# EVOLUTION OF DINOSAURS

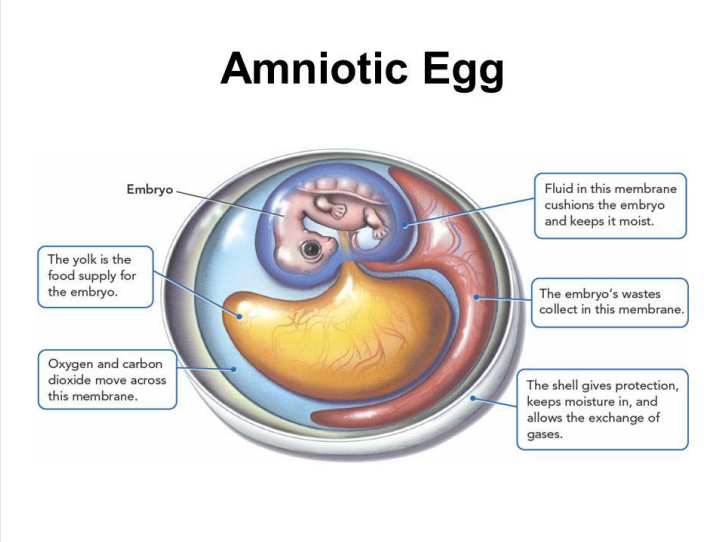
## THE AMNIOTIC EGG

Dinosaurs were believed to have laid **amniotic eggs**. This type of egg has an **amnion, or a sac** which **is fluid-filled around the embryo during development.**

It is vital to **reptile evolution** – allowing for life on land without the need of a water source to reproduce in. The egg provided the **aquatic environment** needed for development of the embryo **within the egg** itself.

<u>Advantages of the amniotic egg: typical exam points</u>

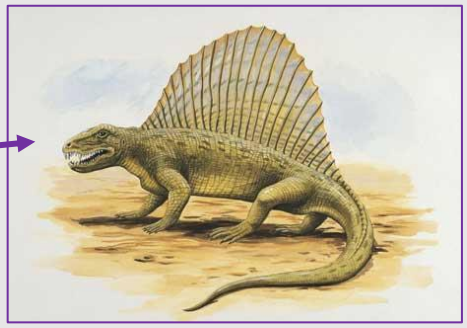
1. The first development for eggs on land was a **hard outer shell** that was **porous and permeable**. This allowed for **gas diffusion** of oxygen into the egg and carbon dioxide out, for **respiration**.
2. The **hard-outer** shell also provided **protection against scavengers** and **water loss**.
3. **A membrane inside** the shell increased the efficiency of **gas exchange**.
4. The **yolk sac** provided the **embryo with food/nutrients.**
5. **The albumin (a watery aqueous substance) supplied water and nutrients**, eliminating the need for a larval stage. The embryo could develop directly into a miniature version of the adult.



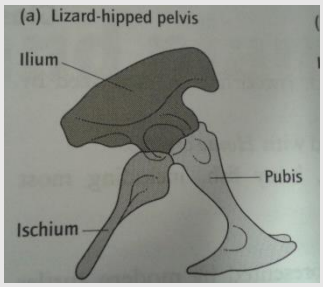

## PHYLUM DINOSAURIA

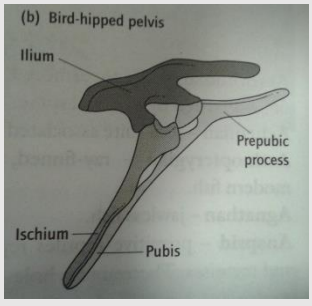
Methods rely entirely on the **bone shape and structure**. Other sources include fossil faeces (**coprolites**), **trackways**, **gastroliths** and **feathers.**

The main differences between dinosaurs are in the **hip bones**.



Dinosaurs evolved from **Archosaurs**, earlier primitive lizards, in the **Triassic**. Dinosaurs began to evolve after the **Permo-Triassic** extinction wiped out most life on Earth, perhaps filling newly vacant **ecological niches.** Dinosaurs were the **dominant terrestrial vertebrates** for some 185 Ma. They were abundant, diverse and successful, diversifying through the Mesozoic and became **extinct at the end-Cretaceous (66Ma**).




There are two main classes:

1. **Saurischia**, meaning reptile or lizard-hipped pelvis. The hip pointed forwards.
   - **I.** Therapoda, includes **birds** and the well-known dinosaur, **Tyrannosaurus.**
   - II. Sauropoda, includes the **Diplodocus.**

2. **Ornithischia**, meaning 'bird-hipped pelvis'. This class includes **Iguanodon**. The hip pointed backwards.

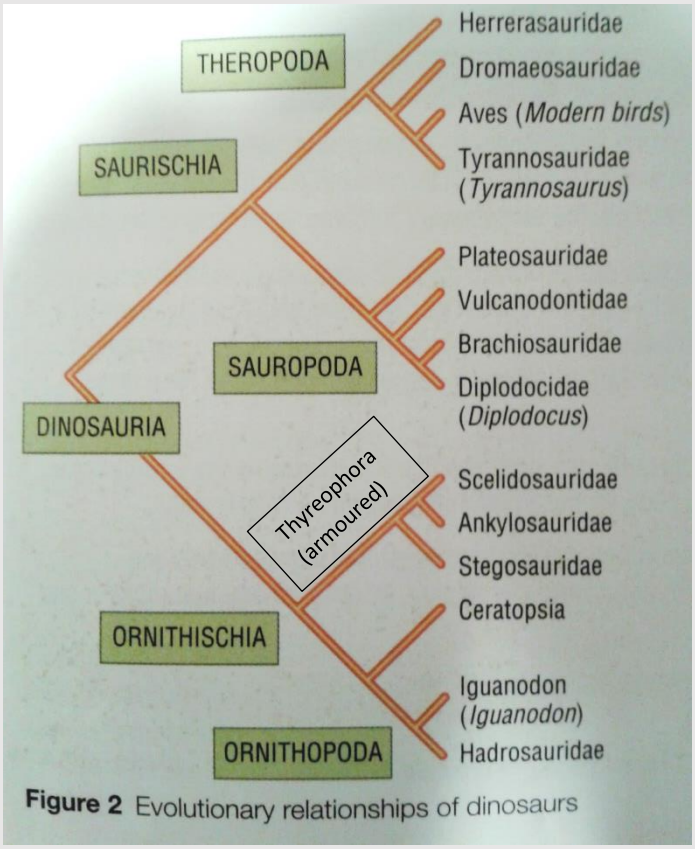


**Figure 2** Evolutionary relationships of dinosaurs

During the life of the **Archosaurs,** the continents were joined together to form the **supercontinent of Pangaea**. This meant that much of the interior was **dry and hot**, and environment where the Archosaurs were believed to have thrived.

Dinosaur evolution is classified by a series of mass radiations, where new **dino-groups** (suddenly on geological terms) evolve and **exploit new modes of life**. These radiations reflect:

- New **biological adaptations**
- Changes in **palaeogeography** such as rifting continents and population isolation.
- **Changes in climate**, such as warming/cooling or sea level rise.

By the **late Triassic**, there were **several Therapod dinosaurs** that rapidly diversified, all **carnivores**. **During the Jurassic, the supercontinent broke up**. With many **land bridges** remaining between fragmented landmasses.
**The climate became milder through the Jurassic, favouring dinosaur evolution**.

- Larger dinosaurs like the **Diplodocus** (a **Sauropod**) which ate a **vegetarian** diet evolved.
- **Ornithischian herbivores** were evolving at the same time, such as the **Stegosaurus**.
- Iguanodon, another Ornithischian dinosaur, evolved a horny beak with which to graze on low vegetation – but not grass, which did not exist at that time. The development of a horny beak probably served as a weapon.

During the Cretaceous, there had been further movement of the continents and many land bridges were removed. The climate became far cooler than the Triassic and Jurassic. This change saw geographical isolation leading to evolution along separate lines. The abundance of Saurischian dinosaurs decreased, becoming quite rare, but there was an increase in Ornithischian dinosaurs, usually of a smaller size.

The **change in size and class abundance** may have been due to **environmental pressures** and **change in diet**. For instance, **flowering plants** began to evolve.

## SAURISCHIANS

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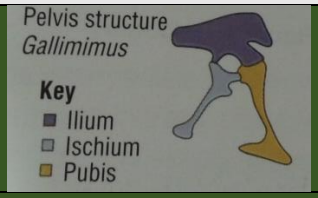
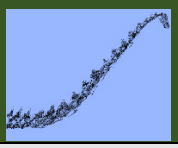
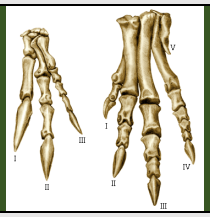
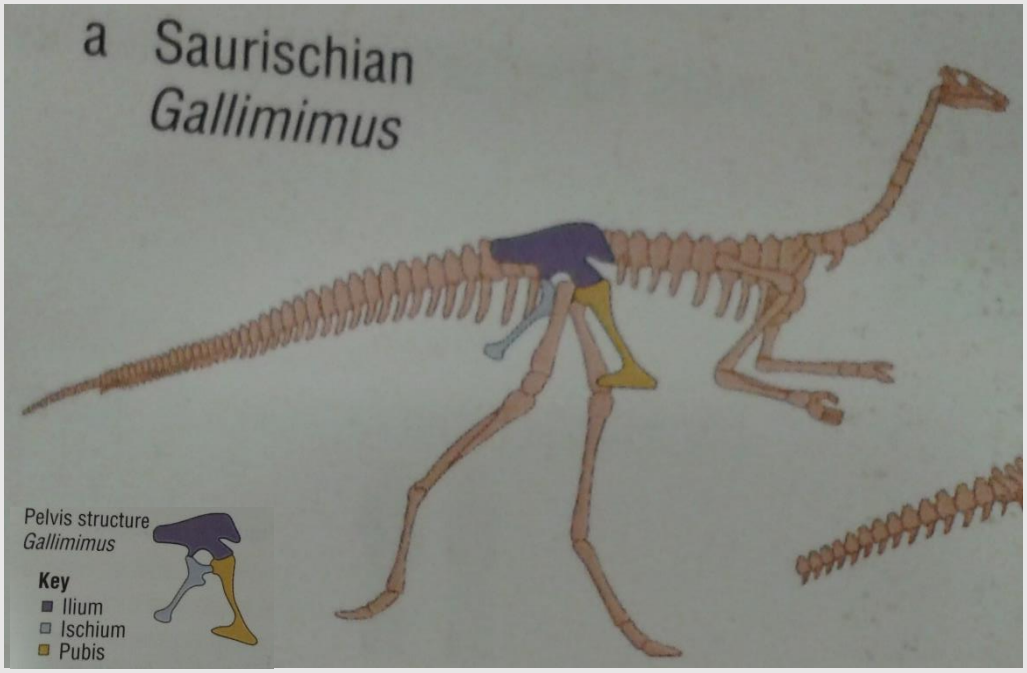
|---|---|
| A primitive arrangement of hip bones, similar to that of reptiles, in which the pubis faces forwards. |   |
| Long 'S' shaped neck. This was flexible and allowed for rapid, precise movement. |  |

Hands consisted of three digits and a thumb, the longest digit being the middle one. Digits were asymmetrical. Dextrous hands allowed them to grasp things.



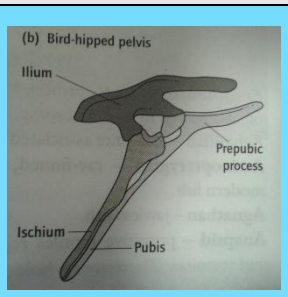


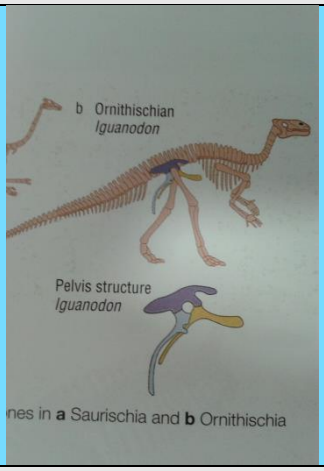

## ORNITHISCHIANS

The arrangement of hip bones similar to birds, with the **pubis pointing backwards.**

The **front teeth are absent**, replaced by a **horny beak** which later became broader in some members of this group leading to the **duck-billed dinosaurs**.

Many Ornithischian dinosaurs were **heavily armoured**, with **bony plates.** These may also have been **heat-exchangers.**
The fossilised plates have **tiny grooves** which may have housed **blood vessels**, allowing heat to be given off or taken in.




### The confusion:

Ornithischian = bird-hipped and Saurischian = lizard-hipped yet birds, or Avian Theropods, as they are termed, **actually evolved from the Saurischian type dinosaurs** nor the Ornithischians.

Q4. Orthischian or Saurischian?
- T Rex. = **Saurischian**
- Iguanodon = **Orthischian**
- Diplodocus = **Saurischian**
- Archaeoptyrex = **Saurischian**
- Stegosaurus = **Orthischian**
- *Gallus gallus domesticus* - The modern chicken = **Saurischian**

**Birds evolved from Saurischian - lizard-hipped dinosaurs!**

**It is very important you do NOT make a mistake and get this the wrong way round!**

Figure 2 Evolutionary relationships of dinosaurs