

Alarming Loss of Key Office Genus.

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In these times the disappearance of species in a little studied area of the world is hardly newsworthy or surprising. That this is happening right under our noses is alarming. This is occurring specifically, about 1 to 2 cm below our noses, in our mouths. The disappearance of cutlery from office kitchens across the globe is a cause for great concern for the fragile ecosystem that is mealtime.

This was first reported by my colleague Prof. Minestrone Soup at the University of Oxford ^{Brookes}, who first noticed that the milk was not mixing in his tea correctly. Being the fuel of the office ecosystem, in much the same way as a watering hole is to a savanna, this finding was worrying. The resulting paper, 'Ecosystem disaster leads to European style tea' hypothesised this was due to a sharp decline of teaspoon numbers ¹. Unfortunately, Soup failed to make a splash, and now those of us in the field of Ferramology are left to spoon-feed this information to the public.

Following this Dr. Richard Fork's group took a stab at confirming this hypothesis, performing a mark-recapture study on several species of the Cutlery genus. Disturbingly they found that the numbers of the 'stainless steel' species of this group drastically dwindled in just three months. With almost nothing left by the end of their yearlong experiment ². Needless to say, Fork's data left a lot to chew on, but it was the sort of work that prods the rest of us into action. However, it did leave an outstanding question, why?

The question as to why this key species are threatened is exactly the sort of mustard that we in the Blade group wish to cut into. The major hypothesis which we look to explore is namely Lim *et al*'s 'Escape to a spoonoid planet ^{3*}', which could hopefully get to the meat and potatoes of this occurrence. We do however want to dismiss sceptics that have cooked up some ludicrous falsehoods in opposition to our findings. The claim is that cutlery is in fact not a genus worth considering, or a step further, claiming that they are not alive in the first place. Without wishing to make a meal out of it these claims are absurd, and it is thyme we dismiss them entirely.

While we do not yet know the reasons for their endangering, it is clear that immediate action is required least we make a dog's dinner of yet another important ecosystem.

References:

1. Tomato, C. Salt, S. & Soup, M. Ecosystem disaster leads to European style tea. *Proceedings of the Royal Society for Silly Walks*. **17**, 45-52 (2013).
2. Fork, R. *et al*. Mark and recapture show declining utensil populations. *Ankh-Morpork Ecology Journal*. **6**, 451–463 (2015).
3. Lim, Megan S C, Margaret E Hellard, and Campbell K Aitken, 'The Case of the Disappearing Teaspoons: Longitudinal Cohort Study of the Displacement of Teaspoons in an Australian Research Institute', *BMJ : British Medical Journal*, 331.7531 (2005), 1498–1500.

* Author's Note - This one is actually a real paper, check it out!

The future is female: The extinction of the Y chromosome

Author: Taylor Rystrom

In recent years, headlines have announced the demise of the Y chromosome and, as a consequence, men. This sensational headline resurfaces every few years; however, men are still around. So, what's really going on with the Y chromosome?

It is likely that the Y chromosome was originally homologous to the X chromosome when XY sexual determination evolved around 160 million years ago. However today, in mammals, the Y chromosome contains SRY, the gene that determines sex, and little else (in humans there are only 45 protein-coding genes on the Y chromosome, most related to male fertility) This is nothing compared to the X chromosome, which has over 1000 genes. The Y chromosome of today is wimpy and has no homolog to recombine with, and thus selection cannot act on specific loci; the genetic wasteland is a package deal. Chromosome researchers have actually called it the "kiss of death" for a chromosome when it gains a sex determination gene. When a sex determination gene evolves, nearby genes are selected for fertility of that sex, and then this region does not recombine since it is advantageous to keep fertility genes close to the sex determination gene. If genes not related to fertility mutate, they are eventually lost, and this is why the human Y chromosome has only 46 genes compared to 1000+ on the X chromosome [1].

If the Y chromosome was similar to the X chromosome when XY sex determination evolved around 160 million years ago and maintains a linear rate of gene loss, it is currently estimated that the Y chromosome will disappear in 4.6 million years [2]. Let's be honest – it is not likely that the Y chromosome evicts one gene every 100,000 years like clockwork. However, it does make for a catchy title among popular science articles. Additionally, many chromosome researchers assume that if the Y chromosome disappears, the SRY sex determination gene will just hop to a different chromosome, cueing subsequent degradation of this chromosome as well. A similar process has occurred in *Drosophila*, where the sex determination gene is already destroying its third chromosome in some species [3].

Is this only happening in humans? Actually, a few rodent species have completely lost the Y chromosome and it seems like genes other than SRY have evolved to determine sex [4]. If something similar happened in humans this would result in a new species that is reproductively isolated from *Homo sapiens*! However, it is worth noting that at least two of these rodent species are endangered due to habitat fragmentation [5, 6]. And the future is definitely female for species with temperature-dependent sex determination such as many turtles, lizards, and crocodiles. Recent research of sea turtle populations has highlighted how extreme the sex imbalance has become in a warming world: at the most important green sea turtle breeding site in the Pacific Ocean, females born now outnumber males 116 to 1 [7]. While this may have an immediate positive effect on the population size (all 116 females can have offspring as long as that one male exists), there could be devastating long-term effects on the genetic diversity of populations, and the researchers even fear that there will soon be a complete feminization of certain populations. A population that breeds on cooler beaches was also examined, and there females outnumbered males as well but only 2 to 1 [7], but only time will tell whether or not this female bias will accelerate.

Frankly, it is hard to imagine a path in this simulation in which humans survive 4.6 million more years, so it's probably a moot point whether or not men will continue down this path of genetic degradation and eventually disappear. If we don't put more effort into protecting the environment and fighting climate change, it won't be just men who become extinct.

References:

1. Graves JAM (2016) How Australian mammals contributed to our understanding of sex determination and sex chromosomes. *Australian Journal of Zoology* 64: 267–276.
2. Griffin DK (2012) Is the Y chromosome disappearing?—Both sides of the argument. *Chromosome Research* 20: 35–45.
3. Graves JAM (2005) Recycling the Y Chromosome. *Science* 307: 50–51.
4. Honda A, Chojookhuu N, Izu H, Kawano Y, Inokuchi M, Honosho K, Lee A-R, Nabekura H, Ohta H, Tsukiyama T, Ohinata Y, Kuroiwa A, Hishikawa Y, Saitou M, Jogahara T, Koshimoto C (2017) Flexible adaptation of male germ cells from female iPSCs of endangered *Tokudaia osimensis*. *Science Advances* 3: e1602179.
5. <https://www.iucnredlist.org/species/21973/22409638>
6. <https://www.iucnredlist.org/species/136695/22409747>
7. Jensen MP, Allyn CD, Eguchi T, Bell IP, LaCasella EL, Hilton WA, Hof CAM, Dutton PH (2018) Environmental warming and feminization of one of the largest sea turtle populations in the world. *Current Biology* 28: 154–159.

Interview: ETT- Fellow Prof Dr Sara Brownell

Author: Marko Bračić

Sara Brownell is an Associate Professor in the School of Life Sciences and Director of the Research in Inclusive STEM Education Center at Arizona State University in Tempe, Arizona, USA. She is a neuroscientist turned full-time education researcher who teaches undergraduate biology while studying biology education. It was a pleasure to have her here in Münster from May to July as an MGSE ETT-Fellow.

During her stay, Sara presented her research at the Joint Symposium (MGSE, EvoPAD, and NC³) and in the Evolution across Fields lecture series. She enlightened us about problems in teaching that we usually don't consider: teaching evolution to religious students and biases of students with certain social identities. Sara organised two very useful workshops for MGSE members in which we had the opportunity to learn how to tackle previously mentioned problems. I attended the first one where I learned how to measure if students accept evolution and understand the key concepts. The second workshop focused on why and how to be more inclusive towards students with certain social identities.

If you missed these activities, no worries! Sara was very kind to accept my interview offer and there will be few questions about the aforementioned problems. Let's talk to Sara.

Hello Sara! First, thank you for all the activities that you organised for the MGSE and for this interview. How was your experience as an ETT-Fellow in Münster?

It was fantastic! I really enjoyed getting the chance to interact with the graduate students. I personally learned so much about differences in the educational systems between Germany and the United States. Münster was also a perfect place to spend

my summer; I loved getting to bike around the city and enjoy this beautiful place.

Was there any interaction with students and researchers in Münster apart from the workshops and talks that you led?

I got the chance to interact informally with some of the graduate students, postdocs, and faculty. Some of these discussions were

related to teaching broadly, but many were more specific to teaching evolution and evolutionary medicine, which are two areas that I specialize in. I also had many fruitful discussions with people about diversity in science and how pervasive biases can be.

I also started a collaboration with University of Muenster faculty member Marcus Hammann exploring how student evolution acceptance may be different between the United States and Germany – we are currently collecting data for that project and we are excited for what we might see!

You explained the challenges in teaching evolution to us, which one do you find most problematic?

Typically, teaching about human evolution is the most challenging for students who may have a conflict between their religion and evolution. However, I don't see teaching human evolution as problematic- I see it as a challenge to try to teach it in a way that is respectful of people's beliefs and accurate scientifically. Most religious individuals actually don't hold beliefs that are in conflict with evolution, but sometimes they don't realize that.

Do you see a religion-evolution conflict (arising) in Europe?

This is really good question. The conflict that we see between religion and evolution in the United States is typically not seen in Europe. Much of this has to do with differences in how religion is viewed in society and the historical conflict between the teaching of evolution and religion in the United States. Most of the research on the conflict between religion and evolution focuses on Christianity, typically what is referred to as Evangelical Christianity. However, whenever religious texts are taken more literally, there is often a problem with evolution acceptance. As the demographics of Europe change, measuring this potential conflict between religion and evolution would be of interest.

We see a similar problem with rejecting scientific knowledge in anti-vaccination and flat-earth movements. Are we, the scientific community, doing something wrong?

I think it's well known that scientists often don't take the time to communicate their research effectively to the public. There is also a problem with language. Evolution is a theory and then people say "it's just a theory", not realizing that scientists use the term theory in different ways. Scientists are often very careful not to say things in absolute, but their tentative language is often criticized by people who don't realize that inherent in the nature of science is a tentativeness. I don't think the scientific community is doing something wrong, but I do think that we can do a better job at training our future scientists to be better communicators.

You introduced your "Religious Cultural Competence in Evolution Education (ReCCEE)", could you briefly explain how to use it in our teaching?

The people teaching evolution are often atheists, but many of the people learning evolution may identify as religious. This presents a cultural gap- where atheist instructors may not be inclusive of religious students because of differences in their religious cultures. We advocate for culturally competent evolution education that can help religious students increase their acceptance of evolution.

You can use lots of different techniques that could be considered culturally competent. You can present examples of religious scientist role models who both accept evolution and identify as religious. You can acknowledge that there are some questions that science can answer, but there are other questions that science cannot answer; this is what is often referred to as the bounded nature of science. You can explicitly tell students that there doesn't have to be a conflict between religion

and evolution; many religious denominations have stated that they endorse evolution.

Could you give us one piece of advice, easy to implement, to make our teaching more inclusive?

Survey who your students are so you don't make assumptions about them. This can be as easy as collecting their information on index cards or you can create a survey for them to fill out. Find out how many are religious. Find out how many of them were born in a country outside of Germany. Find out how many struggle with anxiety. This information can help you better teach them.

Instead of getting lost in the details, you suggest that biology undergraduate programs should be focused on the core biological concepts. Could you briefly introduce the idea?

There is way too much information for us to learn. The amount of biological information is growing exponentially and yet the amount of time for an undergraduate degree is the same. So we have to start making decisions about what to include and what not to include. A report that was published in the United States that was the collection of over 500 biologists and biology educators recommended that we teach 5 core concepts in biology. Essentially, they recommended that every graduating biology major should understand these 5 big ideas of biology or core concepts of biology. This provides a really nice organizing framework for learning some of the details of biology and it mirrors how professional biologists think about problems through a conceptual lens. It's a way to think about learning fewer things in depth rather than learning superficially about a bunch of things that feel really disconnected. This approach is even more important now that information is so easy to access. If students can look it up on their smartphone in under a minute, instructors should think twice about having students memorize it.

What would be your most important advice to scientists (from PhD students to P.I.s) supervising and teaching (undergraduate) students in biology?

I would recommend that you constantly try to collect some data or evidence about how you are doing. This can be as simple as asking students what they don't understand at the end of the class. Everyone's teaching can always be improved and so making evidence-based decisions with our teaching is what we want to do.

Do you manage to apply the findings of educational research into your teaching?

I always try to incorporate my research into my teaching. Some things are easy to implement. I found that students prefer watching videos to reading the textbook, so I started assigning more videos for students to watch outside of class. But some things are harder to implement. Whenever I try something new in my teaching, sometimes it works, but often it doesn't work. So I redesign it, or tweak it, and try to make it better the next time.

Do you miss neuroscience research and working with animals?

Not at all. I thought that I would miss it, but I love education research so much and I can see the immediate impact of the work that I have never looked back!

What was your motivation to switch from neuroscience to educational science?

I loved teaching and spent lots of time teaching students. However, I realized that I actually knew very little about teaching. When I started to explore the academic foundation of teaching, I realized that there were scholars who studied how to improve the way we teach and how students learn. I started reading and wanted to start doing my own research. Then I got hooked!

Any last pieces of advice for PhD students on choosing their career paths?

I would recommend that PhD students develop other skills – more than just doing benchwork/fieldwork research – that they can leverage into other jobs if they decide not to pursue a career in academia. This can be

science communication, science education research, teaching, business, science policy, program administration, etc. Everyone with a PhD has done research, but not everyone hones a parallel set of skills that might make them more competitive for future jobs.

Sara, thank you again and good luck with your future projects!

Where Is The Unicorn? Thoughts about Theories, Truth, and Unicorns

Author: Kathrin Strauß

Are unicorns a real thing? Not the ones printed onto bottles of alcohol or condoms, but as living, breathing creatures? No? Can you prove it?

Now you might refer to a big book on species (or – you know – the internet) and tell me that there is no section on unicorns, that nobody has ever described one and that this is ridiculous. But can you prove that on Proxima Centauri b unicorns do not happily live in a land filled with cotton candy and lollipops? Granted, we know very little about Proxima Centauri b and certainly do not have information about unicorns, lollipops, or cotton candy on its surface. Yet, is that enough to make the statement *There are no unicorns anywhere* true?

We commonly use something called the Correspondence Theory of Truth. Whether a statement is true or false is determined by how it related to reality. If it accurately describes a state of affairs the statement is true. If it does not, it is false. Take an example: It is raining in Münster right now. The statement – or for the more nerdy ones amongst us: the assertive Speech Act – is true, if it is actually raining in Münster right now. So obviously yes. But why is this different from the unicorn?

On an ontological level, it is not. There is a reality, either with rain or no rain in Münster and with unicorns or no unicorns. Both statements may correspond to said reality and that makes them true. Epistemically, however, there is quite a difference. I could prove that my statement is true. I just need to observe the entirety of my relevant reality and show that there is rain. It might be challenging, given the size of my relevant reality, but *Oh, I get by with a little help from my friends*.

You on the other hand try to prove that something is not the case *within all of reality*. And regardless of the number of friends you have and considering the expanding universe, you will not be able to do that.

Karl Popper can explain why that is. *There are no unicorns* is expressing a universal statement. It claims that something – a unicorn – does not exist. If they do, it is wrong. If they do not, the statement is true. The unfair thing is that there is an unbalance. I can falsify your claim, if I catch a unicorn, send it to one of those fancy, high impact score journals and gracefully drop you a copy. There you go. There are unicorns, you are wrong. However, you cannot verify the claim accordingly. Sending me a video of your unsuccessful unicorn hunt does not convince me that there are no unicorns, but merely that you did not look close enough.

The same is true for theories of empirical sciences. As soon as they entail a general claim about how something is or not is. Regardless of in how many cases it accurately depicts reality, the one counter

example where it does not disprove the entire theory. Fitting in does not verify the theory, but not fitting in does falsify it. Therefore, if scientists use phrases like *as far as we know*, it does not mean that there is a low level of certainty to their theory. It merely means, that they know that every fitting case is not a proof and that every ill-fitting case is a disproof, they simply have not found yet. This is as good as it gets. As soon as we find that case, we have to adjust it. That is what we call scientific progress.

There are no unicorns, *as far as we know*.

Not the mama! The sad ending of a children's show about dinosaurs

Author: Jasmin Kurafeiski

Most of you probably know that old children's show "Dinosaurs" about a family of dinosaurs and their day-to-day life, often mirroring our own. The show dealt with many serious topics, for example racism, drugs, growing up, and environmental issues. It was one of my favorite shows, and even though I haven't really watched it in more than 20 years there are many moments I still remember fondly! If you never saw it I'd recommend it, though as a fair warning, my judgment might be clouded by nostalgia.

Here, I want to talk to you about the show's last episode "Changing nature". I was reminded of the episode a couple of months ago and decided to rewatch it. This is one of the episodes dealing with environmental issues, and damn it is a very uncomfortable watch today. For all who never saw the show or this particular episode let me quickly summarize: The episode starts with the family waiting for the arrival of the so-called bunch beetles that show up every year at the same time and eat the cider poppies, a rapidly growing plant. But the beetles do not show up. Charlene, the daughter of the family starts investigating what happened, only to find out that the beetles mating ground has been destroyed by the WeSaySo company in order to build a wax fruit factory. As a consequence, the bunch beetles went extinct and the poppies overgrow everything. Charlene's father Earl, who works for this company, starts defending it, claiming what the company does is necessary for maintaining his right to a comfortable life. After seeing Earl defend the company, his boss B.P. Richfield (unscrupulous business dinosaur who also meddles in politics and wants to build a wall to keep out the 4-legged dinosaurs....) tasks him with taking care of the poppy problem to avoid a publicity disaster. This is where things start to go south. Earl decides to use an herbicide to kill the poppies. This is very successful.... a little too successful as the herbicide kills ALL plants, destroying the food chain. So, what DOES make plants grow? Well, rain does! So they decide to throw bombs into volcanoes to create clouds! You can probably guess how that plan worked out for them...

I remember seeing this as a kid, and I was still quite naive to the extent of climate change. I was aware of the dinosaurs going extinct at some point and also the common explanations (volcanoes, meteor strike) so to me this was just a version of telling that story. Despite the show ending on such a sad note, it felt like a natural conclusion. Watching that episode now, a good 25 years after it initially aired, it feels painfully recent. Clinging to every comfort, denial of how bad the situation is by old rich people, and teenagers trying to get people to realize how bad the situation is. This episode was supposed to be an exaggerated warning that suddenly feels a bit too realistic. You might remember the show for its funny antics, often by Baby "Aagh Aagh I'm dying you idiot" Sinclair, but we should not forget the show's somber end.

“And taking a look at the long-range forecast: continued snow, darkness, and extreme cold. This is Howard Handupme, saying goodnight ... [pause] ... and goodbye...”

Extinction

Author: Dr. Bianca Brügger

Think about extinction, there are different ways
in which some thing vanishes, some other thing stays,
by nature, on purpose or accidentally driven
it did always happen, some examples are given:

When the world was young, shortly after its birth,
dinosaurs were ruling the earth,
when all of a sudden comets did arrive,
one was a hit and wiped out their live.
(Maybe you were lucky if you could fly or dive,
since sharks, crocodiles and birds did survive.)

But even before the final collision,
nature had come to a different decision,
mammals were rising in great variation,
making themselves ready for the
repopulation.

Evolution went on and life found its way,
we ended up where we are standing today,
humanity took over the planet's heir,
but extinction did not simply stop there.

At first we just had to dress and to feed,
we started to hunt down species out of need,
later for power or just to impress,
with the latest catch, and the creatures grew
less.

But not only animals were hunted and killed,
the evil in mankind by blood rush was thrilled,
they slaughtered their own, those in minority,
which led up to genocides unethically.

Well, why would extinction stop here, we do
worry,
how much time is left, should we start to
hurry,

maybe to our days will soon follow dark
nights,
so we prepare for intergalactical fights.

Whilst planning this, science and research try
hard,
to extinct willingly – with illnesses to start,
and are very effective if not held back by
dumbs,
or ill-educated anti-vax mums.

A mouse, they say, would never invent its own
traps,
but with nuclear bombs humanity itself preps,
will we have to wait what the universe holds
in store,
or do we extinct ourselves way before?

A supervulcano, explosions or wars,
melting poles, climate change drowning the
shores,
maybe those will not end the era of men,
but sometime extinction will strike once again.