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A New Book by Evgeny Rothschild on Infection Ecology

Lotte Visser [1]
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Abstract

This review examines the Prague reissue (2026) of Evgeny Rothschild's Infections in Nature: An Ecological Concept. Drawing on long-term studies of natural plague foci, Rothschild hypothesized that changes in environmental geochemical conditions may contribute to the expression of pathogenic traits in microorganisms. Examples of synchronous increases in plague incidence among rodents in distant regions and observations of trace element concentrations in plants illustrate the questions raised by this hypothesis and the data needed to test it. Particular attention is given to the period preceding the first recorded cases of plague. The book is also of historical interest as a firsthand account by a participant in Soviet research on especially dangerous infections. In his new historical and scientific introduction, Dmitry Nikolaenko relates Rothschild's questions to Scientific Recognition Architecture and problem-oriented research information systems (PORIS), which can help identify gaps in observations and compare ecological and epidemiological data.

Keywords: Evgeny Rothschild, infection ecology, natural plague foci, microbial pathogenicity, environmental geochemistry, history of plague research in the USSR, Scientific Recognition Architecture, problem-oriented research information systems (PORIS).

[1] Corresponding author books@pollution-diseases.org

Rothschild E. Infections in Nature: An Ecological Concept.
With a historical and scientific introduction by D. Nikolaenko.
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(in Russian)

What occurs in a natural plague focus when no cases have yet been observed among animals? Why does activity in a focus increase after several years of relative quiescence? Why do increases in incidence sometimes occur almost simultaneously in areas separated by hundreds of kilometres? These questions are central to Evgeny Rothschild's Infections in Nature: An Ecological Concept (1). The book was first published in Kyiv in 2011. The Prague reissue reproduces the text and appendices of the third edition, published in 2014, and opens with a new historical and scientific introduction by Dmitry Nikolaenko.

Infection as a Property

Rothschild's most consequential proposal is that the capacity of a microorganism to cause disease should be studied as a property whose expression depends on environmental conditions. This is the premise of his ecological concept of infection. For plague, he advances a more specific hypothesis. Changes in geochemical conditions within a natural focus may contribute to the expression of pathogenic traits in microorganisms. If such a relationship exists, evidence of it should be sought in the events preceding an outbreak.

This proposal changes the design of the research programme. Once the first diseased animals have been detected, researchers can establish where and when they were found, compare cases, and study the subsequent spread of disease. By that point, some changes in the natural system have already occurred. Rothschild's inquiry centres on that preceding period. It requires monitoring natural foci during years when plague activity is not readily detectable. Such observations make it possible to compare conditions during periods of quiescence and increased activity, establish the sequence of events, and assess which changes may have contributed to the emergence of disease.

The book's approach is clearest in its treatment of specific observations. In the chapter "Eureka," Rothschild discusses nearly synchronous increases and decreases in plague activity among rodents in widely separated desert and semidesert regions of Eurasia. The coincidence in timing alone cannot explain why the outbreaks occurred. It raises the question of which processes might have operated concurrently across such extensive areas. In the same chapter, Rothschild examines how plague activity relates to groundwater levels, proximity to geological faults, and the characteristics of mountainous areas. Elsewhere, he compares measurements of trace element concentrations in plants collected at sites where epizootics were observed. Among the recurring findings, he reports lower copper concentrations in plant samples from such sites.

This example shows where observation ends and causal inference begins. To determine whether lower copper concentrations played a role in disease emergence, researchers would need to establish whether the decrease preceded the outbreak,

whether it also occurred at comparable sites without epizootics, and which other conditions changed at the same time. Some of Rothschild's generalizations extend beyond what the evidence presented can support. This makes his original question all the more important. It helps identify the specific observations needed to evaluate the proposed mechanism.

The Researcher and His Historical Context

Rothschild is a particularly engaging author because the book allows readers to follow his research as it developed. It shows which observations prompted his questions, how he selected material to test his hypotheses, and why he drew on geochemistry to investigate a phenomenon studied by infectious disease specialists. To see how his questions arose, it is often worth pausing over an account of a particular site, a series of samples, or the differences between two foci before turning to the final formulation of the concept.

The book also documents a little-known area of Soviet science, the study of especially dangerous infections. Published accounts often present the findings of individual studies. Rothschild shows how these studies were connected. Long-term monitoring of natural foci, sample collection, laboratory analysis, and comparisons across distant areas formed part of a single research endeavour. He writes as a participant familiar with the time required to determine whether an observed pattern recurs or is confined to a single location and season.

The historical material is supplemented by a bibliography of Rothschild's publications, documents relating to his scientific career, and a separate account of the ecological concept in his own words. The new introduction recounts the history of research associated with Innokenty Soldatkin's group at the Microbe Institute in Saratov and the circumstances in which the book was prepared. Dmitry Nikolaenko knew Rothschild personally and prepared the first edition in Kyiv in 2011. His account helps explain the conditions under which Rothschild worked and how the manuscript came to be published.

The Contribution of the New Introduction

Dmitry Nikolaenko discusses Rothschild's book in relation to Scientific Recognition Architecture and problem-oriented research information systems (PORIS) (2, 3). A research programme centred on recorded cases can provide detailed evidence on the course of an epizootic while leaving gaps in observations of the events that preceded it. Before comparing explanations, researchers need to establish which stages of the natural process have been observed, what data are available, and what further observations are required.

In plague research, this means comparing data on the state of natural foci, geochemical changes, and cases of disease in space and time. Suppose a change in the chemical composition of plants is recorded at the same time as an outbreak. A research information system should allow investigators to determine whether samples from the preceding period are available, whether they can be compared with data from other foci, and under what conditions the samples were collected. If the relevant data are

unavailable, identifying the gap is itself a result of the analysis. It specifies what needs to be observed during the next round of fieldwork. In this way, Rothschild's question can be developed into a research programme that can be refined as evidence accumulates.

The book merits close attention from epidemiologists, ecologists, and historians of science. The appendix "An Ecological Concept in the Study of Infectious Diseases" (pp. 302–316), in which Rothschild gives a concise account of his proposal, provides a starting point. The chapters on field observations then show the scope of his effort to trace the natural process before its effects become observable as cases of disease.

Conflict of Interest

The author declare no conflict of interest.

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