NZASE resource

Teaching human evolution

Human evolution is a fascinating topic, with new evidence bringing ever-changing theories. But for inexperienced teachers, the breadth of possibilities can be overwhelming. NZASE Science Communicator Mike Stone talked with four experienced Biology teachers about how they approach the subject.

These teachers assess learning using NCEA AS 91606 trends in human evolution. Students are required to show understanding of trends in biological evolution (BE) of bones and brain, cultural evolution (CE), for example of tools, fire and clothing, as well as hominin dispersal and domestication.

The four teachers all say not to be daunted by the huge number of ancestor species as the focus is on trends. Erica Jar, at Solway College, says "It is very important to let students know that they might see unfamiliar species in the exam. But the question is not about understanding everything about those species, it's about applying what they have learnt to see where the unfamiliar species might sit within the trend pattern."

Alison Campbell has developed a lot of support material for this topic and recently retired from the University of Waikato. In her blog, Alison talks about new finds, seemingly every year, being great teachable moments. They are an opportunity to show science knowledge is not fixed, as new discoveries can change our understanding (NoS). And they also demonstrate that evolution is not linear – the hominin family tree is very bushy.

Biological evolution

Erica starts by differentiating humans from other primates, and exploring why human

ancestors became bipedal. Students explore how this form of locomotion affects the structure of the skull, hand and other parts of the skeleton as well as the brain.

There are five important species Erica focuses on next: *Lucy*, *Homo habilis*, *erectus*, *neanderthalensis* and *sapiens*. No more than one lesson each, just the basics, BE and CE.

Penny Daddy, HoF at Nga Tawa Diocesan College, agrees. She says "Keep it simple, it's all about trends. Students don't have to remember things like the brain size but they do need to know which species was the first to ... make tools, use fire and leave Africa."

Liz Evans, HoF at Rathkeale College, finds an emphasis on language is important at this stage. "I start with characteristics of the skull in 3-4 lessons and use a Kahoot quiz to reinforce the terms.

"I tell them 'You are using all these new words. See what you have learnt?' to give students confidence. Once we have the language to use, it becomes easier for them."

Three of the teachers set up a visual timeline where students add species and trends in BE and CE. As students justify where to place each feature, it summarises their learning. Erica says "You could give a timeline to them, but they learn more by making it themselves."

Studentmade potato tools in a timeline that summarises CE trends.

Rathkeale students

trying to

make a fire.

Photo: Liz

Evans.





Model Ното erectus from Zhou-

Model skulls are worth skull of the effort, say those that use them. Skulls may be borrowed from some koudian, tertiary institutions or China. museums, bought from Delta or Crescendo or made by a 3D printer with recipes readily available online. Those bought overseas attract a hefty import duty.



And while there, they talk about how to eat without a knife and fork, leading to a discussion about teeth.

To explore cave painting, Penny sets up a room in the dark with lots of paper hanging down. Students watch a three-minute video showing a walk through

Lascaux cave and discuss the paintings' potential purposes. Then they grind up pigments and draw their own cave paintings. Penny burns the edges of these artworks and displays them on the wall.

Others try practical activities such as measuring stride length and relating findings to Laetoli footprints, using spoons and potatoes to make tools, completing set tasks with thumbs tied down to explore opposable thumbs, and comparing skeletons.

Dispersal and domestication

Erica finds that the theories of dispersal are a useful bridge between teaching about BE and CE (mostly in Africa) and domestication (world-wide). With most evidence pointing to the out-of-Africa theory, there have been no questions on multi-regional hypothesis for the last two years in the NCEA exams.

Penny has a quern which she brings in, and during a lesson on domestication it is passed around the class as students try to grind some



Nga Tawa students trying their hand at cave painting by candlelight. Photo: Penny Daddy.

Cultural evolution

Students tend to come to the cultural aspects of evolution with a twenty-first century understanding. It's important for their ideas to become more concrete and realistic. Some teachers find practical activities are useful for this. Liz says "It's all about them - what will help them understand. They love hands-on."

Penny and Liz both give students some fine kindling (e.g. dried lichen or pine needles) and ask them to make fire - on a burning board in the lab or outside, with a fire extinguisher on hand.

Liz asks her students to use only their phone (to find YouTube clips and take photos). They get very keen, all find different ways of making fire but few get their kindling lit. Students learn it is hard and takes time, suggesting why it might have been important for Homo erectus to keep their fire going all day and night.

Students could try a Māori traditional method (hika ahi) of making fire by rapidly rubbing a pointed stick of hard kaikomako in the groove of a piece of soft mahoe wood until the fine shavings or dried moss ignite.

Penny then sets up gas burners (borrowed from PE) in the dark and roasts marshmallows. This leads to a discussion on what fire provides (for example, it changes flavour, kills parasites, hardens spear tips, a place to tell stories).

To make tools, Penny gets some quarried chert which students smash to get an edge. Liz takes her class down to the river to make tools by chipping flakes off sedimentary rocks. She brings in raw fleshed bones (from her husband's hunting) and asks students to cut the meat up and try cracking the bones.



Lisa Matisoo-Smith discusses evidence for the <u>peopling</u> <u>of the</u> <u>Pacific</u>.



barley or oats. They find it takes a lot of work to get the flour, and the activity leads to a discussion about kilns and making bread.

Bringing it all together

The students' constructed timeline summarises the learning. Penny also sets up a scavenger hunt around the school. Each clue leads to the next station, the principal acting as the sabre-toothed tiger at one station and students fill in a chart as they go.

While it is not assessed, some teachers like to make relevant links to Pacific migrations, using <u>Lisa Matisoo-Smith's resources</u> made by the Allan Wilkins Centre.

Advice to teachers

- Read to keep up to date with new finds and latest interpretations.
- Follow the <u>BioBlogs Scholarship Biology</u> page
- Join the Facebook Scholarship Biology group.
- Follow <u>Chris Stringer on Twitter</u>
- Email <u>Alison Campbell</u> or to <u>BEANZ regional</u> reps if you get stuck.

Useful teacher resources

- Dr Alice Roberts, *The origin of us*, BBC documentary series (try your local library).
- <u>Pass NCEA Biology</u> has a wealth of useful links, including most of those below.
- Smithsonian Institute. <u>Human Origins site</u>.
- <u>Talk origins.</u> An overview of human evolution and evidence against creationist claims.
- Alison Campbell, <u>University of Waikato</u> <u>summary of species and trends</u>, regularly updated.
- SciPad, <u>Trends in hominin evolution</u> poster, featuring 10 hominin species.

- Science Learning Hub <u>resources on human</u> <u>evolution</u> and their Pinterest resources on <u>human evolution and migration</u>.
- Yuval Noah Harari, <u>Sapiens: A brief history of</u> <u>humankind</u> (the first five chapters).
- Write-on notes from Cengage, Biozone, SciPAD and ESA
- Smithsonian. <u>Human evolution interactive</u> <u>timeline</u>.
- Don Johansson, <u>Becoming Human</u> documentary series (a good overview).
- PBS. <u>How did humans evolve?</u> Two online, interactive lessons about finding fossils, and the hominid family tree.
- Becoming human. <u>Primate bipedalism:</u> <u>Understanding standing up</u>. A skeleton and trackway activity.
- Sean Zabashi. <u>Cave art</u>. Series of posts about cave paintings being created in a way that made them move in firelight.
- Jared Diamond, 2007. <u>Guns, germs, and steel:</u> <u>The fates of human societies</u>. Fascinating content on why particular species were and weren't domesticated and the implications of this for local populations.

Ngā Kupu

Angaanga – Skull <u>Heke</u> – Migrate, migration <u>Kautete</u> – flint cutting tool with a wooden handle <u>Kuneroa tangata</u> – Human evolution <u>Kuneroa ahurea</u> Cultural evolution <u>Momo</u> – Species Rārangi wā – Timeline <u>Waituhi</u> – To paint, painting <u>Whakarata</u> – Domesticate.

