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A Short-Tort-View on Antimicrobial Resistance in Galapagos Tortoises

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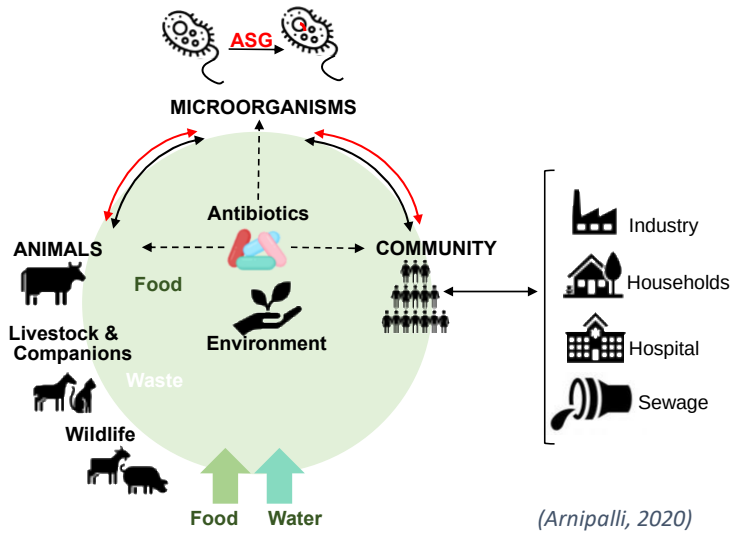
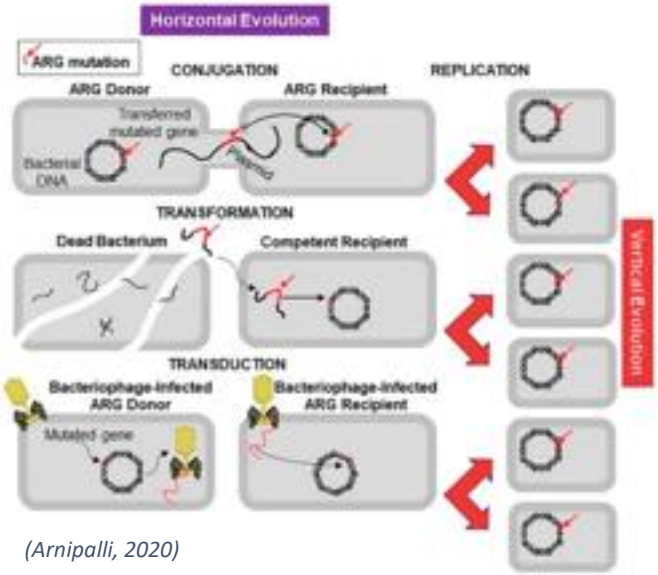


(Arnipalli, 2020)

Abstract. As a preventive agent and high yield-production, antibiotics are heavily being used in the agricultural and animal industries. The continued overuse and misuse lead to threating environmental health. This threat is inclusive of organisms that live there, other flora and fauna, and humans as well. This issue is discussed in Santa Cruz and Alcedo Volcano giant tortoises by Nieto-Claudin et al. (2021) and Kumar et al. (2020) discuss how antibiotic resistance is deadly to organisms, broadly.

What are antibiotics? Before we dive in, a small note on what antibiotics are, may be useful for our understanding of this topic. Antibiotics are either natural or synthetic chemical molecules that are used to inhibit microorganismal survival and growth.

How do antibiotics enter the environment? Common metabolites are released from plants, hospitals, farms, and households with biological wastes such as urine, feces, sputum, placenta, tissues, and organs (figure above). These can also enter the system through abandoned/stray animals and open human defecation in slum areas. The main sources of disposal and spread come from sewage, wastewater treatment plants (WWTPs), and surface runoff the antibiotics and/or antibiotic-resistant genes contaminate water.



(Arnipalli, 2020)

What is the issue with antibiotics, if they control harmful microorganisms? Although antibiotics are useful in curbing the complications induced by microorganisms, especially in food productions in agricultural and animal industries, Kumar et al. (2020) state how development of antibiotics has not been able to keep up with the bacteria that has progressively developed resistance (figure to the right) to these molecules through various mutations, along with, horizontal and vertical evolution mechanisms. Thus, antibiotics are overused and misused to compensate for this resistance, which lead to bacterial infections, metabolic diseases, and other effects when organisms and humans come in contact with contaminated water and land that's filled with these antimicrobial resistant genes.

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So where do the turtles fit into all of this? Nieto-Claudin et al. (2021) conducted a survey in which fecal samples of Giant tortoises were collected from 200 free-living tortoises from western Santa Cruz Island, heavy human population, and 70 tortoises from the isolated Alcedo Volcano on Isabela Island, light human population, to see if antimicrobial resistant genes are associated with human activities. Santa Cruz is prone to having more of these antimicrobial resistant genes because it is more developed and anthropogenic impact is more than what exists on Isabela Island because of the levels in human modifications. On this note, in the fecal samples collected, they showed higher loads of antimicrobial resistant genes in the tortoises from western Santa Cruz Island, specifically from farming and urban areas that contain factors in the figure above that discusses sources of contamination.

If the turtles are plagued by antimicrobial resistant genes, why should humans care? Antimicrobial resistant genes that enter any organism's system, can deregulate homeostasis, immune responses, and hurt the gut microbiome because these resistant bacteria are enabled to grow and persist. Moreover, these tortoises serve as sentinel species for the ecosystem that they live in, meaning that they can detect risks in the environment. Thus, looking into how antimicrobial resistant genes are plaguing these tortoises can offer better insight into as to what is to come for humans.

What does this mean going forward? Nieto-Claudin et al. (2021) supports the article by Kumar et al. (2020) in how human activities, especially in agricultural and animal industries, lead to accumulation of antimicrobial resistant genes in an organism's system. Thus, going forward it is in policy makers' best interest to reduce and regulate the overuse and misuse of antibiotics.

Citations.

Kumar, S. B., Arnipalli, S. R., & Ziouzenkova, O. (2020). Antibiotics in Food Chain: The Consequences for Antibiotic Resistance. Antibiotics, 9(10), 688. https://doi.org/10.3390/antibiotics9100688

Nieto-Claudin, A., Deem, S. L., Rodríguez, C., Cano, S., Moity, N., Cabrera, F., & Esperón, F. (2021). Antimicrobial resistance in Galapagos tortoises as an indicator of the growing human footprint. Environmental pollution (Barking, Essex : 1987), 284, 117453. https://doi.org/10.1016/j.envpol.2021.117453