LEARNING FROM ECOLOGY

Controlling pathogens *As Nature Does*: by their self-DNA

Prof. Stefano Mazzoleni (stefano.mazzoleni@unina.it)

Lab of Applied Ecology and System Dynamics - Dept. Agricultural Sciences, University of Naples Federico II

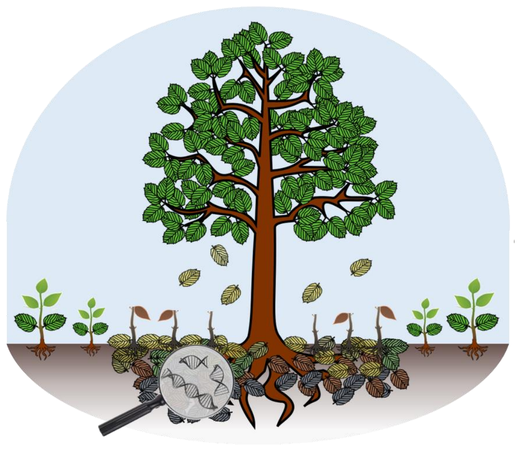
Abstract

The research for new products against pathogens, parasites, and infesting species implies huge scientific and economic efforts. Traditional approaches are based on random screening procedures searching for bioactive compounds from different sources. However, the development of new products, in most cases, has been limited by side effects on biological systems other than the target, environmental contamination, and by the induction of resistance in the organisms to be controlled. Consequently, despite the major and increasing efforts on research of new products in both agriculture and medicine, the rate of approval is significantly decreased in recent years.

The recent discovery in ecological studies of the inhibitory effect of extracellular self-DNA has opened new perspectives for highly species-specific inhibitory product for the control of pathogens and parasites. This new approach presents relevant economic and environmental advantages.

The Discovery

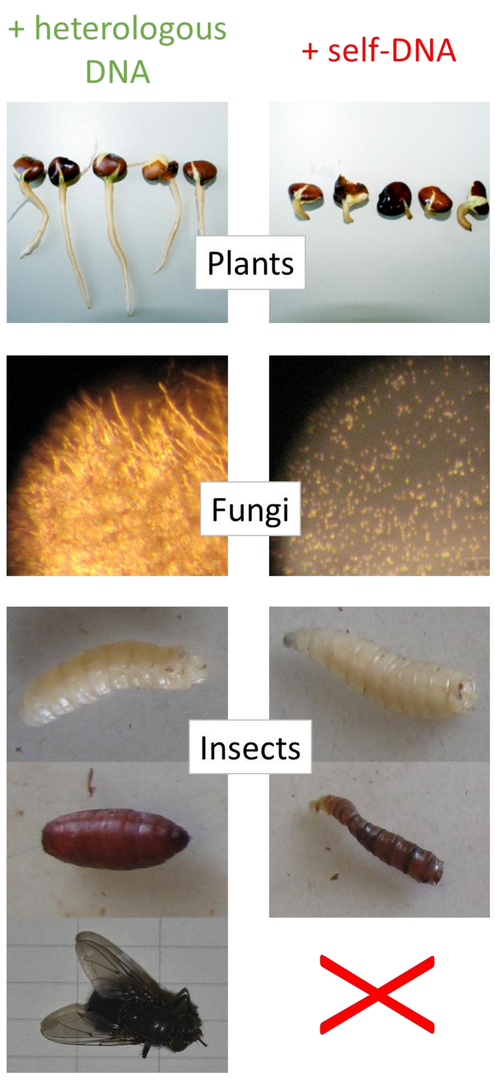
new function of extracellular DNA



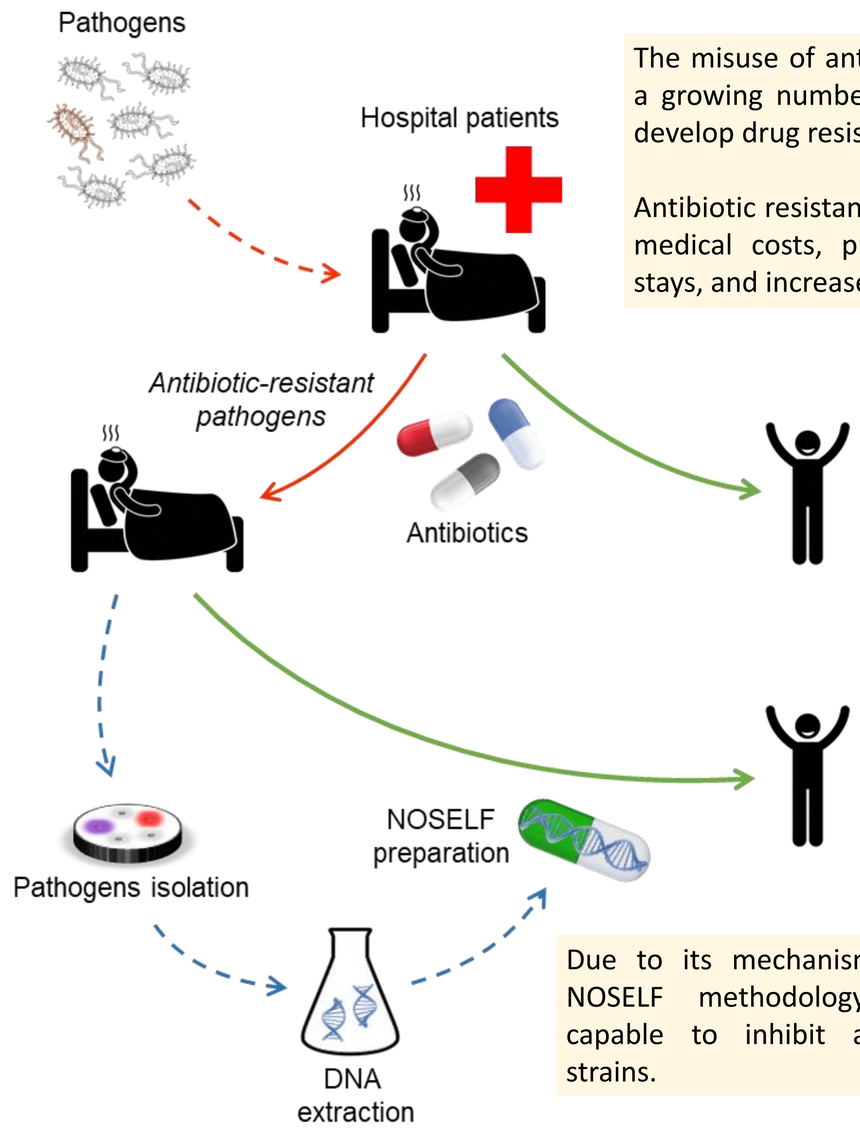
DNA released by the decomposition of plant litter inhibits the growth of the same species. This new function of extracellular DNA may explain the plant-soil negative feedback in natural ecosystems as well as the soil-sickness in agriculture.

All species can use as nutrient the DNA of other species (heterologous DNA), whereas the uptake of self-DNA is toxic.

This discovery opens revolutionary scenarios for natural biocontrol.



Antibiotic resistance

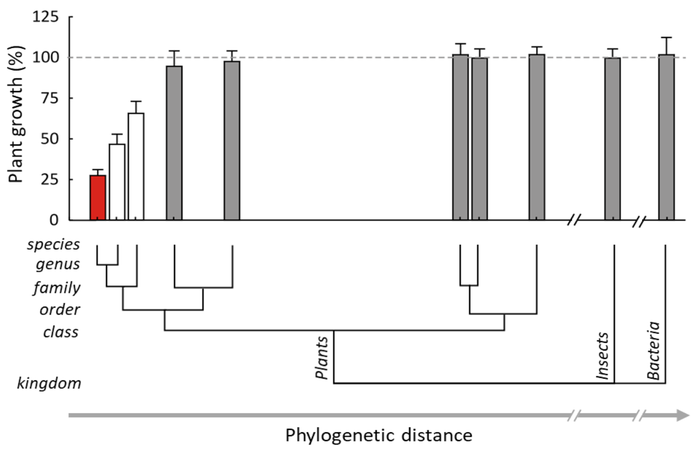


The misuse of antibiotics is causing a growing number of infections to develop drug resistance.

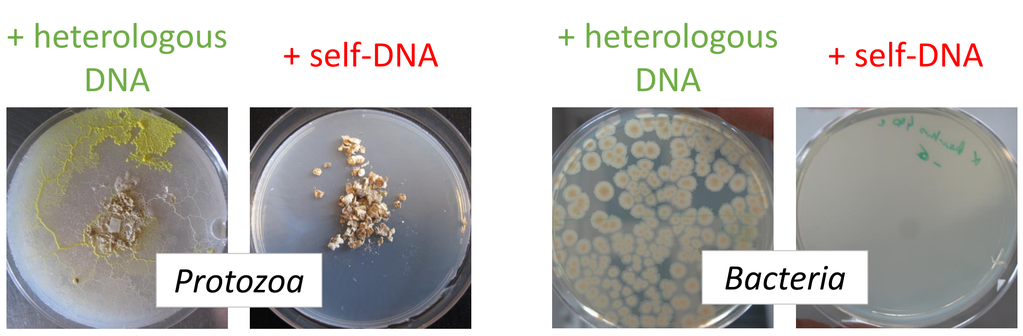
Antibiotic resistance leads to higher medical costs, prolonged hospital stays, and increased mortality.

Due to its mechanism of action, the NOSELF methodology is potentially capable to inhibit antibiotic-resistant strains.

Specificity and toxicity



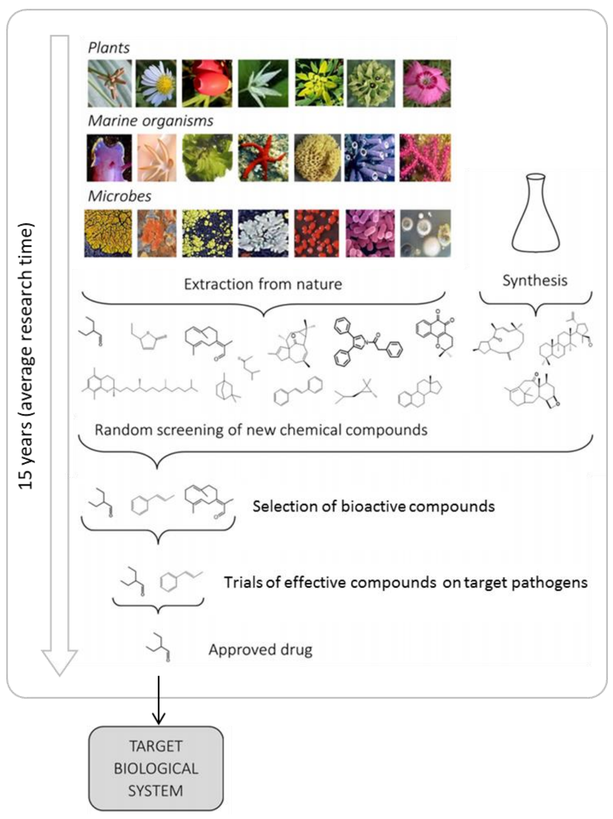
Growth of a plant species (*Quercus ilex*) exposed to either self-DNA or DNA from species of increasing phylogenetic distance.



The inhibitory effect of self-DNA on all living organisms opens new therapeutic perspectives for the treatment of pathogens unaffected by existing drugs like, for example, *Plasmodium* species causing malaria.

R&D costs and times

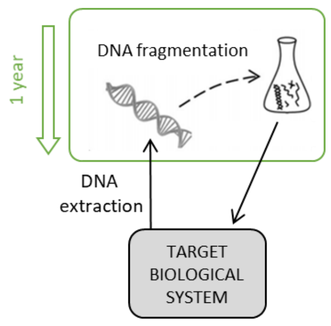
Traditional phytochemical and pharmaceutical research



The research for new drugs implies huge scientific, industrial and economic efforts. Traditional random screening approaches often fail because of side-effects (toxicity, environmental contamination, onset of pharmacological resistance).

The recent discovery that self-DNA is a species-specific inhibitor, provides potentially revolutionary solutions to drastically reduce R&D costs and times.

New NOSELF method



In collaboration with:

AND Biopharma

pjens@koppert.nl

KOPPERT BIOLOGICAL SYSTEM

HMikkelsen@koppert.nl

Further readings:

Mazzoleni S, Cartenì F, Bonanomi G, et al. 2014. New perspectives on the use of nucleic acids in pharmacological applications: inhibitory action of extracellular self-DNA in biological systems. Phytochem Rev. 13:937–46

Mazzoleni, S. et al. 2015. Inhibitory and toxic effects of extracellular self-DNA in litter: a mechanism for negative plant-soil feedbacks? New Phyt 205:1195–1210

Mazzoleni, S. et al. 2015. Inhibitory effects of extracellular self-DNA: a general biological process? New Phyt 206:127–32