

An occasional column, in which Mole and other characters share their views on various aspects of life-science research. Messages for Mole can be sent to [mole@biologists.com](mailto:mole@biologists.com). Any correspondence may be published in forthcoming issues.



## Collectors

Don't make a sudden move, but look over there – over at the edge of the garden. A magnificent buck with eight points (that's antler talk) is grazing at the edge of the woods. Of course, being a mole with mole vision, it might be a tree stump, but no – it really is a buck. My dear friend Professor Badger would want to shoot it, stuff it and hang it in his den, but fortunately he isn't here, so we'll just watch.

It is a lovely day, here in the great outdoors. Flowers flowering, bees being, and leaves on the trees months away from leaving. And that lovely buck, who is now intently watching me. (Deer don't eat insectivores, do they? No, didn't think so.) So I'm going to take a little break from thinking about the sociality of biomedical research, publishing papers, writing grants, eking out a living doing this science thing. Yes, I *should* be working on my grant, but this is nice. And it puts me in mind of a similar sort of day many years ago, when I visited Professor Groundhog in his inaccessible retreat on a far-

away wilderness shore. (I had sailed there with Professor Badger, as it happens, which was one way – perhaps the best way – to get there.)

Professor Groundhog had been a well-known and respected scientist in my field, and he had now retired to said retreat, where he had set out to become, as he put it, a Victorian scientist. Every morning he would tie a contraption he had made out of a plastic bucket and some cheesecloth to his feet and would swim around his little bay. Then he would spend a few hours carefully cataloguing his catch with the aid of a dissecting scope, a sketchpad and several field guides, in an effort to record the marine fauna in his neighbourhood. After lunch he would work in his very extensive garden, deep in the woods, where he was planting trees, shrubs and other planty things he acquired from catalogues that sell such things from all around the world. His daily efforts were a battle, he said, to keep the forest away and his botanical wonders apart. And then at night, he would settle down to his telescope, where he was calculating the angular

momenta of globular clusters. (As I recall, there happened to be a rather astonishing comet in the skies at that time, but it didn't particularly interest him.) The entire experience was memorable, intriguing and, if I'm honest, a little creepy. But I think he succeeded in his main goal, and he remains the closest thing to a Victorian scientist I've met.

Much of the history of biology, going back to the beginnings of this mad pursuit, have been subsumed with the quest to collect and catalogue the living things around us, and that pursuit continues today. Once the concept of species was formulated, the goal was to find more of them and, ever since Carl von Linné, we have sought to find out how one relates to another. Enter biological systematics, with its kingdoms, phyla, classes, orders, families, genera and species, and we had enough to keep us as busy as *Apis mellifera*.

When a new species is identified, we collect a specimen, and if it is indeed *new*, it becomes the *type*. This is a thing in the sense of Plato's *types*, the absolutely real thing against which any others like it must be compared. So, when I find a bug and think it is an example of, I don't know, *Buggus buggei*, I can compare it to another one that I know is *B. buggei*, because someone compared *it* (or another one somewhere in the chain of knowing) to the *type*. And where is this archetypal bug? It is sitting in a *type collection*. And that, most likely, is sitting in a museum. Yup, that is (or was) what museums are (or were) *for*. I'm talking about Museums of Natural History – the Museum of Dental Fixtures won't have any type collections. But your university museum almost certainly does (or at least, *did*), which will, eventually, bring us to one of our points. But not yet. It is, after all, a lovely day. Oh, but the buck wandered off. Oh well.

When I was a mole-let, learning about systematics (yes, I'm that old), I was taken to the type collections at my university. Cabinet after cabinet of specimens, each one containing the

type of a particular species. Some were in jars, some were stuffed and mounted (I did mention that the buck wandered away, yes?), and some were pinned to boards. And they were all *decaying*. Some of the jars had nothing but a bit of detritus floating in the oily fluid inside. I very clearly remember opening one cabinet to a flurry of pieces of construction paper to which plant specimens were taped, and these spilled out across the floor in a heap (with many stray bits of vegetable matter falling about). And these were all *types*, each one the very thing that defined a particular species. I have to stress that this was a particularly good type collection, at a very good university (of course, since they had the sense to admit *moi*), and it was, again, more than just a little creepy. That was a long time ago, and I doubt that any of those specimens have survived.

And why should they? Even way back then (life was very hard – to give you an idea, we didn't even have personal computers or email, let alone cell phones; we did have video games though, and I was very fond of 'Pong'), we knew that biology, the way *we* would do it, wasn't about mouldy old specimens of this or that species. It was about molecules and chemistry and cells and the way things work. Even my terrific teacher, Professor Wombat, who was the curator of the collections, wasn't too concerned about this holdover from another time.

As the bard sang, "I was so much older then, I'm younger than that now". (Okay, he is a grumpy old nasty bard now, but still.) Fast-forward to today. We are now again collecting, but now we collect genomes. Not just our own genomes, but the genomes of lots of living things. We aim to collect and catalogue the genomes of every species of living thing on the planet – or at least, many of them. And we can do it, and we are. And it turns out that there is gold in them thar genomes. It seems that, long before we were working out how things work out, evolution had been inventing lots of cool

new ways that things *can* work, and by exploring these different solutions, we are gaining fantastic insights into not only how *we* work, but how much we can tinker ourselves.

But there's a little problem. We know that there is a great deal of genetic variability, even among members of a species, or subspecies or sub-subspecies. Even in inbred mice. Everywhere. So when we sequence the genome of, I don't know, *B. buggei*, how do we know which one it was? Or for that matter, if it even *was* said bug that was sequenced?

Will the genomes be our new type collections? Who will curate them? Sure, we've got computer folks who try to make sure that everything is put in properly and can be taken out again, but who will make sure that a rose is a rose is a *Rosa*? Or when a gene variant is found, and another and another, who will determine that this isn't just variation, but something different?

Do we care? Maybe some of us don't really, not about which species is which. But we do (or should) care if the sample from which we plan to clone a potentially interesting and important new enzyme is likely to actually *have* this gene, and to do this, we're going to need to know the species. Yes, we can just synthesize the gene, we're that good, but we're not good enough yet to figure out how it works in the organism that uses it (and why it works as it does).

Yes, we may just need those Victorian scientists who know a lot about little things, who collect and collect and catalogue and type. That is, if we want to be cutting-edge biologists.

Maybe none of this is very interesting to you, because you're going to work on that variant of the variant of the enzyme you cloned from the cell in your incubator. What sort of cell is it? How do you know? Me, I'm going swimming.

*Mole*

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