Antimicrobial Resistance Gallery

Humans are no longer at the apex of the food chain/web

(Kenneth Timmis)

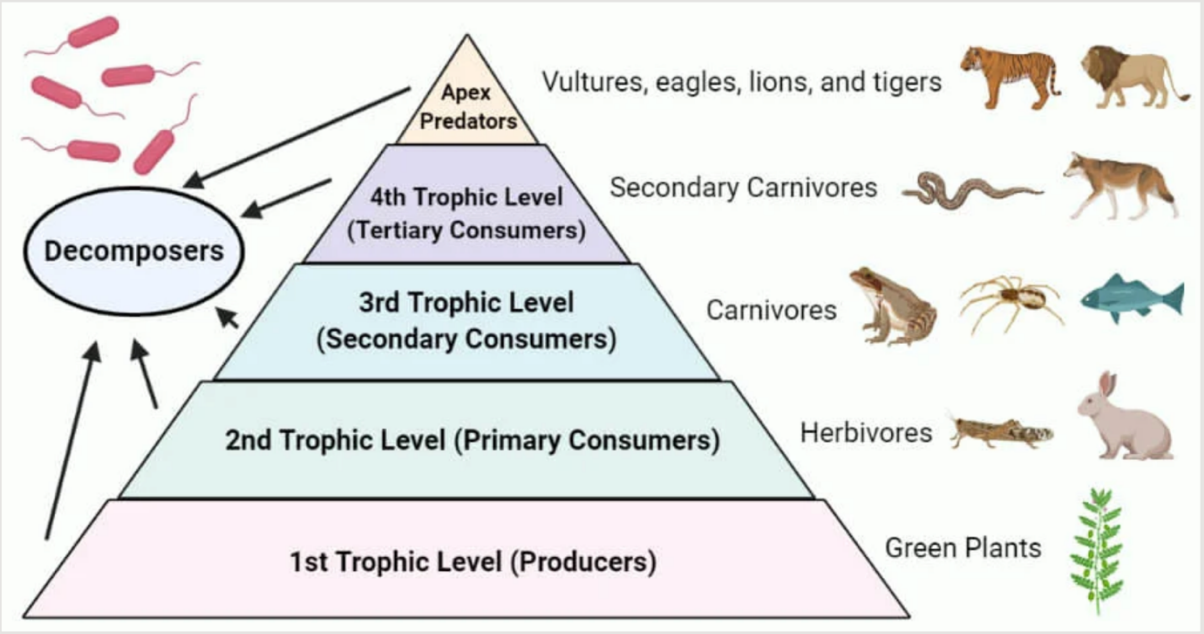

Image from Microbe Notes (https://microbenotes.com/trophic-level/)
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Humans, with their intelligence and ability to create all manner of tools and weapons, have long been considered to be at the apex of the food chain (because of the multiple interactions of the members of food 'chains', there is not a linear pathway in most of them but rather a network, so we speak of a 'food web'). This is very evident from the practice of agriculture in which we grow and harvest plant crops, and keep food animals, to eat. In general, we eat, and are not eaten by, other organisms, at least when we are alive.

Of course, this is only true on land: when we enter the sea, we become vulnerable to marine predators. And even on land, we are 'eaten' – decomposed – by the microbes when we die, unless we are cremated before the microbes can get going. But eating dead bodies is not generally regarded as a major factor in the position an organism has in the food web: the issue is killing and eating live organisms.

However, before the 20th century, we mostly died of infections caused by pathogenic microbes. In this case, because the microbes killed us and then ate us, we might be forgiven for thinking that they had always been at the apex of the food web. Okay: the microbes that ate us were mostly different from those that killed us. But still.

All of this changed with the discovery of antibiotics because we humans gained the ability to kill pathogenic microbes before they could kill us (or at least to kill enough of them so that our own immune defences could win the battle). Thus, we were able to protect ourselves against a major cause of death. The emergence of antibiotics elevated our position in the food web because, suddenly, no other organism could regularly kill us: we became top predators. Even marine predators could not kill us when we built boats and went to sea. We were top dogs! Yes, there have been pandemics caused by bacterial and viral pathogens that have killed large numbers of humans, just as there are storms at sea that capsize our boats and tip us into the sea where fish can eat us. But these are isolated events, the exceptions that prove the rule. Suddenly, what we normally died of changed dramatically. As a result of antibiotic therapy, we survived infections, lived longer, and ultimately succumbed to other diseases, like cardiovascular disease and cancer. But not to other killer organisms.

Now, however, all of this is changing again because of antimicrobial resistance. Increasingly, we can no longer fight off microbial pathogens. And, because we are generally living longer, and our bodies accumulate damage, wear out, and do not function like they did when we were 20, we are more susceptible to infections. Moreover, we may need to repair or replace malfunctioning body parts through medical interventions. This often involves surgery, which weakens us further and exposes us to nasty antimicrobial-resistant bugs that lurk in hospitals (the ESKAPE+ bugs: see other contributions in this Gallery), or requires that we take medicines that depress our normal defences in order not to reject a spare part transplanted into us from the body of some other kind soul. As a result of the combination of nasty bugs that increasingly cannot be killed by current antibiotics, and our depressed immune systems that are less able to fight off pathogens, microbial infections are predicted to become the leading cause of death in the future. Microbes are again rising to the apex of the food web!

What can we do to frustrate their ambitions? Well, other portraits in this Gallery discuss strategies being explored. But one important aim is to learn more about antimicrobial resistance: the more we know, the better equipped we are to fight it.