



WHAT MAKES AN INSECT AN INSECT?



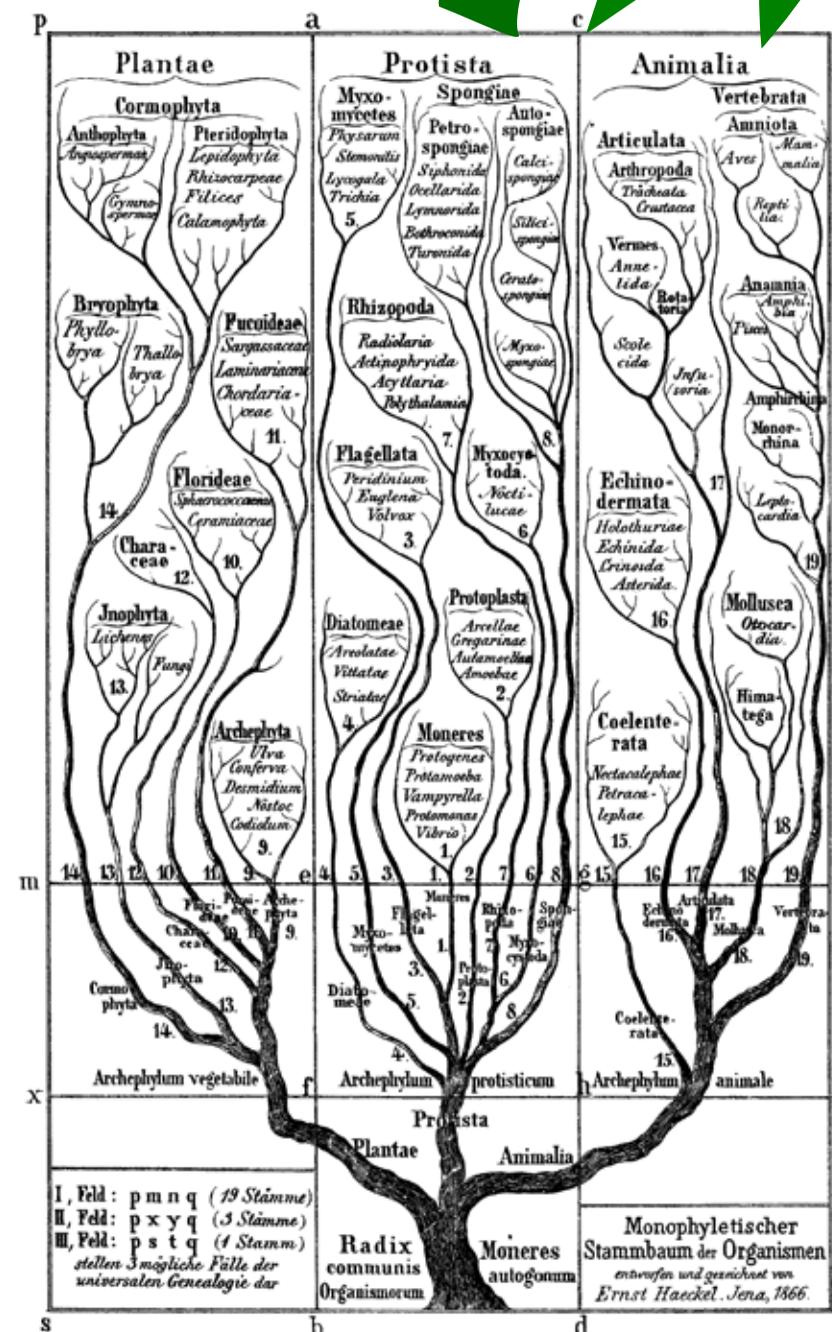
A wise arthropod once said: All insects are bugs, but not all bugs are insects

JUST like the organisation of a school – the students at the lowest level, the teachers above them, the head of departments above the teachers, and the headmaster or headmistress at the top – a biological classification is a hierarchy. The “rank” is the level in this biological hierarchy, where “species” is the lowest rank, “genus” is the rank above, “family” is the next rank up, and so on all the way up through seven ranks to the highest one, “kingdom”. For example, one of the kingdoms is Animalia, the animals, where we find our species, *Homo sapiens*. Another kingdom is Plantae, the kingdom of plants. Where do insects fit in?

Over hundreds of years of scientific history, taxonomists have come up with many different classification schemes. A taxonomist is a biologist who specialises in

classifying organisms into groups with similar characteristics, such as how they look, how they behave and where they come from. These classification schemes have gradually got more and more detailed as we’ve discovered more living creatures and learned more about them.

Have you ever heard of the game where you ask the question, “Is it animal, vegetable or mineral?” Well, that comes from a very early 18th-century classification scheme that had three kingdoms – animal, vegetable and mineral. The mineral kingdom was dropped from later classifications, as it contained things like fossils and rocks that weren’t even living! By the beginning of the 19th century, biological classifications were being visualised “upside down” as a branching tree of life, with kingdoms at the base of the tree and different groupings of animals represented by branches at various levels.



A tree of life by Ernst Haeckel from 1866. “Arthropoda”, which includes the insects, is on the top right.

We now know that all the organisms that exist on Earth are connected through hundreds of millions of years of evolution. Those life forms – us included – are the successful species that have survived longer than all the others since life first appeared on the planet around 3.5 billion years ago. And one of the most

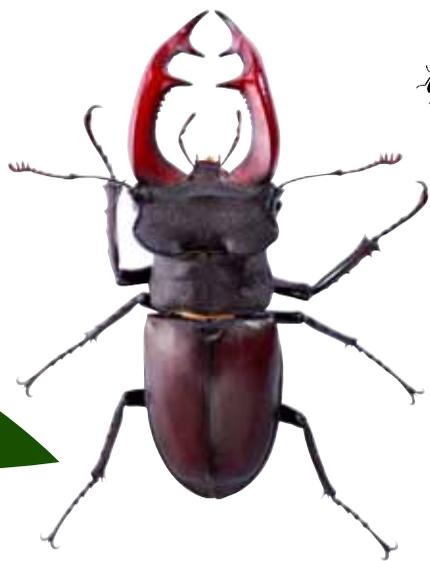
successful kinds of animals? Insects. Fossils tell us that they’ve been here on Earth much longer than we have: for at least the last 400 million years. There may be as many as 10 million living species.



WHICH BUG GOES WHERE

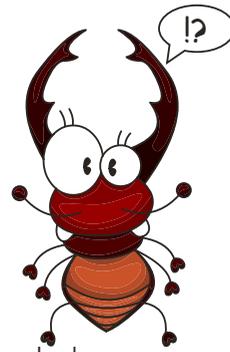
The rank directly below kingdom is "phylum", and there are roughly 40 in the kingdom Animalia. One of those 40 phyla is called Arthropoda – the scientific name for "bugs". But it turns out that while all insects are bugs, not all bugs are insects. Dust mites, spiders, ticks, woodlice, centipedes and scorpions are all bugs, but none of them are insects. And worms aren't even arthropods, by the way.

So how can you tell insects apart from other creepy crawlies? Here's how:

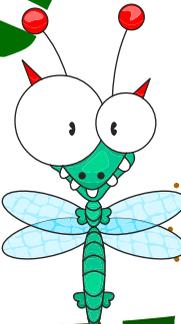


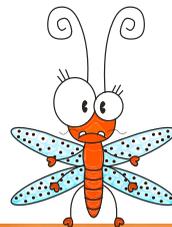
 Insects, like all arthropods, have an exoskeleton (but no backbone). The external skeleton, or exoskeleton, protects and supports the insect's body. It's made of a strong and flexible material derived from glucose called chitin. Slugs may be creepy, but they're out.

 Stag beetles are all armour-plated charm.



 Insects, like all arthropods, have jointed legs and a body that's divided into segments. Unlike some other Arthropoda, insects have a three-part body comprising the head, thorax and abdomen, and three pairs of legs. Sorry, spiders and millipedes.

 Insect body plans: a dragonfly sports a no-nonsense abdomen.



 Insects, like all arthropods, have compound eyes and appendages. Consisting of hundreds and hundreds of tiny individual "eyes" arranged on a curved surface, compound eyes have a huge viewing angle, and many insect species use them to detect infrared and ultraviolet in addition to visible light. The two antennae attached to an insect's head are highly sensitive appendages used for detecting "smell". Ticks and mites, off you go!

 Never get into a staring competition with a fly.



 Insects, like certain arthropods, undergo metamorphosis. Development in insects involves gradual change that includes distinct life stages, such as embryo, nymph (immature form) and imago (adult stage). Although there are many creatures that develop by moulting – shedding the skin or the exoskeleton – only certain insects perform the trick of "complete" metamorphosis in four stages: embryo, larva, pupa and imago. Go home, lice and scorpions! **AGJ**

 A milkweed butterfly pupa hangs out.

