Report

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How long until E. coli conquers the Earth? Starting with a single cell; how long (in hours) will it take for the mass of an E. coli culture to equal that of the Earth?

So, assuming the bacteria is in ideal exponential phase, and has a limitless amount of nutrients to consume for the sake of this hypothetical experiment. We’re told that the generation time of a single bacterium is 30 minutes. Since this is an ideal exponential phase, they’ll all divide in once, so, that’s the time it takes for the colony to double in size. We’re going to start with single bacterium and we’ve to find out the time it’ll take to reach the mass of the planet earth.

The problem with the above calculation is that the bacterium takes 30 minutes to divide (and therefore form 2 bacteria), and in another 30 minutes both these bacteria divide, so the number (and mass) of bacteria doubles 48 times a day.

To get to the root of the problem, we’ve to calculate about how many of bacterium do we need to equal the mass of the earth; we do have relevant data for that,

To calculate the total number of bacteria, we’ve to divide the mass of earth to the mass of *e. coli,* we get,

That many number of bacteria we will be requiring for conquering the earth. To get this colossal amount by doubling, we have the following formula,

where, *f* is the final number, *i* is the initial number and *n* is the number of generations. We know from the data, initial number is one, since we starting the experiment from a single bacterium, final number is the total number, that we calculated earlier. To find the number of generations,

So, they’ll take around 64 hours to take over the entire earth. It's important to realize that in this experiment, several assumptions have been made. In reality, bacterial cultures do not grow indefinitely. Eventually the microbes run out of nutrients and cannot proliferate at the exponential rate described above. In microbiologist terms, the culture is said to enter stationary phase. The growth rate slows, and eventually reaches a steady-state where the number of microbes dividing replaces those that die. Eventually, more bacteria die, from the lack of nutrients or toxins building up in the media, than are replaced by new cells. For this reason, a culture of bacteria could never grow to consume the full mass of the earth.