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Geboren 1960 in Mannheim
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FOCUS

PROJECT

Evolutionary Ecology Meets Medicine: Implications for Combating the Evolution of Drug Resistance and Virulence

Moderne Medizin, expandierende Populationen und wachsende Mobilität haben die Selektionsdrücke auf Krankheitserreger (z. B. durch Medikamente) und die Möglichkeiten ihrer Ausbreitung (z. B. SARS) dramatisch verändert. Virulenz (z. B. von neuen Krankheiten) und Antibiotikaresistenz (z. B. bei HIV, TB, Malaria, Staphylokokken- und Salmonelleninfektionen) sind weltweit wachsende Probleme. Beide können lebensbedrohend sein, sie gefährden den medizinischen Fortschritt, sind eine Herausforderung für Kontrollprogramme und ein Kostenfaktor.
Das Projekt strebt an, die Ursachen der hohen Variation in Ausmaß und Rate der Resistenzentstehung, ihrer Reaktion auf Interventionen und ihre Auswirkungen auf die Virulenzevolution zu identifizieren. Evolutiv betrachtet, sind Resistenz, Virulenz und eine mögliche Rückkopplung zwischen ihnen zu erwartende Phänomene. Die Koevolution von Wirts- und Mikrobenarten (Viren, Bakterien, Pilzen, Parasiten) hat Eigenschaften selektiert, die Mikroben helfen, der Wirtsimmunantwort sowie der Medikation zu widerstehen und neue Wirtsarten zu erobern. Wir kombinieren deshalb evolutionsökologische Theorien mit mathematischen Modellierungstechniken, um folgende Fragen zu klären: Welche Fitnesskomponenten der Mikroben, außer der Resistenz, tragen bei gewissen Krankheiten zum weltweiten Erfolg weniger (multipel) resistenter Klone bei? Wie beeinflusst der in sehr unterschiedlichen Selektionsregimen resultierende unsachgemäße Antibiotikagebrauch die Resistenzausbreitung in Hospitälern, Gemeinden und verschiedenen Ländern?

Lektüreempfehlung
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TUESDAY COLLOQUIUM, 15.03.2005

The Limits of Intuition: How mathematical modeling helps us understand biological complexity

At first glance, the biological systems I am interested in have little in common: malaria parasites within an individual patient, hybrid frogs coexisting with their parental species, reproducing male and female flies or bacterial populations in vaccinated human populations. A closer look, however, reveals that in all of these cases the participants are tightly linked by the fact that the relation is obligatory for at least one of them. That is, either only one or both participants cannot survive and/or reproduce without the other. This interdependence results in conflicts of interest and complex interaction effects and it leads to co-evolution.
Can we understand why we see coexistence in these systems despite the sometimes severe conflicts? Can the complexity arising from the obligatory coupling be explained by simple mechanisms? When interaction effects and non-linearities occur, our intuition quickly reaches its limits and mathematics becomes a valuable tool. My work, therefore, combines the realism of data and experiments with the strengths of mathematical models in handling complexity. I will use two very different examples of so-called evolutionary "arms races" to demonstrate how:

* Sexual conflicts can be solved mathematically

When females mate with multiple males, the stored sperm of rival males compete for fertilization. The resulting high variance in paternity shares is partly explained by male characteristics. In many species, females also have a morphologically complex reproductive system, which could enable them to influence paternity by post-copulatory sperm manipulation. How and to what extent can females control paternity shares?

* Complex diseases can be treated mathematically

In host-parasite relationships the two participants interact on the population level as well as within each infected individual, and the respective results of these inter-actions affect each other. Modern medicine has introduced vaccines and anti-microbials to the ancient arms race between our microbes and us. How do these interventions change the spread of infectious diseases in hospitals or the community?

EVENINGCOLLOQUIUM
,
22.03.2005

Truth and the F-Word, or: Knowledge versus Ideology? On Epistemological Uses of Feminism in the Social and Natural Sciences

PUBLICATIONS FROM THE FELLOWS' LIBRARY

Hellriegel, Barbara (2006)

Sexual conflict over floral receptivity

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1047209888

Hellriegel, Barbara (2006)

Mathematical modelling : a tool for hospital infection control

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Hellriegel, Barbara (Zürich,2005)

Gemeinsam statt einsam : Peer-Mentoring als Nachwuchsförderung in eigener Regie

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Immunoepidemiology : bridging the gap between immunology and epidemiology

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Modelling the immune response to malaria with ecological concepts : short-term behaviour against long-term equilibrium

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