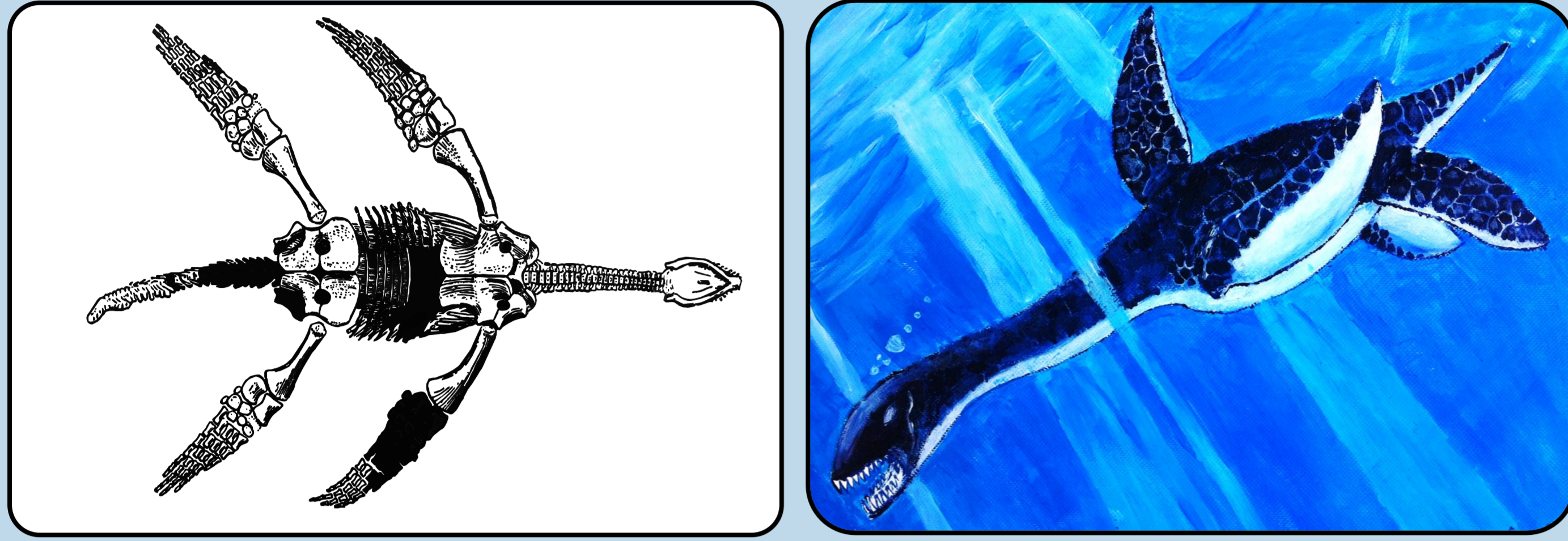


The Hydrodynamics of Plesiosaurs

What are plesiosaurs?

- Plesiosaurs are extinct **marine reptiles** that existed at the same time as the dinosaurs during the Mesozoic era.
- They are **unique** in the known natural world in that they use **four flippers for propulsion**.

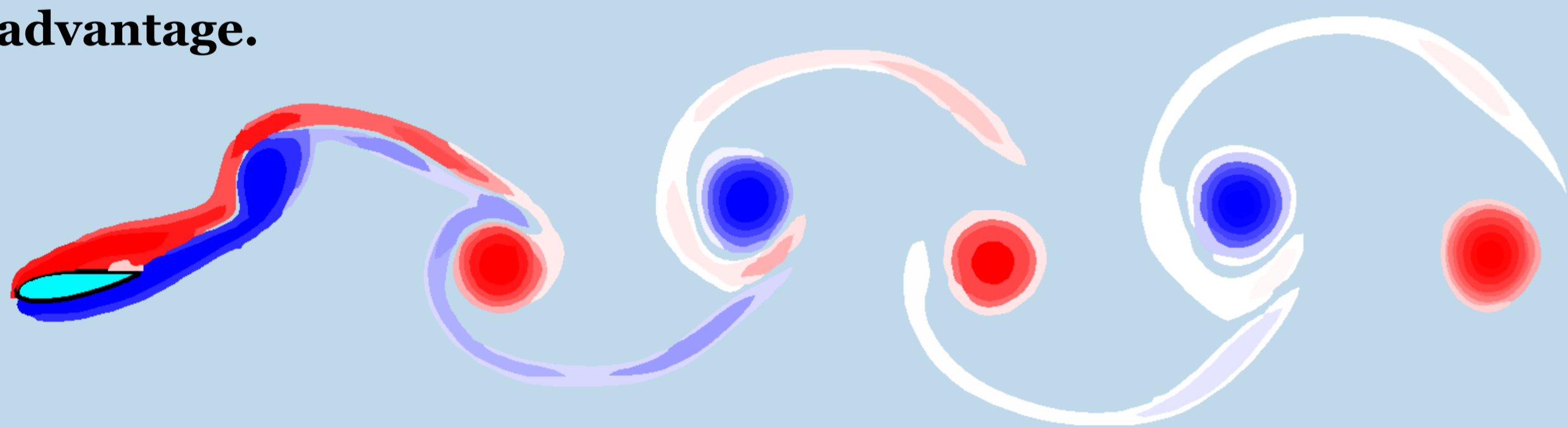


How would they swim?

- It is thought that the **different types of plesiosaur would use their flippers in different ways** when hunting as they have different requirements.
- Whilst hunting, **plesiosauromorphs** may drift around slowly for a long time, looking for fish and trying to remain undetected. This would require a flipper movement, or gait, that has a **high efficiency**, but wouldn't need much thrust.
- As active pursuit predators, **pliosauromorphs** would need to use a gait that has a **high thrust**, to be able to catch fast moving prey, but as the hunting time would be relatively short, a high efficiency would be less important.

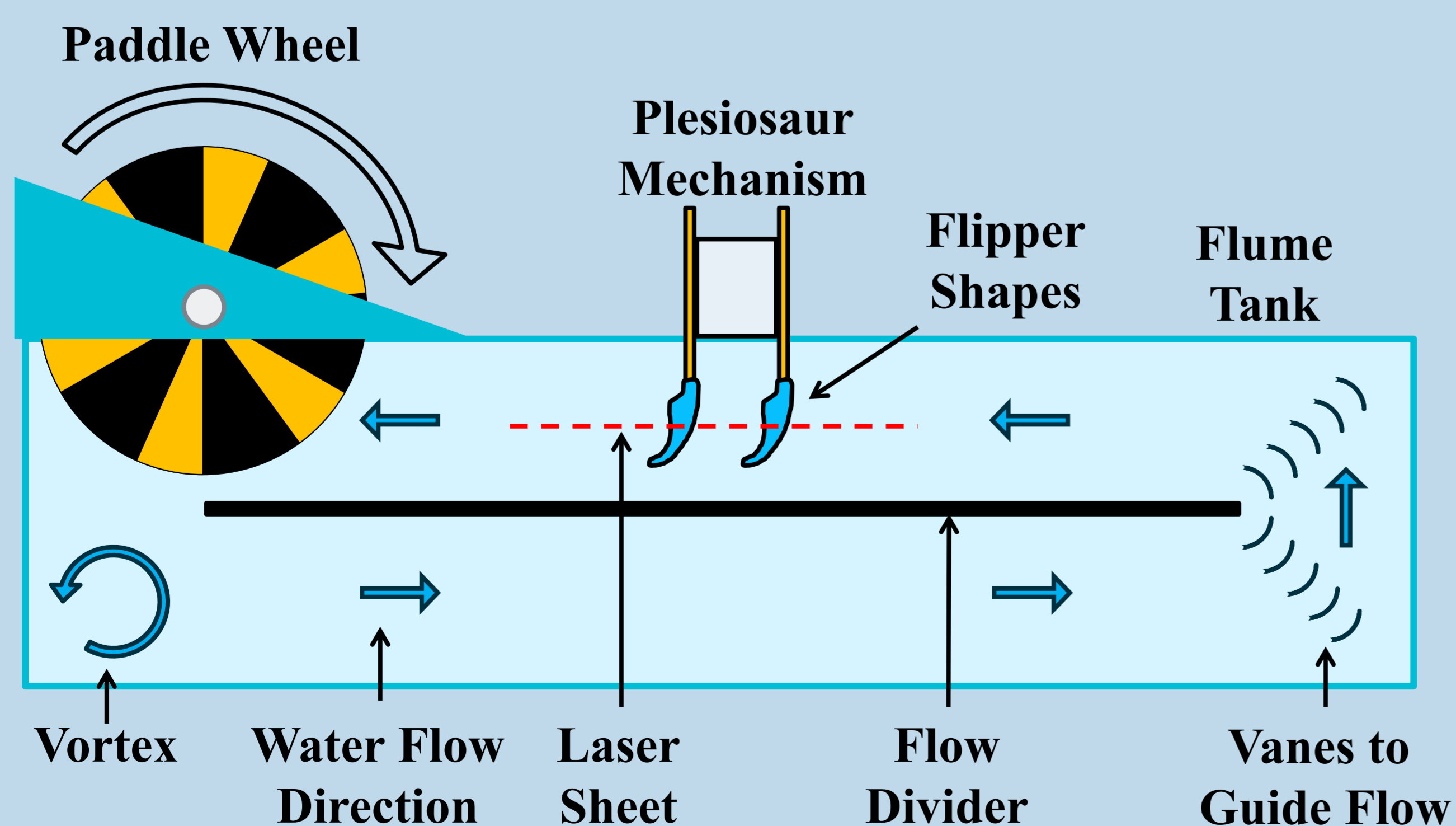
It's all about vortices

- A **vortex is just rotating fluid**. For example you create a vortex when you pull the plug from the bath and the water makes a whirlpool.
- **Flapping wings produce alternating vortices** behind them which gives thrust.
- A **second wing** behind the first wing is able to **extract energy** from these vortices, and **can create thrust more efficiently** than a single wing.
- This **increase in efficiency** may have given plesiosaurs an **evolutionary advantage**.



The demonstration experiment

- The demonstration experiment is a simplified version of the real experiment.
- **The scale is about 1:10**, so the real thing is 10 times larger in each direction.

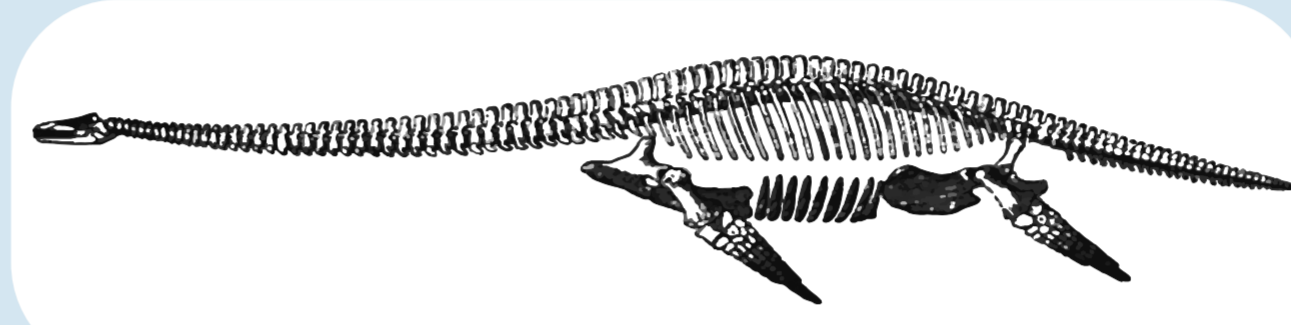


The two different types of plesiosaur

- Although there are many different types of plesiosaurs, they can be loosely grouped into one of **two main morphologies** (body-plans):

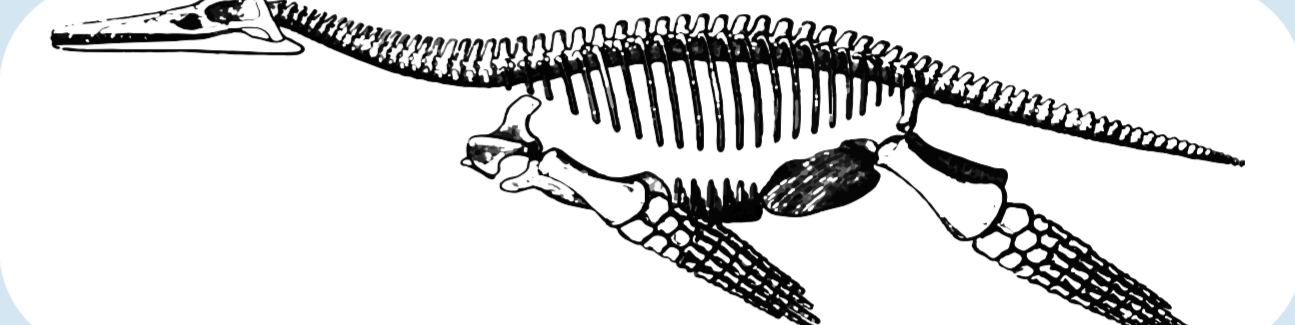
Plesiosauromorphs

- Long necks,
- Small heads,
- Usually pin-like teeth suitable for fish,
- Small flippers compared to body,
- Flippers are long and slender,
- Are thought to be **ambush predators** that lunge at shoals of fish.



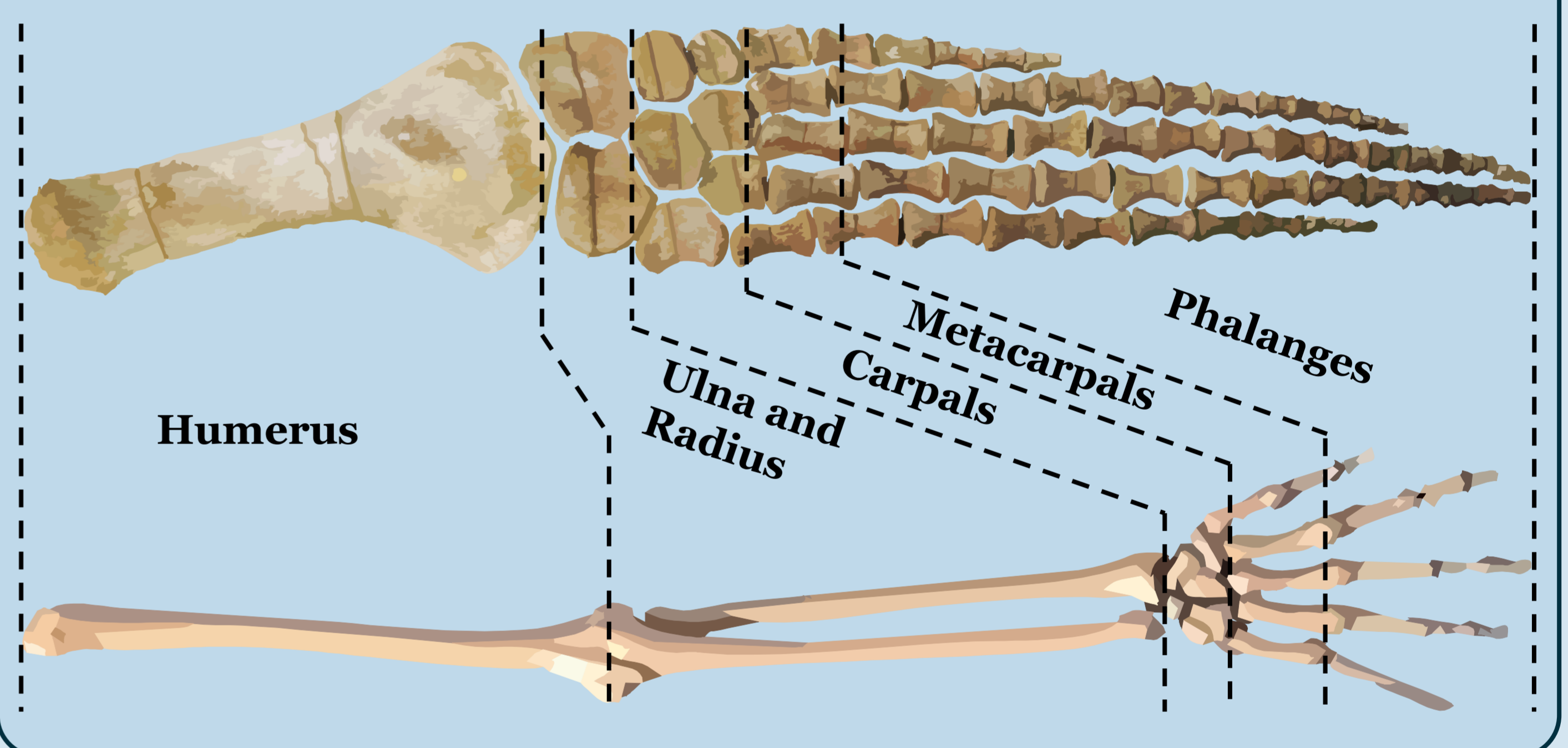
Pliosauromorphs

- Short necks,
- Big heads,
- Robust teeth suitable for large prey,
- Large flippers compared to body,
- Flippers are wide,
- Are thought to be **active pursuit predators** which chase after large prey.



Anatomy of a flipper

- The plesiosaur flippers are modified limbs **specialised for aquatic locomotion**.
- They have a **streamlined profile** and **swept-back planform**.
- The anatomy of the flipper is **homologous** (the same shape and structure) to the limb of any tetrapod, and we can compare the bones of the **human arm** to those in the **plesiosaur flipper** to highlight the similarity.



The real experiment

- The flume tank used for the real experiment is **14m long** so that flippers which are 0.5m long can be used.
- There is a **carriage system** mounted on top which provides **5 axes of motion** to the flippers.

