



## The Ubiquity of Microorganisms in Earth's Ecology

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### Abstract

Microorganisms are ubiquitous in all kinds of micro- and macro-ecology environments on earth. They can survive even in inhospitable environments, where conditions cannot support more complex organisms, mammals and men [1].

For most of the last century, humans were able not only to interact but also to alter many environments significantly. As to his relationship with microorganisms, we have developed antibiotic against bacteria since the Penicillin was discovered of Penicillin by Alexander Fleming in 1928 [2]. That was a significant discovery in Medicine; however, men soon discovered counteracting bacterial resistance [3].

Bacteria grow exponentially and adapt quickly to the environment. Several past actions of Humans over the environment have resulted in extreme reactions from the microbiome. Numerous interaction s between microorganisms have been detected and classified [4].

What men must be aware of is that he is a small piece of a complex ecosystem, where he far outnumbered by microorganisms [5]. Any interaction with the environment is bound to result, eventually, in alterations on the word's microbiome – e.g., clinical malpractices when using antibiotics and using those as growth factors in intensive farms resulted in the emergence of two critical antibiotic-resistant strains [6,7]. On the other side, each patient we treat is in himself an ecosystem; therefore, any treatment with antimicrobials must take into account not only data such as anatomy, physiology, pharmacology and anatomy but also ecologic factors [4,5].

**Keywords:** Microorganisms; Ecology; Ecosystem

### The ecology of microorganisms

Microorganisms are ubiquitous in most environments of the earth. The simple procedure of exposing an open a Petri-dish with rich culture medium in a room where there are enough human movement and interaction may reveal the growth of dozens of bacteria and fungi upon overnight incubation. That has been done often enough in experiments on microbiology courses [8].

On the other hand, it is possible to temporarily guarantee a sterile or clean environment in a given room for a couple of hours [9,10]. Sterilised medical instrumentation preserved inside adequate packages and techniques may remain sterile for years [11]. Exposing that same blood-agar plate on a quiet place, inside a well-kept Operating Room, (equipped with HEPA filters and positive air flow) can show shows, in most cases, very few or none microbial growth [12,13].

Bacteria and fungi can thrive overall. Aquatic thermophiles survive in the high-temperature environments of geysers [14,15]. Chemosynthetic mats survive in the deep cold ocean where there is scarce light, and they must extract energy from heat and chemistry molecules resulting from volcanic activity [16].

Some micro-organisms are vital to the production of foodstuffs such as cheese, bread and pizza. We can consume probiotic micro-organisms either in yoghurt or in lyophilised state inside capsules [17].

Though some Infecting microorganisms can produce distinct smells we do not any more believe in the miasmatic theory [18]: since the discoveries of Dr Semmelweiss [19] and Nurse Nightingale [20], we acknowledge the role of bacteria, carried through our very hands, in hospital infection. Most bacteria are thus transmitted

via indirect contact, though some – such as *Mycobacterium tuberculosis* – can be transmitted through air droplets [21].

The first antimicrobial ever discovered was Penicillin [10]. However, bacteria soon revealed some of their remarkable characteristics: their capacity of multiplying, mutating and adapting [22]. After less than a century, The CDC [23] established a list of the most dangerous bacteria against man, and the layman language calls those “Superbugs”.

We fear those beings day and night, when we watch World War Z and Epidemics [24], and during the day where we read the latest news about superbugs. Potentially pathogenic bacteria can hide in all environments, such as the *Edwardsiella tarda* that may live in my aquaria [25,26], the *Legionella* spp. That can survive in our air conditioning systems [27], and the multiple species *mycobacteria* that may persist in my garden among the innocent roses [28]. All of them are potential agents of human infection, either healthcare-related or community-acquired.

However, what we need to be conscious about is that all those beings are a part of a complex ecosystem—upon which we have been and are a strong influence. It is relatively easy to keep microorganisms away from the air of an OR or to sterilise surgical materials temporarily. However, from time to time we must review sterilising and hygiene methods, particularly inside hospitals.

Each man carries his bacteria, whose numbers bear a logarithmic relationship to the total number of his cells [29]. They are kept under control by our immunity, and some of them are useful to us. But even those beneficial bacteria may eventually be pathogenic whenever they infect a new anatomic site, either driven by surgery or trauma, or by immunosuppression.

An important fact is that, while a human generation lasts about 15 years, bacteria can double every 30 minutes, and mutagenicity is much more intense in those beings [3]. Here, the way humans manage their environment comes into play, as strong ecological determinants [30]. We sometimes forget the simple hygienic procedure; overpopulation results in an enhanced capacity of transmission of microorganisms, because men live and sleep in overcrowded spaces and concentrate food and organic remains. We overuse antibiotics each day in our livestock, in our pets, and ourselves. Immune-suppressed and sick people around the world fail to take the needed doses of antimicrobials for their ailments and turn themselves into an extensive reservoir of resistant microorganisms. The HIV pandemic and the ageing of the population has resulted in a more significant percentage of immunosuppressed people, and that has changed the epidemiology of some diseases. Old diseases like syphilis, Tuberculosis and Gonorrhoea are now

superbugs and figure on lists like the CDCs. We target bacteria like *Campylobacter*, even not being 100% sure they are the pathogenic drive under a given process [31,32]. Agents such as Zika-virus feast on our newborn kids, while we are as oblivious to the *Aedes*, *Culex*, spp. Mosquitoes and other insects – or else, we indiscriminately apply insecticides to the result that those beings, too, eventually develop resistance and its ecology as we have been before the spread of the Yellow Fever, the Dengue fever and the West Nile Virus.

After alarmist press releases and responding to the widespread fear of those superbugs, healthcare professionals and authorities such as hospital managers tend to equivocally resort to expensive new measures and protocols, not always considering the ecological and long-term consequences of their acts. Physicians prescribe new antibiotics, for the same infections, to be incompletely taken by their patients. The pharmacy industry is furthered to develop new drugs. Meanwhile, people sometimes forget to wash their hands [33-35].

## Conclusion

In a nutshell, we must consider that the problem with microbial infections does not restrict to the name of the bacteria. Men must have in mind that microorganisms are part of a complex ecosystem. We need to take responsible control of ourselves and our environment. Treating each patient demands the analysis of a disease process in which the individual is in himself an ecosystem so that the exact role of microorganisms must be determined. The use of pesticides and antimicrobials in Farming and Agriculture must be consistent with oncologic handling. Before stating sophisticated screening and isolation measures in hospitals for bacteria such as MRSA, VRE and multi-resistant BGN, we should take a look at the more straightforward, pragmatic, ecology means we can use to control the environment. Some specific sets of operational procedures must continue, and we must execute periodic hygienic, disinfection and sterilising procedures, to guarantee the cleanliness and minimal risk of infections and avoiding the contaminating patient's surgical wounds and cavities. In an ecology world where the bacteria are perhaps the most abundant species, we advise all never to forget to wash their hands.

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