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EDITORIAL

Recipe ingredients for re emergent protozoa: climatic change, rain, zoonosis, mountain and food

Ingredientes de una receta para protozoos re-emergentes: cambio climático, lluvias, zoonosis, montaña y alimentos

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When someone says that global concentrations of carbon dioxide (CO2) have continued to increase in the atmosphere to reach annual averages of 410 parts per million, it does not mean much to most people[1]. But certainly, the consequences of the changes derived from alterations on the hydrological and meteorological cycles have an impact on many living systems, including zoonosis[2]. Global climate change produces ecological perturbations, which cause phenological shifts, as well as alterations in parasite transmission, with the potential for host switching[3–5]. The intersection of climate change with transmission dynamics, called ecological fitting, permits emergence of parasites and diseases without evolutionary changes in their capacity for host utilization[6–8].

Climate change is causing the resurgence of many parasites. Neglected tropical diseases such as toxocariasis are now increasing the number of children with blindness in urban settings; this situation is intrinsically and surprisingly linked to rain anomalies[9,10]. Toxocariasis is one of the neglected tropical diseases that should be considered a priority for zoonotic control programs. But it is not the only one; there are other parasitic infections requiring even greater attention, with an integrated and multidisciplinary reflection on the type of measurements that need to be taken. Important human pathogenic parasite protozoa such as *Toxoplasma*, *Cyclospora*, *Cryptosporidium* and *Giardia* share water and foodborne transmission as major determinants of their prevalence in human populations[11–14]. Wild, companion animals, and faunal species used for food production are related to the zoonotic transmission of the above-mentioned diseases, making them targets of the One Health approach[15–19]. In addition, the interplay between agriculture boundary expansion, alterations of natural ecosystems, and the introduction of animal species for food production in these modified environments create conditions for changes in the chain of transmission[20,21]. Mountains have been identified as essential for food production in many countries[22]. The complexity of mountain agricultural systems, which usually involve a mixture of vegetables and fruit cultivars, as well as cattle (cows, sheep, pigs) and poultry, make them "perfect" environments for the increase in contact between protozoa and food products[22–24]. The recipe for the increased transmission of pathogens has as one of its ingredients the raising of precipitation rates, a direct consequence of global warming[2,25–28]. More rain causes an increase in water runoff from the soil of mountains into the rivers that are the source of drinkable water for towns downstream[25,28,29]. Chlorine treatment of drinkable water does not eliminate protozoans, acting as the "cherry on top" for re-emergent protozoa infection[30,31]. These circumstances can easily explain the changing epidemiological situation we are facing in the frequency of these protozoa in humans with health and economic consequences that have not yet been fully evaluated[32–34].

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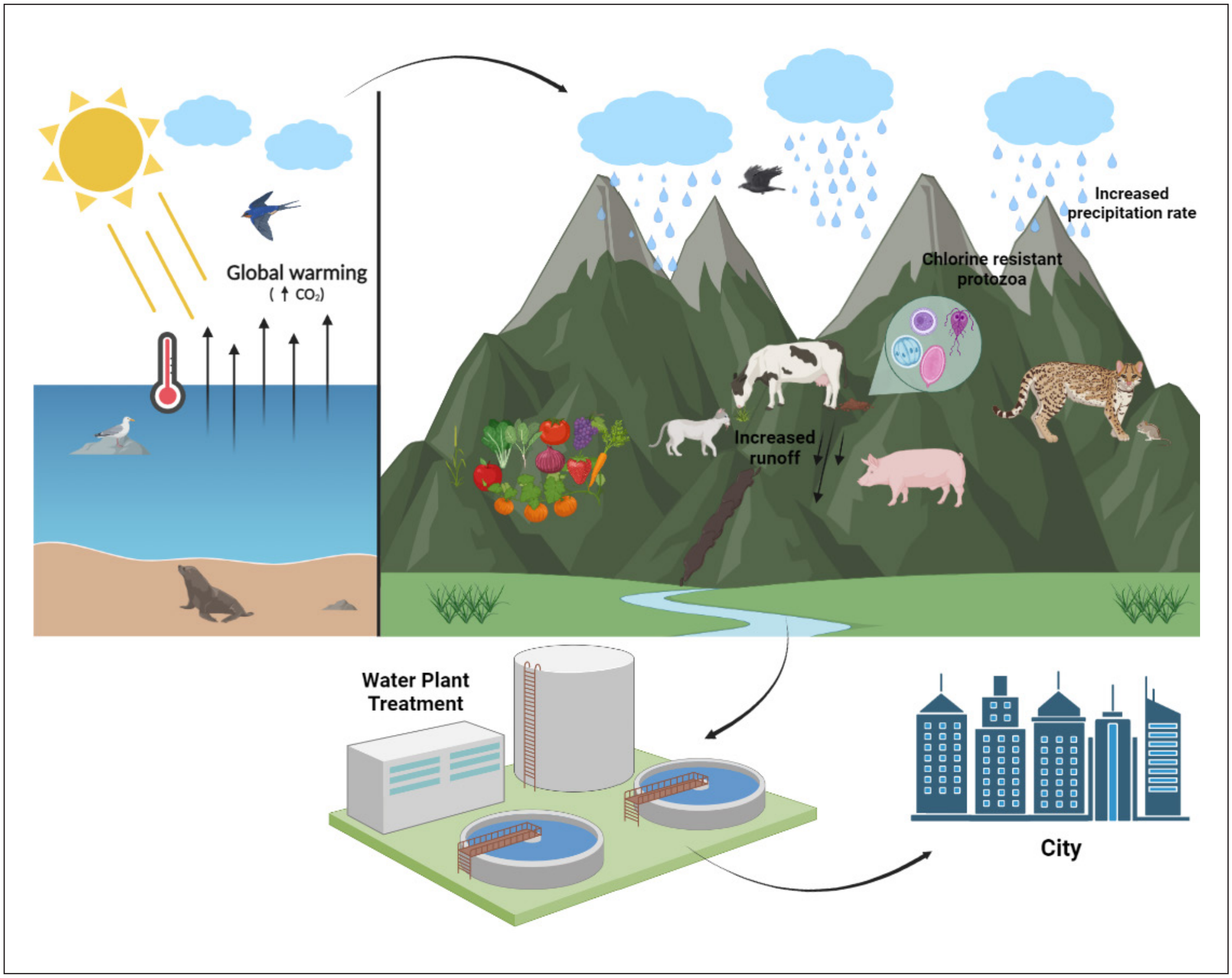
As a corollary, it is urgent that academic, health, and environmental authorities, as well as agriculture producers, coordinate actions to control and limit the burden of the diseases caused by the consequences of climate change leading to the reemergence of these human pathogens (Figure). One aspect that needs to be considered as part of this emergent situation is that the mathematical models used to predict the dynamics of infectious disease transmission should incorporate climatic variables as well as the number of abandoned pets that are causing the resurgence of endemic infections that generate critical new human health challenges[35,36].



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