.
- At some point, evolution may borrow the organ to be used with a different purpose.

- Examples of pre-adaptation:
  - Feathers in dinosaurs: though they did not fly, rudimentary feathers would be useful to conserve temperature in warm-blooded dinosaurs.
  - Half a lung in fish would be useful to make it more buoyant.

- The first fishes did not have jaws.
- It is supposed that the jaw bones were present in ancestors, but they were doing something else.
- Probably these bones were supporting the gill arch located behind the mouth.
- Although well designed for that ancestral function (breathing), these bones were pre-adapted to become jaws.
- Pre-adaptation helped them obtain the new function (eating) when evolution needed them to move forward to the mouth.

Problems of Pre-Adaptation

- This hypothesis is an interpretation based on speculation.
  - There is no evidence for pre-adaptation.
  - Fossils do not show pre-adaptation.
- It has become the convenient solution that explains the origin of almost any morphological feature.
- Suggesting pre-adaptation is simply a way of avoiding the issue.
- If a feature already functions perfectly, why would it change into something else?
  - The fish bones worked just fine. Why would they evolve onto something else?
  - Wouldn't natural selection eliminate such intermediate structures?
- If a feature is not well adapted or does not work perfectly, what good is it? Wouldn't natural selection eliminate it completely?
- What good is five percent of a jaw or an eye?
- If a structure is well fit, then it needs not to change, and if it is not fit, then natural selection will eliminate it.

The Meaning of Intermediates

- If the theory of evolution is correct we would expect to find many intermediate forms as one species “evolves” into another.
- Darwinists have suggested several fossils as proof of transitional forms.
- However, close examination reveal that these intermediate forms may not be the result of evolution.

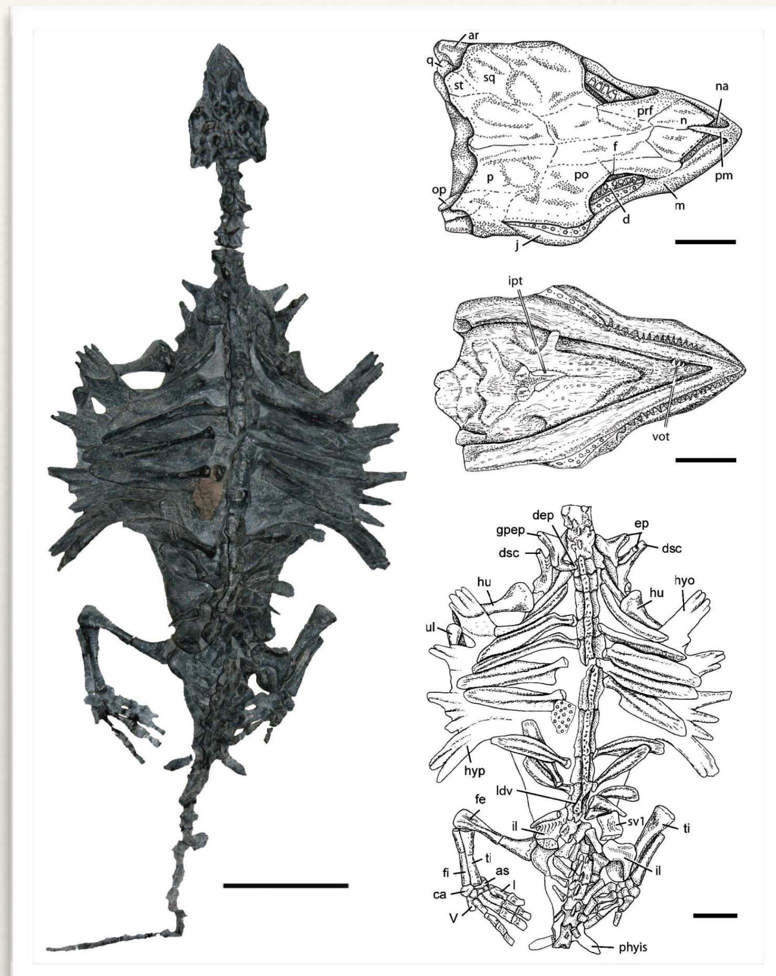
- Intermediate fossils show a combination of characters.
- But a combination of characters does not necessarily mean the organism or species was transitional.
- The combination of structures could be “intermediate” without the creature being transitional.

- Let’s suppose that we knew seals, sea lions manatees, beavers, castors, and otters only from fossils.
- A paleontologist could arrange them in a particular temporal succession claiming that they evolved and went extinct many millions of years ago.
- This paleontologist could claim that these fossils show a transition from land to water, or vice versa.
- Is a sea lion or a castor evolving into another creature just because they have membranes in their feet and spend much time in the water?

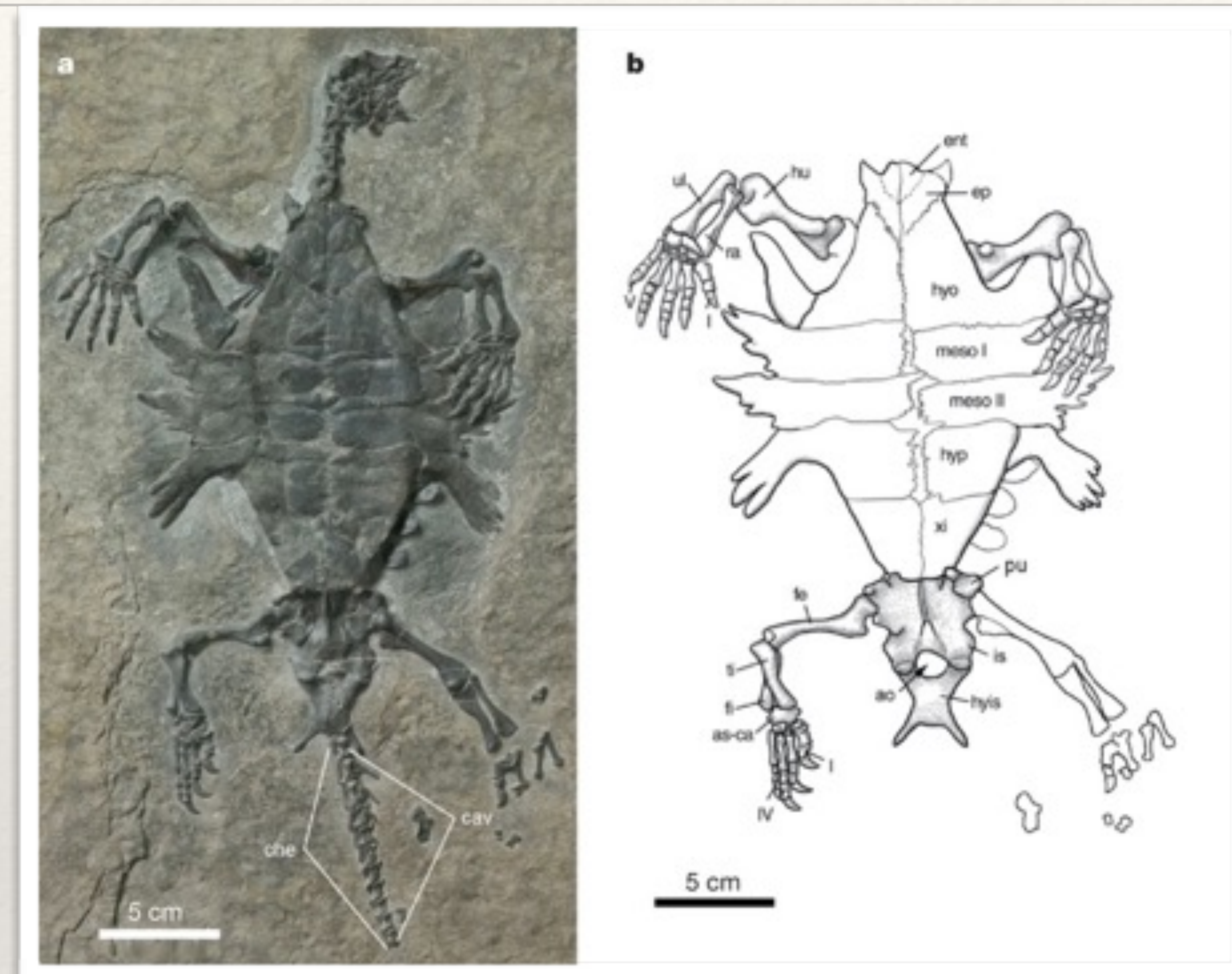
Odontochelys-The Fossil Turtle

- Fossil turtle found in China. Claimed to be an intermediate between a lizard-like ancestor and turtles
    - "Since the age of dinosaurs, turtles have looked pretty much as they do now with their shells intact, and scientists lacked conclusive evidence to support competing evolutionary theories. Now with the discovery in China of the oldest known turtle fossil [*Odontochelys*], estimated at 220- million-years-old, scientists have a clearer picture of how the turtle got its shell." (Field Museum 2008).
- Clearer picture?

Odontochelys



View of dorsal side



View of ventral side

- *Odontochelys* isn’t a missing link, but a challenge to evolutionary theory.
    - “The evolutionary relationships and ecology of turtles through time, and the developmental and evolutionary origins of the shell, are major controversies in studies of vertebrate evolution.” (Reisz and Head 2008)

- Distinctive *Odontochelys* features:
  - Plastron only (lower shell)
  - No carapace (upper shell)
  - Teeth instead of beak
  - Free sacral ribs
  - Long tail
  - Only dorsal ribs and neural dermal ossifications present.

- Because *Odontochelys*
  - Is the oldest known turtle
  - Has the lower shell well developed
  - Has the upper shell not fully developed (ossified)
  - Show similar timing of shell ossification as in modern embryos…
- Some paleontologists have suggested that the plastron evolved before the carapace.

- Reisz and Head think that there is another explanation:
    - “Although this evolutionary scenario is plausible, we are particularly excited by an alternative interpretation and its evolutionary consequences. We interpret the condition seen in *Odontochelys* differently –that a carapace was present, but some of its dermal components were not ossified. The carapace forms during embryonic development when the dorsal ribs grow laterally into a structure called the carapacial ridge, a thickened ectodermal layer unique to turtles. The presence of long, expanded ribs, a component of the carapace of all turtles, indicates that the controlling developmental tissue responsible for the formation of the turtle carapace was already present in *Odontochelys*. The expanded lateral bridge that connects the plastron to the carapace in other turtles is also present, implying that the plastron was connected to the laterally expanded carapace. Thus, an alternative interpretation is that the apparent reduction of the carapace in *Odontochelys* resulted from lack of ossification of some of its dermal components, but that a carapace was indeed present. This interpretation of *Odontochelys* leads us to the possibility that its shell morphology is not primitive, but is instead a specialized adaptation.”

- Reisz and Head continue:
    - “Regardless of the primitive or derived nature of its shell, *Odontochelys* is in evolutionary terms the most ‘basal’ turtle yet found. Its discovery opens a new chapter in the study of the origins and early history of these fascinating reptiles. Both interpretations alter our views of turtle evolution: *Odontochelys* either represents the primitive ecology for turtles, consistent with the hypothesis that the turtles’ shell evolved in aquatic environments, or it represents the earliest turtle radiation from terrestrial environments into marine habitats. Either way, these ancient turtles demonstrate yet again the value of new fossil discoveries in changing our understanding of vertebrate history.”

- Translation: Both interpretations suggest different views of evolution, but evolution itself is never subject to falsification or questioning– no matter how opposite the two interpretations.

- Other problems with the evolutionary model:
    - Evolutionists don’t know whether turtles evolved as aquatic or terrestrial animals
    - They don’t know whether *Odontochelys* is primitive or advanced.
    - Despite being the ‘oldest’ turtle, *Odontochelys* is remarkably similar to most modern turtles.
    - No ancestors or transitional forms from any other animal are known.
    - The fossil record should be filled with intermediates.
    - If they existed, why did they or their ancestors not fossilize?
    - Scientists wonder why turtles have not evolved much in 220 million years since *Odontochelys*.

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