

Biodiversity and Emerging Infectious Diseases (EIDs): the role of the Research Infrastructures (RIs)

Christos Arvanitidis, Juan Miguel González Aranda, Lucas de Moncuit de Boiscuillé, Peter Van Tienderen and Alberto Basset

EEF Webinar “ecology day”: Healthy ecosystems, healthy people,
September 14, 2020



How old is the attempt to find interrelations between biodiversity and ecosystems on one hand and the Emerging Infectious Diseases (EIDs) on the other?

- The Plague of Athens (Λοιμὸς τῶν Ἀθηνῶν, 430 BC)
- Killed ~ 75,000 to 100,000 people
- Much of the eastern Mediterranean also saw an outbreak
- The plague returned twice more, in 429 BC and in the winter of 427/426 BC. Some 30 pathogens have been suggested as having caused the plague.



Plague in an Ancient City, [Michiel Sweerts](#), c. 1652-1654
(from wikipedia)

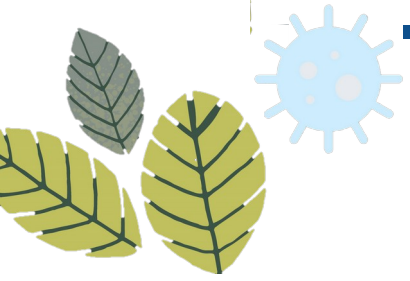


Ancient Greek medicine concepts

- **Issues to be concerned:**
- Geographic location
- Social class
- Environmental issues such as:
 - Mosquitoes
 - Rats
 - Clean water
 - Diet



Physician treating a patient (Attic red-figure aryballos, 480-470 BC)
(from wikipedia)

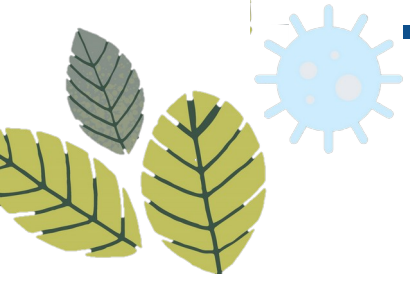


Ancient Greek medicine concepts

- **Hippocratic Corpus and Humorism:**
- Balance between blood, yellow and black bile, and phlegm
- Shift from supernatural disease to biological disease
- Emphasis on environment: patients would be subjected to various diseases based on the environment they resided



View of the Asklepieion of Kos, the best preserved instance of an Asclepieion. (from wikipedia)



Ancient Greek medicine concepts

- **Aristotle's influence:**
- Concern for empiricism, biological causation, and the diversity of life
- Formal causes guide all natural processes
- **Dioscorides**
- Influence of his work on European herbal medicine



Asclepius (center) arrives in Kos and is greeted by Hippocrates (left) and a citizen (right) (from wikipedia)



Modern concepts between human and ecosystem health




ARTICLE

DOI: 10.1038/s41467-017-00923-8

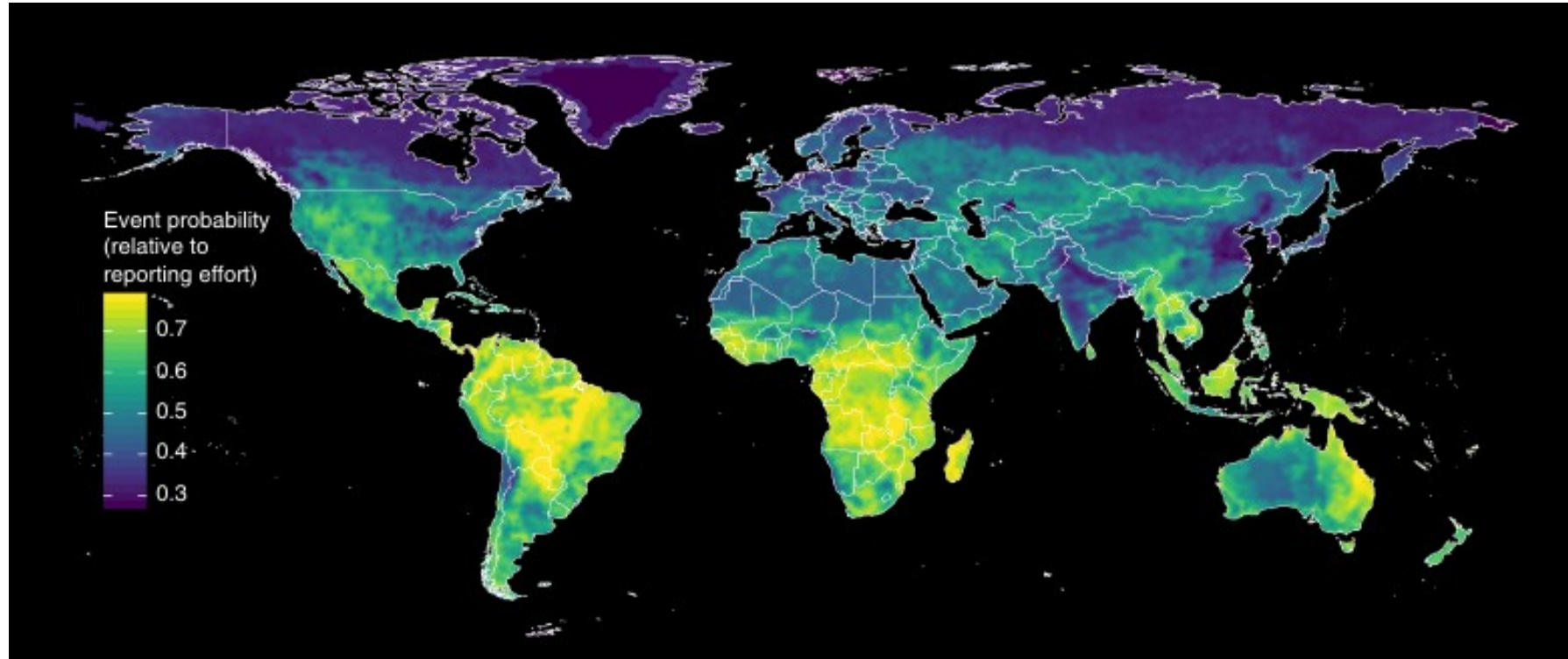
OPEN

Global hotspots and correlates of emerging zoonotic diseases

Toph Allen¹, Kris A. Murray^{2,3}, Carlos Zambrana-Torrel¹ ¹, Stephen S. Morse⁴, Carlo Rondinini⁵,
Moreno Di Marco^{6,7}, Nathan Breit¹, Kevin J. Olival¹ & Peter Daszak¹



Modern concepts between human and ecosystem health

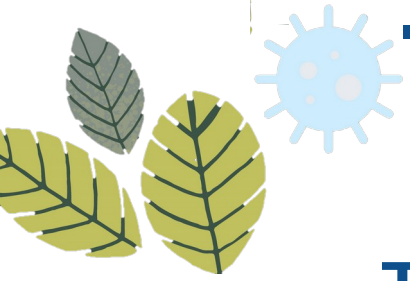


- The results suggest that the risk of disease emergence is elevated in tropical forest regions, high in mammal biodiversity, and experiencing anthropogenic land use changes related to agricultural practices



Modern concepts between human and ecosystem health

- Existing hypotheses: greater host biodiversity, increases the “depth” of the pathogen pool from which novel pathogens may emerge, which in turn increases the potential for novel zoonotic pathogens to emerge
- High host biodiversity decreases risk or that biodiversity loss may increase risk (i.e., the dilution effect)
- Disease richness or prevalence increases with increasing wildlife species
- Future work may be able to enhance the predictive power of this approach by focusing on even tighter classes of disease, taxonomic groups of pathogens and hosts, or transmission modes, and building models to forecast changes in risk distribution or to examine more specific mechanistic hypotheses.



The “whats”, “hows” and “whys” of the European RIs



Tools for science operating as **facilities**, **resources** and **services**;



Develop our **technology** and provide a **thruster** for the advancement of **knowledge** by offering unique research services to the **users** and **stakeholders** from many states;



Conduct top-level research in **all** possible scientific **disciplines**: from social sciences to astronomy and from genomics to nanotechnologies;

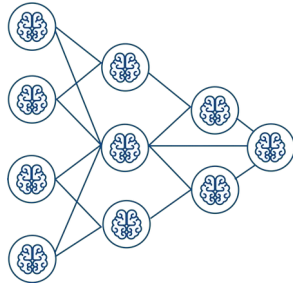


Vehicles to **break** current **barriers** both **within** and **between** disciplines are **ready** to play their role within the new Framework;

...but what do they offer to this Approach?



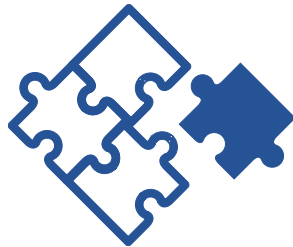
The European RIs offer...



On the science side

Consilience (unity of knowledge): "Literally a 'jumping together' of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork of explanation."

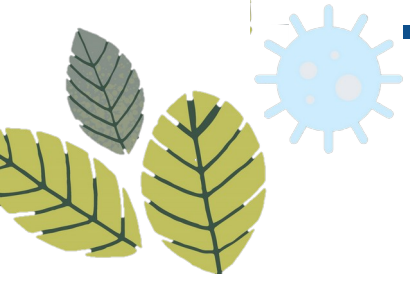
Synthetic knowledge: Looking for knowledge stemming out of evidence from as many disciplines as possible (cross-domain).



On the technology side

An environment **boosting integration**, **community de-fragmentation**, and **innovation** and **growth**, practically without limits.

But...they are facing challenges: **scientific, technical, societal, cultural**
Are the RIs need to be organically linked to Green Deal & Energy Union?



LifeWatch ERIC: Development

High Level Architecture of LifeBlock

Decentralized

Transparent

Immutable

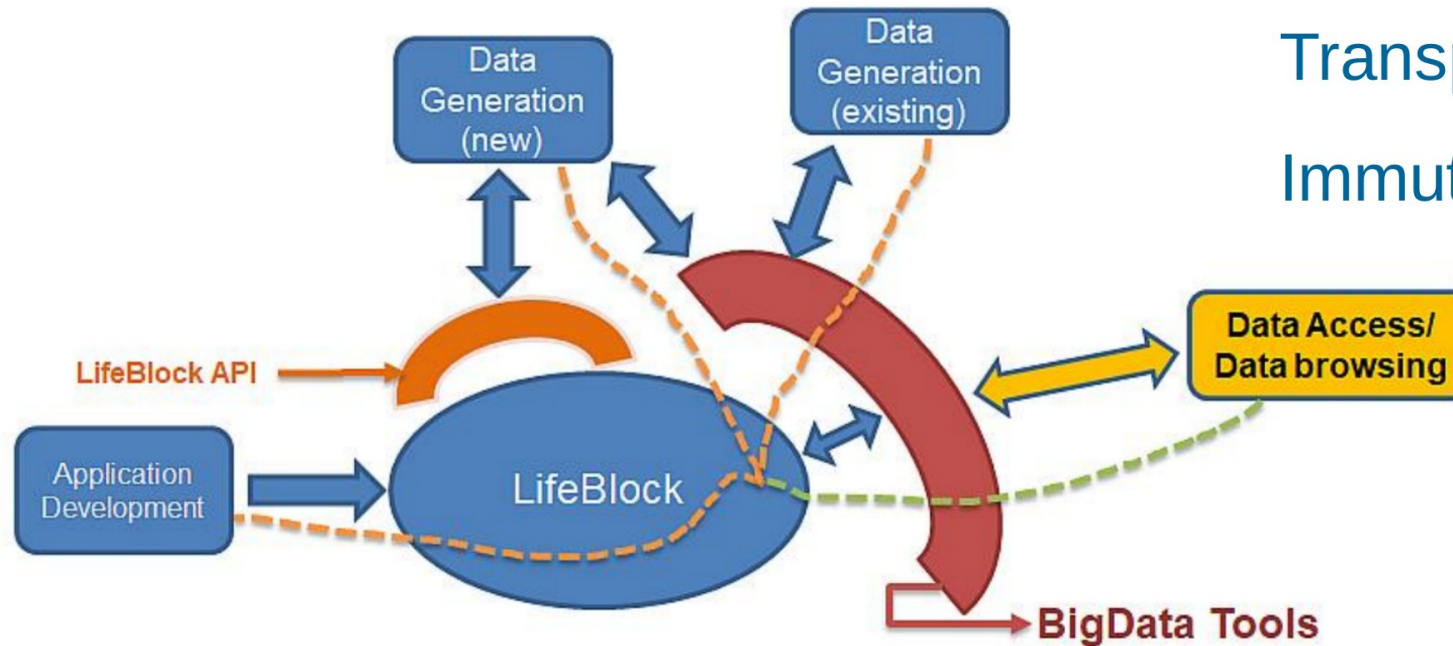


Figure 3. High level Architecture of LifeBlock, LifeBlock Blockchain platform

One stop-over access, a single authentication system, docker technology



Dashboard

New workflow +

☐ Dark theme

≡ ARMS VRE



Create new workflow

Workflow name

CSV file

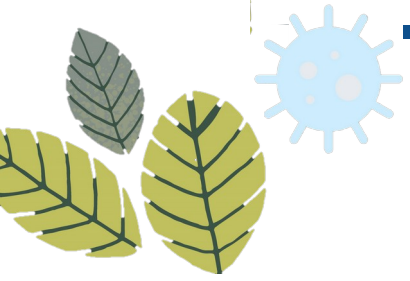
PEMA parameters

Crate new flow



LifeWatch ERIC: What can offer?

1. Up-to-date federated infrastructure (facilities, hardware, software);
2. Access to **FAIR-compliant** multi-sourced **open access data** (**LifeBlock**; Blockchain tech);
3. Access to **reproducible analytics** (**Tesseracto**; Technical Composability Layer);
4. Access to **mobilized communities** and **networks** working on all kind of BER;

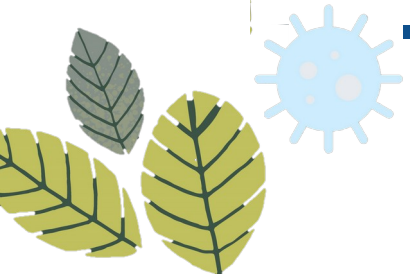


Thank you all for your attention!

Questions?

<http://www/lifewatch.eu>

ceo@lifewatch.eu



ecology^{day}

14th September
2020