

## MicroChat: Elements of critical thinking

### Appearances can be deceiving (due diligence and reality checks)

(Kenneth Timmis)



Kate is the girl on the right of the image, Cindy-Lou Ximena is at the bottom, and Jess is the boy in the centre  
(image created by Fran Jebok; see also <https://www.theabsurdmicrobe.com/recurring-characters/>)

*Kate, looking very bright:* Hello Farmer Giles! You seem very busy this Saturday morning!

*Farmer Giles:* Hello Kate! Yes, the Autumn is a busy time for farmers with all the harvesting of crops and ploughing for the next ones. My: you are looking very smart today!

*Kate:* Yes: it's my birthday tomorrow and I am helping mum prepare for my party. Quite a few people from my class are coming. I am on my way to the shops to get flour because Mum is baking cakes and thinks she will not have enough.

*Farmer Giles:* Ah: one of those will be a carrot cake which your mum tells me is your favourite. I took her some of my juiciest, freshly-pulled carrots yesterday, so I think you will have a super cake!

*Kate:* Oh, yes: carrot cake is my favourite....but mum makes a good selection of different ones which all taste good.

*Farmer Giles:* well: she would be proud to hear this - I hope you tell her when she bakes!

## A learner-centric microbiology education framework

But you are right: there is nothing like home cooking for goodness and flavour; much better than those supermarket cakes! They always look beautiful with all manner of shapes, designs and decoration – a dear friend brought me one for my last birthday with a beautiful red tractor on the top! But, although they can look wonderful, they are basically sponge that does not have too much taste and cut into some shape or other. And goodness knows what might go into them because they can have rather long shelf lives. When your mum bakes a cake, it needs to be eaten up immediately – which, given that it is delicious, is no problem at all – because otherwise it will dry out and go mouldy.

*Kate:* You are absolutely right: I already know of one mum of a friend who has already bought for my birthday a pink cake in the shape of a heart with a ballerina on top. I am sure she means well, and it will be completely eaten by the hungry lot of my class, but it won't compare with the carrot cake!

*Farmer Giles:* Well, we seem to have landed on a topic that is very important for life, namely *appearances can be deceiving*. I think you have heard of the phrase “*You can't judge a book by looking at the cover*”

*Kate:* Oh, definitely: there are songs with this title. I particularly like the version by Jadyn Rylee (<https://youtu.be/1b9gH-OlozU?feature=shared>) because it is a powerful message about bullying, which we sometimes get in school, but Ximena prefers the version by Ruby Ibarra (<https://youtu.be/RdntuSSNv1I?feature=shared>) and Jess likes some older versions (<https://youtu.be/3aAuNIiwQxk?feature=shared>; <https://youtu.be/BbNIMsCsexE?feature=shared>; [https://youtu.be/Vltd42\\_T7EE?feature=shared](https://youtu.be/Vltd42_T7EE?feature=shared)).

*Farmer Giles:* Oh, I see you know all about the issue of appearances can be deceiving!

*Kate:* Of course. Some of the presents I will receive tomorrow will be wrapped beautifully and look gorgeous, whereas others, for example from Jess, will be packaged quite scruffily. But what is inside will not necessarily be like the packaging. For example, I already know that another friend will be giving me a beautifully packaged pair of pyjamas (uuhhh!), like every year, whereas Jess has bought me a new app for my phone which I really want.

*Farmer Giles:* Right! As you know, I am fascinated by microbes, their activities, the key roles they play in plant biology and farming, and also how they affect us. They are so influential in our lives and yet, because they are so small, they are invisible, so “*out of sight, out of mind*”. Almost no-one thinks about their microbes, despite the fact that they affect us all the time.

As you may know, we have just as many microbial cells in and on our bodies as human cells: humans are half microbial. And yet, because microbes are invisible, we do not see them when we look in the mirror or at another human. I wonder how humans might look if our eyes were as strong as a microscope? We would see all of our skin cells covered in microbes! And this would be the real picture of a human, not the microbe-less person we see with the eyes we have.

*Kate:* Gosh: I never thought of that! It sounds a bit like the Centaurs and chimeras we learned about in school.



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*Farmer Giles:* Yes: and just imagine that when you look at me, since your eyes cannot see my microbes, I would be what your eyes and brain tell you, namely a microbe-less human. But if humans were indeed microbe-less, we would be very scrawny poor things with very short lives. We know this because scientists are indeed able to create so-called “germ-free” (gnotobiotic) or microbe-less animals (and, important for me, plants), which they have to keep in sterile environments<sup>1</sup>. However, such animals have poorly developed immune systems, physiological abnormalities, and need intensive care to survive. Humans without microbes would look strange and not be very well (<https://youtu.be/80tPR5HH9Zo?feature=shared>).

*Kate:* Ooohh: sounds awful!

*Farmer Giles:* Definitely – we need our microbes. But germ-free animals and plants are really important for research, especially research on how our microbial friends interact with us and make us strong and healthy. Understanding how the human body works, gets sick, and can be made well again, owes much to research with germ-free mice.

But, to get back to our theme of appearances can deceive, when you wake up in the morning and see your mum, you recognise her as human because your brain tells you that her appearance is a result of her human cells-tissues-organs-body. This belief was imprinted during your early months of life. But she is so much more than that: she is a metaorganism, half microbial: without her microbes she would look different. Simply because our eyes have limited resolution, we do not see the reality. Appearances are deceiving!

*Kate, with a mischievous smile on her face :* Hmmm – in future, I think I am going to see you in my mind’s eye as a chimeric farmer-microbe combo with your red face covered in sunbathing microbes!

*Farmer Giles, laughing:* Ha – nice thought!

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<sup>1</sup> Aghighi F, Salami M. What we need to know about the germ-free animal models. *AIMS Microbiol.* 2024 Feb 6;10(1):107-147. doi: 10.3934/microbiol.2024007.

## A learner-centric microbiology education framework

*Kate:* But, Farmer Giles, if appearances can be deceiving, if we can't judge a book by looking at its cover, how can we get the real picture, how can we avoid being deceived?

*Farmer Giles:* Kate, this is the key question – you are such a smart girl, just like your mum. The answer is something people call *due diligence*, and which others call *Verify! Verify! Verify!* Obviously, if something appears a certain way that does not affect us, we do not need to worry about it. However, if it is important to us, we need to know if its appearance, or what we are told about it, is real.

As an example: you see an advert for a new skincare product that promises to remove pimples within a couple of days. This promise is really attractive to many young teenagers who suffer from pimples, so you might be persuaded to buy it. However, before you do: *Verify! Verify! Verify!* Go online and check what experiences others have had who bought it and develop a more realistic picture of what the product can achieve. And, most importantly, check for any clinical and safety tests that have been made on the product, and determine if they were carried out by the manufacturer or by a respected independent agency.

*Kate:* Well, that seems simple enough. Thank you farmer Giles for this nice advice to avoid being taken in by nice images or words. In future I will definitely peek behind the appearance to see what is really there!

Well, I must go and get the flour for mum or she will start to worry where I am. If you have time tomorrow, after ploughing your fields, please come over for a slice of carrot cake: I will make sure that the last one is reserved for you!