Editorial

Emerging Infectious Diseases

With every passing decade and with the advance of the planetary sciences, humankind is realizing exactly just how fragile a planet the Earth really is. Increasingly, science allows us to understand how appropriate the term ‘the balance of Nature’ is in describing the inherent interactions of geological forces, flora and fauna. This message of the fragility of a planet and the ecosystems that make it up is brought home in a very poignant and powerful way in the theme of ‘emerging infectious diseases’ and the three articles that make up this issue of *Annales Nestlé*.

Why is this class of diseases – which can be caused by any pathogen from viruses and bacteria to fungi, protozoa and multicellular parasites – both a concern to be addressed in the clinical and public health domain, but also a message from Nature to mankind? A subtle testimony that something is afoot in the natural order is the fact that emerging infectious diseases are a growing problem in both human and veterinary medicine. A new disease, bat white-nose syndrome, believed to be a fungal infection, attacks hibernating bats in their caves with a moldy growth on their snouts. First detected in spring 2007, it is spreading like wildfire in the northeastern States of the USA. A plague of similarly dramatic gravity and spread was recognized in a wasting disease associated with opportunistic infections among homosexual men in California in 1981. It bears the name of acquired immune deficiency syndrome (AIDS) and is caused by various strains of the human immunodeficiency virus. It is believed that it originally passed from wild apes to humans

in Africa. These are two typical examples of what wild life and public health epidemiologists are confronting in an era of emerging infectious diseases.

The focus of the series of three articles in this issue of *Annales Nestlé* [1–3] relates to this theme in a human context, and secondarily, where appropriate, to its child health relevance. This is not to say that transmission among humans and animals is not important. However, here, we put things into a very human perspective, with or without some involvement of animals and zoonotic transmission. Such is the case in the specific article on tick-borne diseases [2] prepared by Ingomar Mutz of Austria. This field of interest has grown, both in the laboratory and in public health, since Lyme borreliosis burst onto the medical scene in 1975. Lyme disease was found to be caused by a spirochete and transmitted by deer ticks in the woods of southern New England, especially around Lyme, Connecticut.

Dr. Mutz provides revealing insights into how tick-borne diseases of importance to man have evolved and emerged, and how scientific understanding has tried to keep pace. This has been associated with the understanding of a wholly new protozoal pathogen, the rickettsiae. Ticks travel on the hides of animals and transfer by contact to pets and to their masters or directly to humans to leave blood-sucking bites. The article in the present issue catalogues at least 21 separate infectious diseases caused by 7 different classes of microorganisms. Tularemia, Q fever and Rocky Mountain spotted fever would be three of the entities most recognizable. Dangerous diseases are those caused by the flavivirus, as they produce an encephalitis that can be life threatening. So can be the hem-

orrhagic fevers in which the pathogen interferes with the normal clotting mechanisms in the blood, promoting internal bleeding that can affect the brain. The range of ticks in the world covers all altitudes and latitudes. They occur in the tropics but are not tropical diseases.

Fungi are an interesting member of the plant family, with a unique and primitive metabolism. They range from giant mushrooms to tiny buds of yeast, capable of living as single cells or aggregating into elongated filaments to form molds. Marcia Garnica and Marcio Nucci [3] of the University Hospital in Rio de Janeiro, Brazil. They point out that depressed immunity, as occurs in hematological malignancies, bone marrow transplants and immunodeficiency states, are the predisposing factors in all classes of fungal diseases, and concentrate on how the pathogenic organisms and clinical presentations and consequences are rapidly changing as well. *Candida albicans* is still the leading cause of systemic fungal sepsis (fungemia), largely seen in hospitalized patients, but numerous other emerging species are being seen in hospital settings. Children are commonly affected. Molds, filamentous fungi, commonly recognized for attacking the feet, also produce grave systemic human disease in the aforementioned settings of immunosuppression.

The center piece of this issue provides a cutting-edge compilation of biological and ecological factors across the whole gamut of emerging infectious diseases with an emphasis on why they continue to emerge. It then uses seasonal influenza as a biological touchstone and the current porcine A(H1N1) pandemic as a paradigm of emergence. This review is derived from the state-of-the-art instruction given in a course in Masters of Public Health training at the Boston University School of Public Health. The authorship brings the blended perspective from a recent student in the course, Amanda DeLoureiro, and two faculty members, Jean Maguire van Seventer, an immunologist with background in veterinary medicine, and Davidson Hamer, an infectious disease specialist and epidemiologist [1]. This combination of professionals has taken a very systematic approach to the topic. They underscore how ecological factors such as climate change, water and land use, as well as changing migratory patterns and behavioral factors such as cultural and behavioral practices, including illegal and deviant practices, demographics and crowding, modern transport and travel, and technology, including antibiotics resistance can influence the transmission, virulence or both of all classes of pathogens leading to the emergence of new (mutated) infectious agents or new infective possibilities for the standard pathogens. However, on closer analysis,

much of the 'ecological' conditions can be related to 'behaviors' of humankind in more aggregate ways, and are often remote to the point of contraction of the infection of interest.

In the most contemporary sense is the influenza A(H1N1) virus, the so-called 'swine flu', which emerged in March 2007 and was declared a full, class 6 pandemic on June 11, 2009. Laboratories had prepared and tested a specific vaccine for release in early October of this year. Independent of the specific efficacy of the new vaccine against the pandemic virus, the statistics cited by van Seventer et al. [1], for the regularity of annual flu immunization in the pediatric population of the US, are alarmingly low. As reflected in mortality rates from seasonal influenza in children, <10% of fatal cases had received a yearly vaccination. The unsupported immune response of children is also a factor in emerging epidemic and pandemic strains. When a mutation of a strain retains substantial characteristics of a previous variant, older individuals often have acquired cross-reactive immune defense from previous exposures to similar antigens. Children, without exposures in prior seasonal outbreaks have 'naïve' – and very vulnerable – host defenses. Emerging strains that derive from animal varieties must have – or acquire – the ability to pass from person to person. The highly lethal avian A(H5N1) influenza strain has yet to achieve that ability, whereas the less virulent porcine A(H1N1) virus is very adept at transmission within the human population.

The situation of a child in both physiological development and family hierarchy should focus our attention to unique effects of emerging infectious diseases in the juvenile population. It can occasionally lead to special protection, as seems to be the situation with certain influenza strains whose mortal victims are those with the most developed immune systems, that is young adults – not children. On the other hand, pediatric neurological and cardiovascular diseases predispose to more complications and death. However, a cerebral form of avian flu [A(H5N1)] was only seen in one of the fatal cases, in a Vietnamese child. Since influenza is more likely transmitted by direct contact than through aerosol dispersion, the less developed hygienic practices of young children, i.e. with regard to hand-washing and avoiding unsanitary contacts, predisposes them to exposure to the virus. When it comes to zoonotic transmission of the pathogen, school age children may be more likely to be in contact with pets, domestic animals and wild life, and infants might be those most sheltered from these potential carriers of emerging pathogens.

Children do not only suffer when they get sick, but also when other people around them get sick. The starkest example of this in an emerging infection context is the millions of orphans around the world who have lost parents to the AIDS epidemic. This has affected their emotional and their economic destinies. With relation to the current pandemic of A(H1N1) influenza, two of the consequences were the disruption of transport and education. Even for those who did not contract swine flu, temporary closing of their schools impacted negatively on their learning. If they are from a country whose foreign currency depends heavily on tourism, local outbreaks will scare the tourists away, deepening economic misery for the children in the poorest strata of society.

The morale of tales in the science fiction genre of literature, dating back to Jules Verne, is of the disastrous consequences of mankind's resisting or abusing Nature. By forcing species out of some habitats (and into others), while contributing to a rise in air and sea temperatures, lowered water tables and shrinking wilderness, the stage is set for the animal carriers of diseases to move into different relationships with human populations never seen through history. In the clinic, selectively killing some of the organisms with antimicrobial agents makes room for other, perhaps more virulent cousins to take their place. Maiming them with antimicrobials allows them to re-

turn more resistant than ever to the effects of drugs. The comic admonition in a classical US television advertisement, *Don't fool with Mother Nature!* is worth giving a second hearing. On the one hand, as medical practitioners, it is our duty to have the best knowledge and tools to treat our patients and populations that fall victim to emerging infectious pathogens. On the other hand, as responsible citizens and inhabitants of the planet, we can take home another intertwined message – that of our duty to reflect on how better to care for our environment and impact less on the other plant and animal species that share the planet with us.

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References

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- 3 Garnica M, Nucci M: Emerging fungal infections. *Ann Nestlé* 2009;67:133–139.