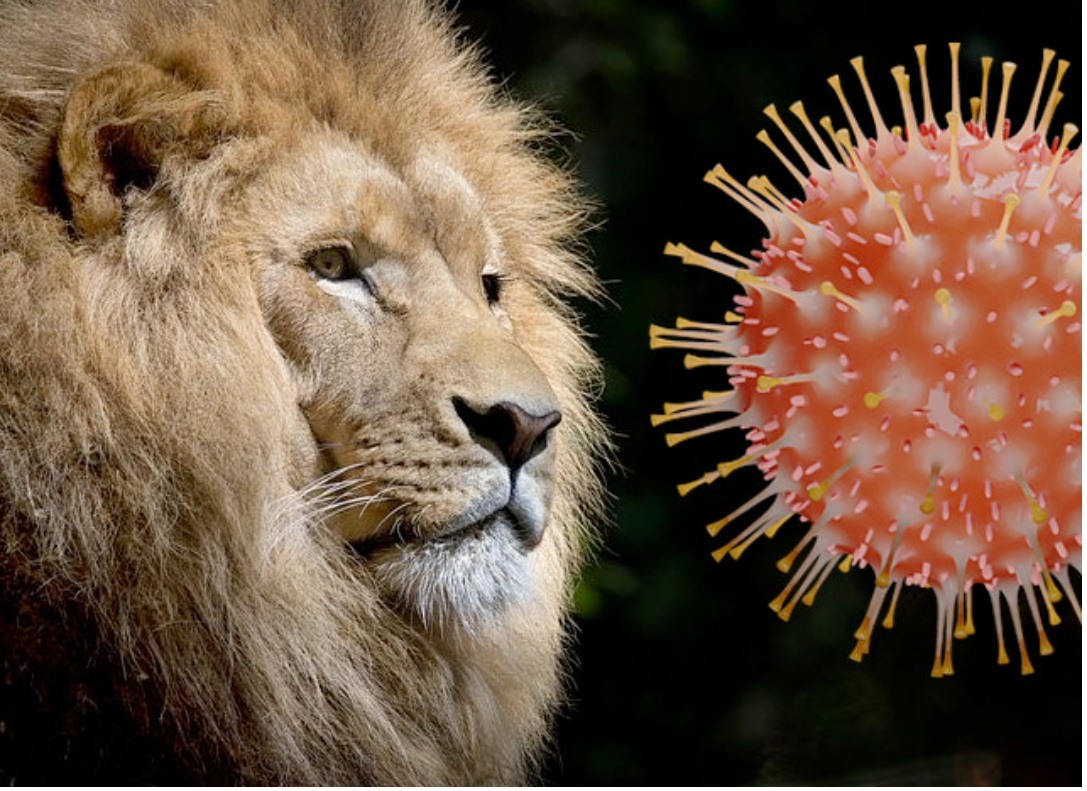


Mikro-bioa, Gaitza, Normaltasuna, eta Naturaren Natura

Arantza Etxeberria Agiriano

arantza.etxeberria@ehu.eus

IAS Research Group on Life, Mind, and Society

Logika eta Zientziaren Filosofia Saila

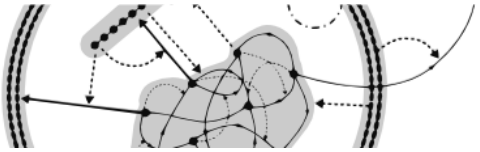
Euskal Herriko Unibertsitatea, UPV/EHU

eman ta zabal zazu

universidad del país vasco

euskal herriko unibertsitatea

IAS-Research
Centre for Life, Mind & Society

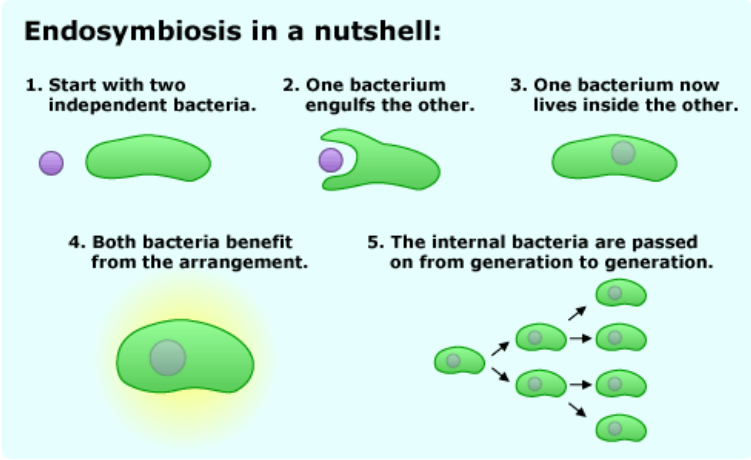


- ***Mikrobioak. Birusak zer diren***
- *Patologikoak bakarrik ez (Pasteurren osteko aroa)*
- *Indibidualtasuna biologian. Organismo-ingurumen sistemak gara.*
- *Gizakiaren gaitzak zeintzuk diren. Euren historia*
- *Osasuna eta gaixotasunaren ikuspegi soziala*
- *Osasuna eta gaixotasunaren ikuspegi filosofikoa (Medikuntzaren Filosofian)*
- *Natura, normaltasuna, eta normatibitatea*

Lynn Margulis

Zelula eukariota sinbiosi prozesu baten ondorioz agertu zen eboluzioan.

- Ez mutazio motel eta gradualen bitartez
- Bi zelula prokarioten elkartzean



http://evolution.berkeley.edu/evolibrary/article/_0/endosymbiosis_03

Carl Woese

1928-2012

- Biziaren zuhaitza
- transmisio horizontala
- zuhaiska endredatu
- Funtsean hiru zelula mota daude
- Bakterioak, arkeak, eukariotak

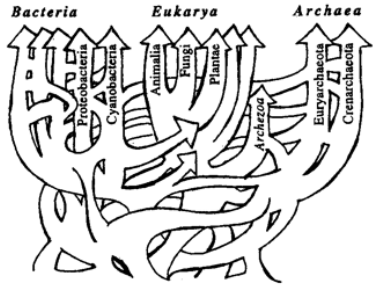
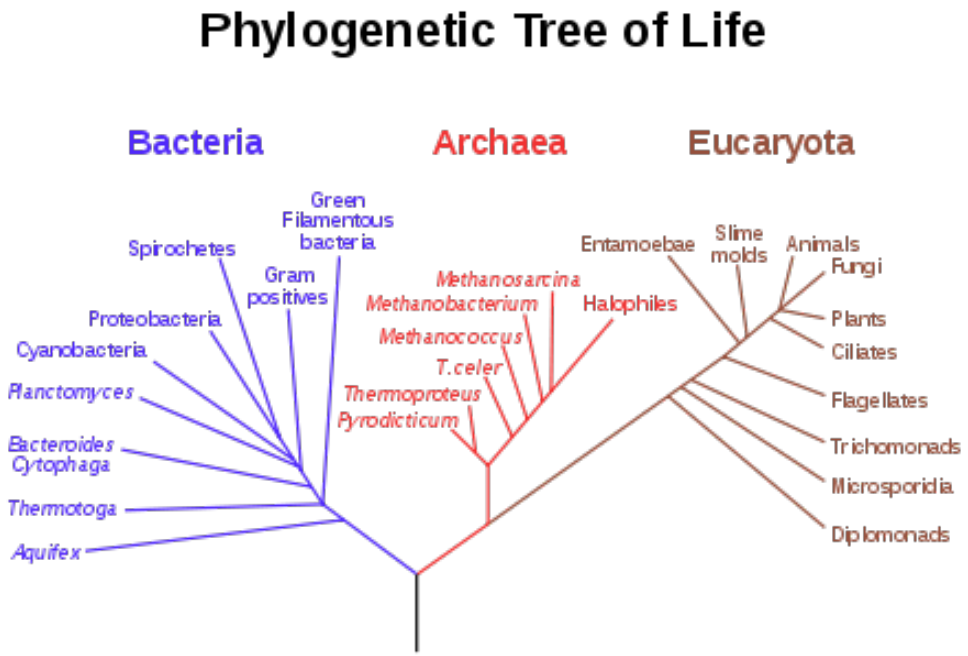


Figure 2. "A reticulated tree, or net, which might more appropriately represent life's history" (Doolittle 1999:2127, figure 3).

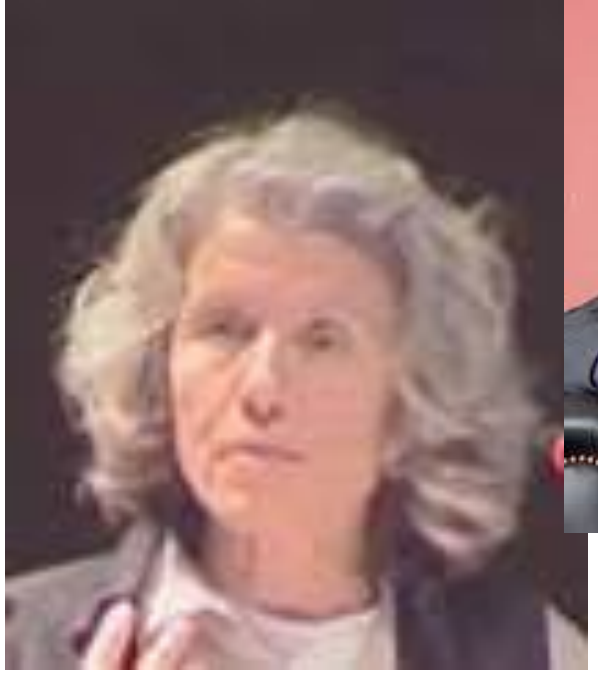


Holobionteak

- Organismoak espezieanitzeko izaki konposatuak dira
- Likenak bezala

Gilbert, Sapp, Tauber (2012) 5

Maureen Omalley
John Dupré
Thomas Pradeu

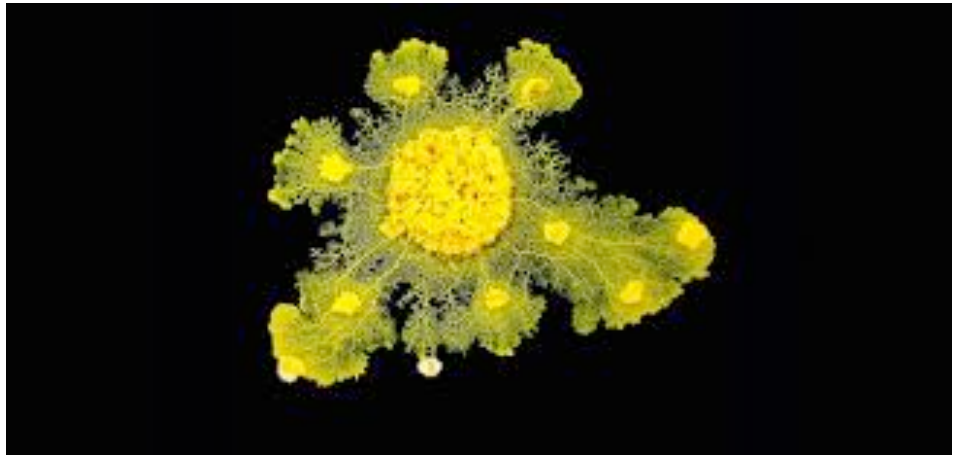


- Organismoak kimerak dira
- Microbioen garrantzia
- Microbe-macrobe

“

“Who can look at anything any more — a door handle, a cardboard carton, a bag of vegetables — without imagining it swarming with those unseeable, undead, unliving blobs dotted with suction pads waiting to fasten themselves on to our lungs?”

Arundhati Roy



Arundhati Roy

Nork begiratu dezake berriro ezer –ate heldulekua, kartoizko kaxa, barazki poltsa—imajinatu gabe zipriztindurik dagoela ikusezinak, hilgabeak, bizigabeak diren “blob”ez, euren xurgatze-kuxinak gure birikei itsasteko zain?”

birus

Bizidunak dira

Birus eta patologia

Birus eta identitate

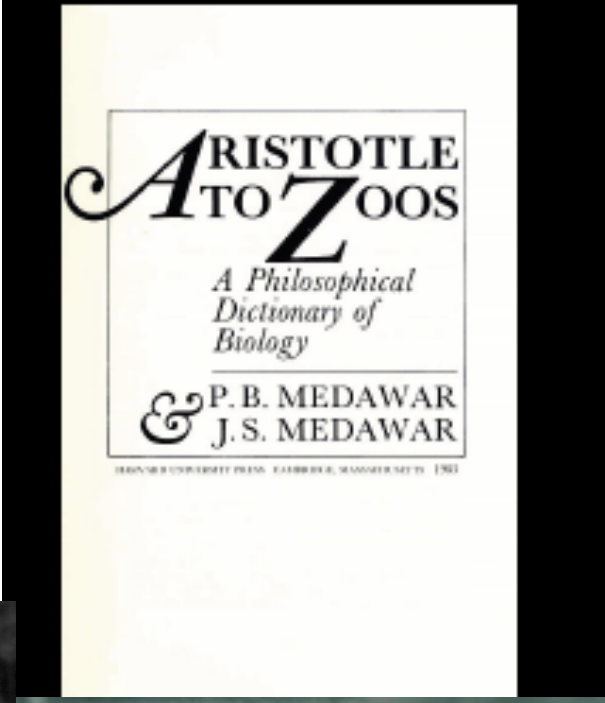
Birus eta eboluzioa

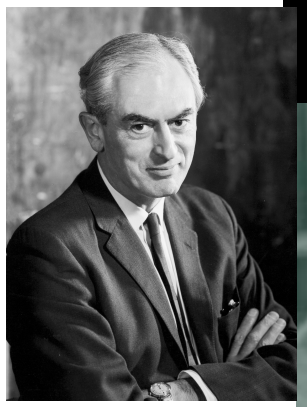
BIRUSA …

- “berri txarra da, proteinaz bildurik”

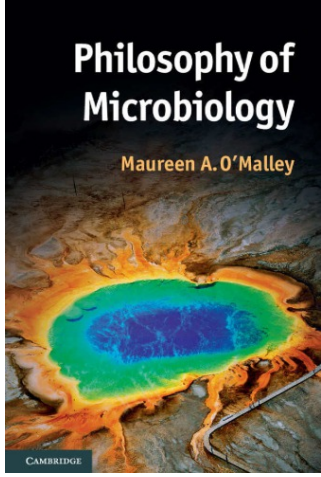
“a piece of bad news wrapped up in proteins”

- “Ongia egiten duen birusik ez da ezagutzen”





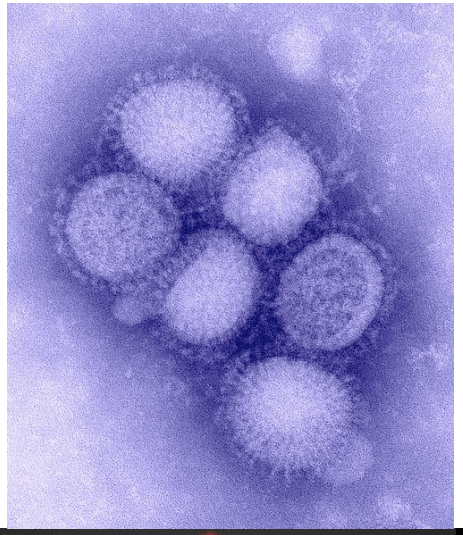
Peter Medawar
Jean S Medawar



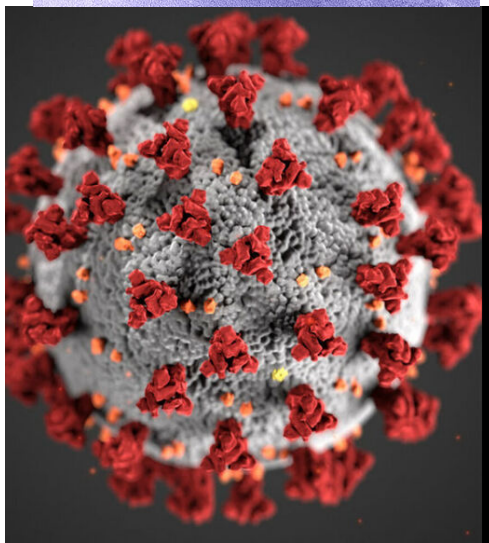
Virus; bacteriophage	Non-cellular evolving entities able to use cells for reproduction. Viruses use eukaryotic cells; bacteriophage ('phage') use prokaryotic cells. The most inclusive term is still virus, however.

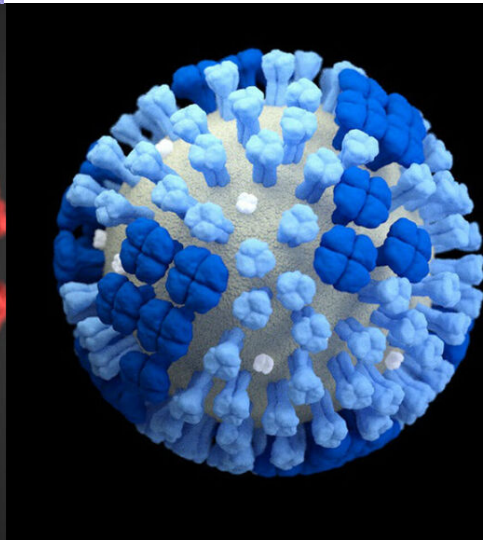
"**zelularrak ez diren izaki ebolutiboak, zelulak erabiltzen dituztenak ugaltzeko**".

There are an estimated 4–6 x 10^{30} prokaryote cells on the planet and about an order of magnitude more of viruses (Whitman et al. 1998). Soil



Oso ugariak →10^{32}





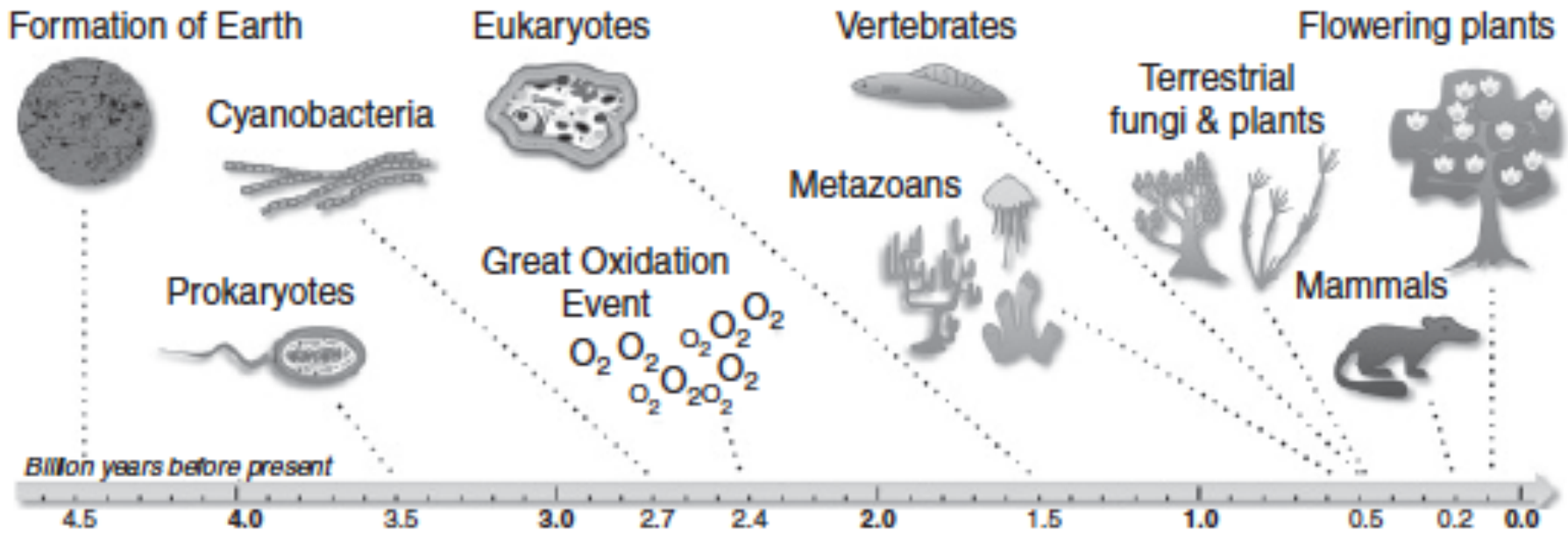
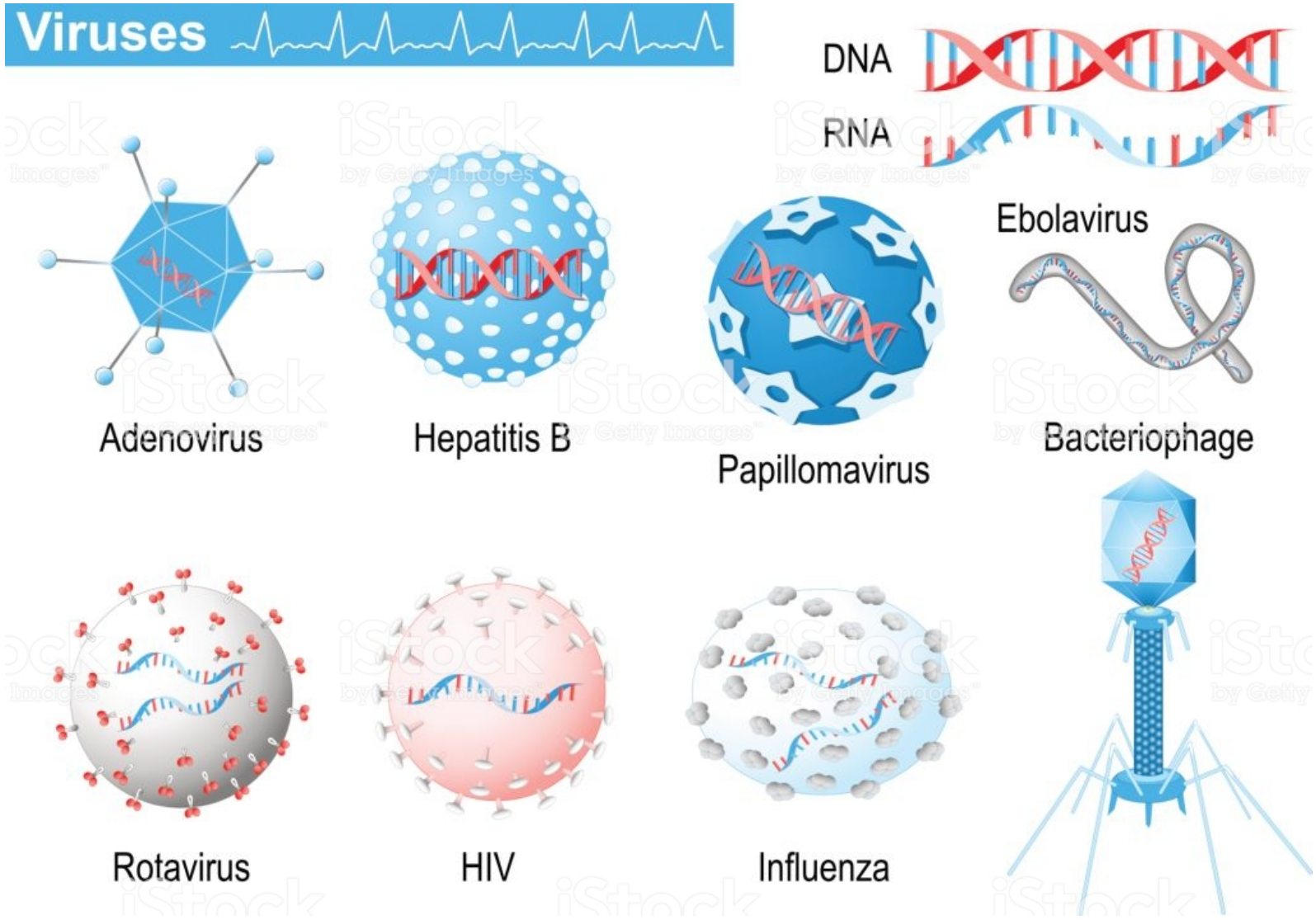


Figure I.3: The evolutionary importance of microbes, with approximate dates.



- Oso ugariak 10^{32}
- Barietate ugariak (80 familia inguru)
- Genealogia zuzenik ez da ezagutzen
- Askotan eragiten duten patologien arabera sailkatzen dira

https://www.istockphoto.com/es/vector/virus-arn-y-adn-m%C3%A9dico-infograf%C3%ADa-con-los-iconos-de-los-virus-gm654122378-119009211

Bizidunak dira?

- **Ez**
  - bizitza independentea eta burujabea ez dute
  - Metabolismorik ez, erreplikatzeko makinariarik ez

- BAI,
  - biziaren eboluzioan eta antolakuntzan duten eragina azpimarratzen da.
  - Ugaztunen plazentak, eragin geokimikoa, etabar.

Nondik datoz?

- “progreso edo aurrerabidea” ren ikuspegia
- “regreso edo atzerabidea”ren ikuspegia
- “birusak lehenik” ikuspegia

Didier Raoult & Patrick Forterre

- Bizidun kontsidera daitezke
- 4. domeinua?

- EZ
  - López-García & Moreira
  - Koonin
  - No son un grupo monofilético

PERSPECTIVES

OPINION

Redefining viruses: lessons from Mimivirus

Didier Raoult and Patrick Forterre

Abstract | Viruses are the most abundant living entities and probably had a major role in the evolution of life, but are still defined using negative criteria. Here, we propose to divide biological entities into two groups of organisms: ribosome-encoding organisms, which include eukaryotic, archaeal and bacterial organisms, and capsid-encoding organisms, which include viruses. Other replicons (for example, plasmids and viroids) can be termed 'orphan replicons'. Based on this suggested classification system, we propose a new definition for avirus — a capsid-encoding organism that is composed of proteins and nucleic acids, self-assembles in a nucleocapsid and uses a ribosome-encoding organism for the completion of its life cycle.

The Darwinian revolution created a new approach to classification by proposing a common origin for living organisms. Since then, scientists have grouped animals and plants phylogenetically, rather than by gross appearance. The genetic revolution and our ability to build trees based on genetic similarities provided support for this method of classification. Over the past 30 years, the development of more efficient sequencing strategies has led to the reclassification of organisms into a universal tree of life based on ribosomal RNA sequences[1]. Viruses, however, lack ribosomes and have not yet been incorporated into this universal tree of life.

Until now, the genetic information that is encoded by viruses was not thought to contain sufficient information to allow their general phylogenetic classification, and consequently no clear definition of viruses is currently available. This is unfortunate, as viruses are the most abundant living entities on the planet[2] and metagenomic studies from randomly sequenced environmental samples have revealed that viral genes constitute the largest part of the genosphere[3,4]. Recent research has revealed an important role for viruses in various evolutionary scenarios, including the origin of DNA and mammals[5–7]. Here, based on our knowledge of archaea, archaeal viruses[8] and intracellular bacteria[9], and the recent discovery of the largest known virus, Mimivirus[10–13] (FIG. 1), we propose a new definition for the virus life form. Of course, any attempt to redefine an entire field will be controversial; however, a debate of this issue, using all of the currently available data, is needed. We propose a definition of viruses (and cells) that is based on the hypothesis that viruses are more than just parasitic nucleic acids and that the presence of either capsids or ribosomes forms the basis of the principal classification system in the living world.

Defining viruses — a history

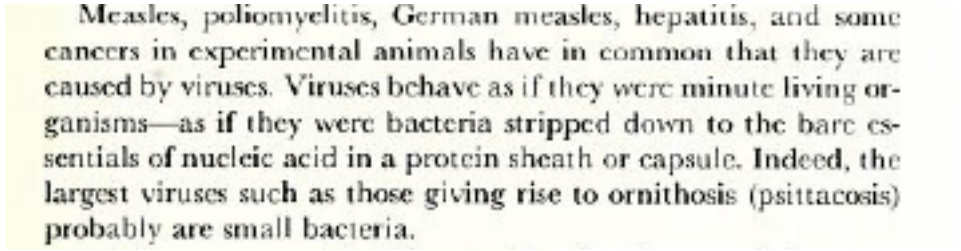
According to Karl Popper[14], definitions are based on the data and tools that are available at a specific moment in time. In the nineteenth century, the word 'microbes' was coined by Sedillot[15] to define cellular microorganisms that were only visible using a microscope. In the middle of the twentieth century, microorganisms were divided into two groups, eukaryotes and prokaryotes, based on cellular structural features[16]. Eukaryotic cells have a nucleus and a nuclear membrane, whereas prokaryotic cells do not (although Planctomycetes, such as *Gemmata obscuriglobus*, are bacteria that have a nucleus and a nuclear membrane)[16]. In the last part of the twentieth century, molecular-biology tools opened the way for a new classification system for all cellular organisms. Carl Woese[17,18] discovered the existence of three different ribosomes in the living world, which replaced the old prokaryote–eukaryote dichotomy with a trinity — archaea, bacteria and eukarya. All cellular organisms could thus be placed together in a universal tree of life. Viruses, however, were missing from this picture.

Unlike most other microorganisms, viruses are obligate intracellular parasites that cannot replicate independently. They can infect organisms from all three domains of life, and can even parasitize other viruses; for example, the delta agent (with the hepatitis B virus[19]) and satellite viruses (with an adenovirus or tobacco mosaic virus (TMV)[20,21]). Despite their ubiquity and enormous importance to human health, viruses have long been neglected by evolutionary biologists, and are thought to be derived from cells. Indeed, as a direct consequence of the cellular theory that was established in the nineteenth century, living organisms and cellular organisms are synonymous to most scientists.

Viruses were initially thought to be infectious agents that are not visible under a microscope and can be filtered through 0.22 µm ultrafilters (hence the name 'ultravirus')[22,23]. During the twentieth century, researchers developed two theories about viruses. The bacteriologists Félix d'Herelle, who discovered bacteriophages, and Macfarlane Burnet, who received the Nobel Prize in medicine in 1960, believed that viruses were organisms[24,25] (as did Louis Pasteur), whereas Wendell Stanley[26], who crystallized TMV and received the Nobel Prize in chemistry in 1946, believed that viruses were biomolecules. Later, while promoting the eukaryote–prokaryote dichotomy, André Lwoff[27] defined viruses as small (one dimension smaller than 0.2 µm), infectious, but not autonomous, agents that cannot divide by binary fission, and consist of proteins and a single type of nucleic acid. Lwoff insisted that viruses are not organisms and maintained that the infectious element of the virus is the nucleic acid, unlike bacteria or other pathogens, in which the infectious agent is the organism itself (although this theory has been contradicted recently[28]).

virus eta gaixotasuna

- Elgorria
- Paperak
- Poliomielitis
- HIES
- Rubeola
- Hepatitis
- Minbizia (batzuk)



Measles, poliomyelitis, German measles, hepatitis, and some cancers in experimental animals have in common that they are caused by viruses. Viruses behave as if they were minute living organisms—as if they were bacteria stripped down to the bare essentials of nucleic acid in a protein sheath or capsule. Indeed, the largest viruses such as those giving rise to ornithosis (psittacosis) probably are small bacteria.

- Medawartarren garaikoak oker zeudela uste da orain
- Orain uste da euren rola eboluzioan garrantzitsua izan dela, baita biologia funtzionalean ere. Adibidez:

    - Lurraren biogeokimika arloan birusen rol erregulatzailea
    - Birusak gorputz makroen eboluzioan eta eraikuntzan (plazentak)
    - Birusen arteko elkarrekintzen eragina

Virus (microbios)

- Mehatxu?
- *Co-development* (Garapen partekatua)
  - Scott Gilbertek erabiltzen du hitza adierazteko mikrobioak, tartean birusak, mehatxua baino, ekarpena egiten dutela zelulaniztunak direna izan daitezen

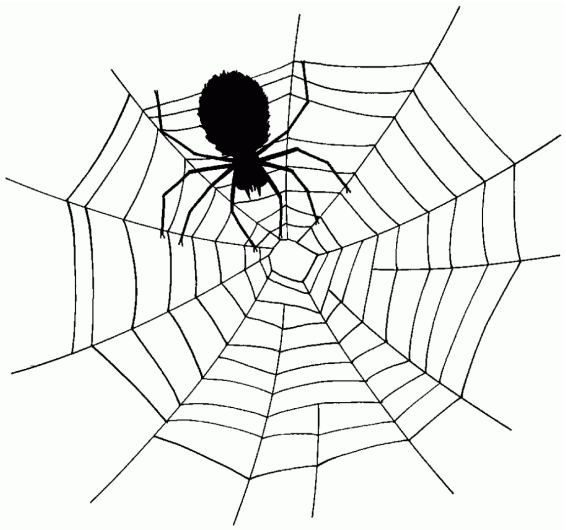
“Mendebaldeak gero eta esterilagoa den ingurumena ekoiztu du, planifikatu ez den eta ezin den natura ezabatzean datzana”

Sariola & Gilbert 2020, 746 or.

- mentalitate aldaketa bultzatzea mikrobioekin (birusekin)
- Anfibiosi kontzeptua

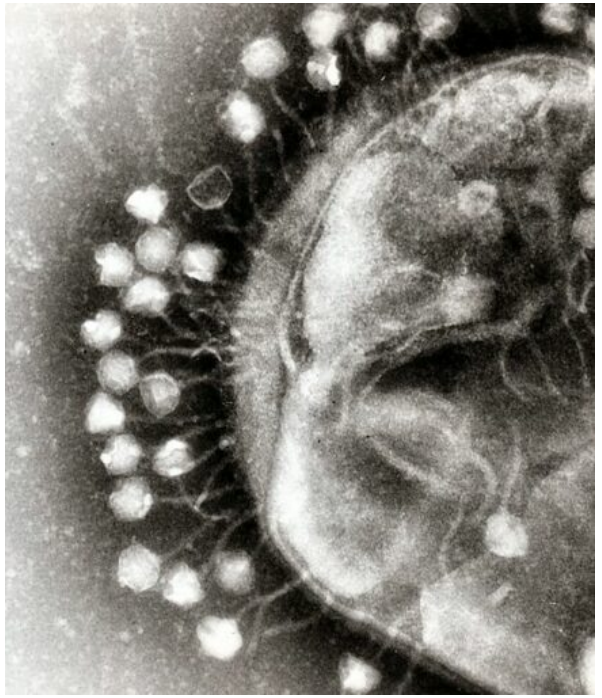
- Holobiontea espezie ezberdineko zelulaz osatutako izakia da (edo organismoa) non mikrobioek laguntzen duten fisiologia eta egonkortasuna (resilientzia) mantentzen.
- “Holobionteen osasuna eta gaixotasunean ostalariaren eta mikrobiomaren arteko erlazioa ostalariaren baitako gorputz atalen eta organoen arteko erlazioak beste eragin du” (Rosenberg & Zilber-Rosenberg 2019).

- *Nitxo Eraikuntzaren Teoria*



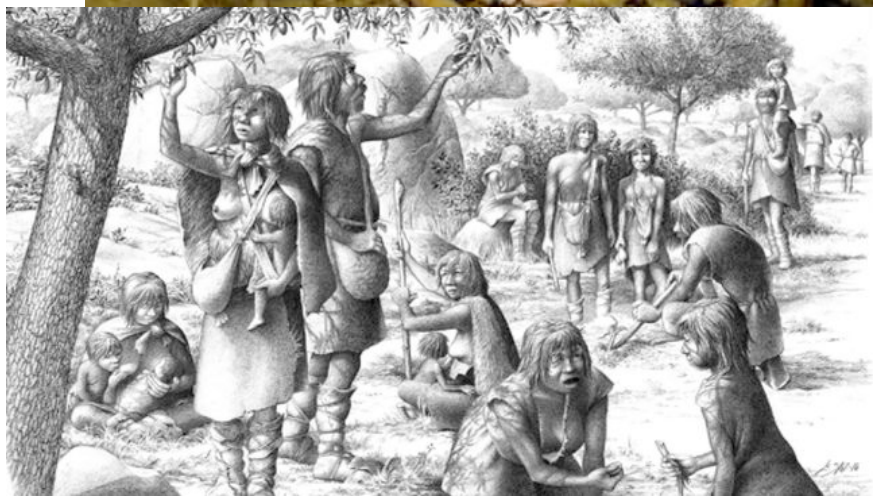
Paradigms of living together

- **Bacteriophages** being used as alternatives to antibiotics to provide treatments for bacterial infections
  - Bacteriophages are viruses that can provide relief to patients suffering from sometimes unbearable pain.
  - They have also contributed massively towards basic research, our understanding of DNA and how much scientists can manipulate it.



- *Ehiztari-Biltzaileen arteko gaixotasunak*
  - Bizitza latza: zauriak, goseam klima arazoak, harrapariak
  - Ez zegoen gaixotasun infekziosorik

  (elikagai edo zauri infektatuak, bai baina ez gerora ezagutu diren epidemiak)
  - Ez zuten katarrorik
  - (ostalari anitzen beharra)
- Orain dela 12-15 mila urte
  - Bizitza sedentarioa
  - Nekazaritza, abeltzaintza
  - Elikagai gehiago, kalitate eskasa
  - Barietate gutxi, lan gogorra, pilaketa…
  - Animaliekin hurbiltasuna



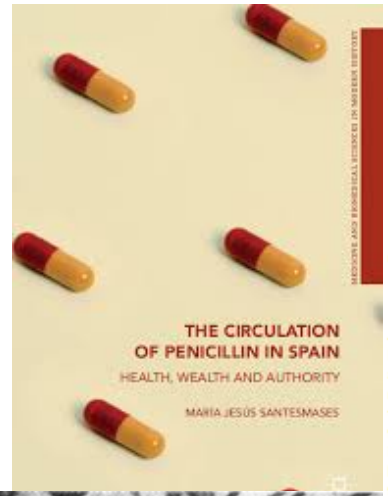
Animaliengandik gizakietara (zoonosis)

- Txakurrak → > 65 gaixotasun partekatu
- Ganadu → tuberkulosia
- Zaldiak→katarro arrunta (rhinovirus)
- Txerriak → gripe
- …
- Beste batzuk
  - GIB (HIV)
  - Hegaztien gripea
  - Ebola
  - Covid19
  - …

Historian zehar eta nekazaritza eta abeltzaintzaren garapenaren ondorioz eta biziza sedentarioaren ondorioz epidemia ugari egon dira.

- Mendea, peste beltza, (batez ere 1347-1353), bakterioa: *Yersinia pestis*.
- XV eta XVI mendetan, Ameriketako biztanleen populazio osoak hil ziren eramandako baztanga birusak eta beste mikrobioen eraginez.
- 1683, Anton van Leeuwenhoek animalkuluak ikusi zituen bere mikroskopioan.
- 1796 Jenner baztangaren aurkako txertoa
- 1853 John Snow, kolera geldiarazteko neurriak (ur ponpa kendu) (bacterioa Vibrio colerae)
- 1860s Pasteur→ "gaixotasun infekziosoen ideaia mikroorganismoen eraginez.
- 1876 Koch, anthraxen egilea identifikatu zuen, bacillus anthracis
- 1892 Dimitri Ivanowsky → patógeno minuskuluen existentzia frogatzen du
- 1898 Martinus Beijerink birusak identifikatzen ditu (pozoia esan nahi du virus hitzak).

- Koch/Pasteur
  - Gaixotasunen teoria mikrobianoa
  - Txertoak, antibiotikoak



The New Biologies
Body & Society
2016, Vol. 22(4) 19–52
© The Author(s) 2016
Reprints and permission:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/1357034X14561341
journals.sagepub.com/home/bod
SAGE

Antibiotic Resistance and the Biology of History

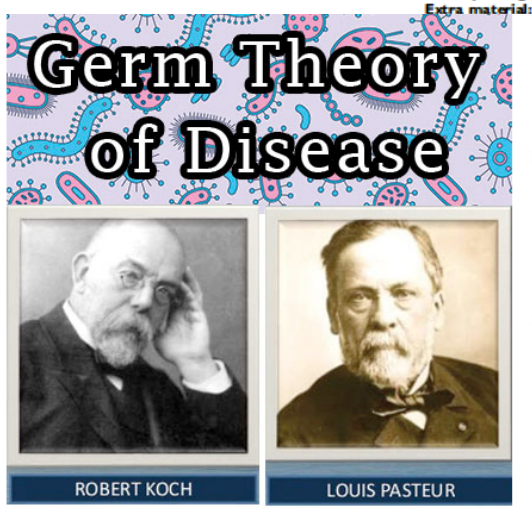
Hannah Landecker
University of California

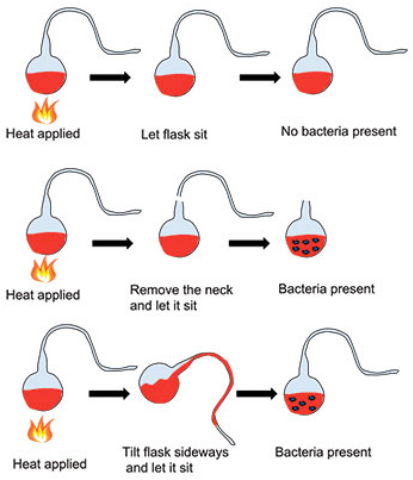
Abstract
Beginning in the 1940s, mass production of antibiotics involved the industrial-scale growth of microorganisms to harvest their metabolic products. Unfortunately, the use of antibiotics selects for resistance at answering scale. The turn to the study of antibiotic resistance in microbiology and medicine is examined, focusing on the realization that individual therapies targeted at single pathogens in individual bodies are environmental events affecting bacterial evolution far beyond bodies. In turning to biological manifestations of antibiotic use, sciences fathom material outcomes of their own previous concepts. Archival work with stored soil and clinical samples produces a record described here as 'the biology of history': the physical registration of human history in bacterial life. This account thus foregrounds the importance of understanding both the materiality of history and the historicity of matter in theories and concepts of life today.

Keywords
antibiotic resistance, antibiotics, biology, biomedicine, biopolitics, biotechnology, social studies of science

A recent American Centers for Disease Control threat report on bacterial pathogens refractory to treatment with antibiotic therapies contains a blunt warning: 'simply using antibiotics creates resistance' (CDC, 2013: 14). Solutions have become problems, putting biopower out of joint. Measures and places of biological control, hygiene or bodily discipline teem with antibiotic resistant bacteria. Pets, supermarket meat, hospital drains, locker

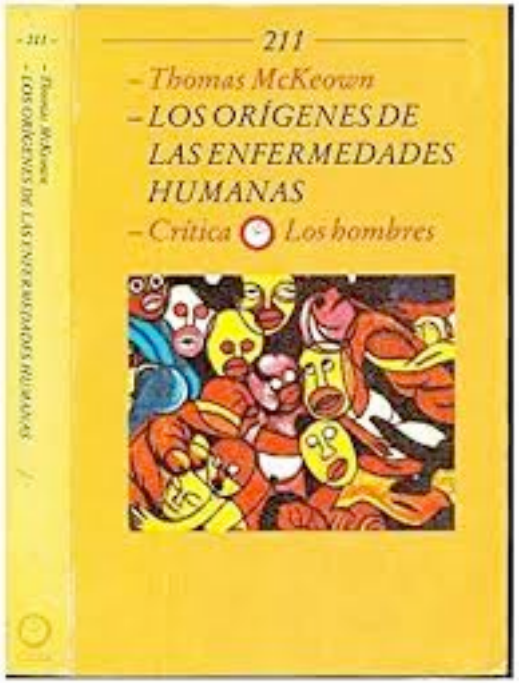
Corresponding author: Hannah Landecker. Email: landecker@soc.ucla.edu
Extra material: http://theoryculturesociety.org/





Gaixotasun motak

- 1) *jaiotzetako gaixotasunak*, konstitutiboak edo berezkoak liratezkeenak
- 2) infekziosoak, mikrobioak edo parasitoak eragindakoa (hauek pobreziarekin lotzen zituen). Abdel Omran → "age of pestilence and famine" (pestilentzia eta gosetearen aroa)
- 3) gizakiak eragindakoak, "aberatsen" gaixotasunak (tabakoak, gehiegizko elikadura, gehiegizko sedentarismoa etab.) age of degenerative and man-made diseases (degeneratiboak eta giza-ekooizpeneko gaixotasunen aroa)



Trantsisio epidemiologikoak

Abdel Omranek gaixotasunen trantsizio epidemiologikoen eredua landu zuen. Harper eta Armelagos (2010)

- *Lehenengo trantsizioa:* nekazaritzaren sorrera: infekzioak eta elikadura gaixotasunak.
- *Bigarren trantsizioa:* orain dela bi mende: populazio batzuetan infekzio gutxiago eta gaixotasun degeneratiboak
- *Hirugarren trantsizioa:* infekzio ezagunak berpizten dira eta gaixotasun berriak, hauek azkar zabaltzeko gaitasuna dute globalizazioa dela eta.

Harper eta Armelagos 2010, 680 or

Table 1. The Three Epidemiological Transitions.

Transition	Paleolithic Baseline	First Transition	Second Transition	Third Transition
Time Period	Pre-Neolithic Cultures; More recent hunter-gatherer cultures with little outside contact	Neolithic cultures-Early Modern Times in Western Europe and United States; Still characterizes many low-income countries	Early Modern times to 20th century in Western Europe, United States; Occurred more recently in some other high-income countries and is in progress in lower income countries	End of the 20th century to the present, global
Characteristics	• Pre-agricultural • Low mortality and fertility rates • Small population size • Varied diet	• Agricultural • High mortality and fertility rates • Large population size • Diet heavily reliant on crops	• Agricultural • Low mortality and initially high then low fertility rates • Large population size • Increased life expectancy • Varied diet, overnutrition common • Discovery of antimicrobials and vaccines, improved hygiene	• Agricultural • Large population size • Declining life expectancy? • Failure of antimicrobials • Rapid spread of novel infections • Age of onset of chronic diseases delayed in high-income countries

Harper eta Armelagos 2010, 681 or

Table 1. *Cont.*

Common causes of morbidity and mortality	Infections such as tapeworms, body lice, pinworms, typhoid, staph, and possibly yaws	• Infections such as malaria, smallpox, measles, tuberculosis • Nutritional deficiencies	• Degenerative diseases such as heart failure, stroke, diabetes, cancer • Allergies, asthma, autoimmune diseases • Sexually transmitted infections such as HSV-2, gonorrhea, HIV	• Those diseases present in the 2nd transition • Antibiotic resistant forms of tuberculosis, strep, staph, *etc.*

ation. In partic-
anation for the
splay from gen-
tingency disap-
ts initial condi-
vth and is com-
up the popula-
utside world or
ions. Thus far,
e of the specu-
othetical ahis-

develop a the-
ling variety of
th lots of sim-
ons, they also
l be "laws" of
nplexity theo-
verse, though
vas the entire
the universe
e reached the

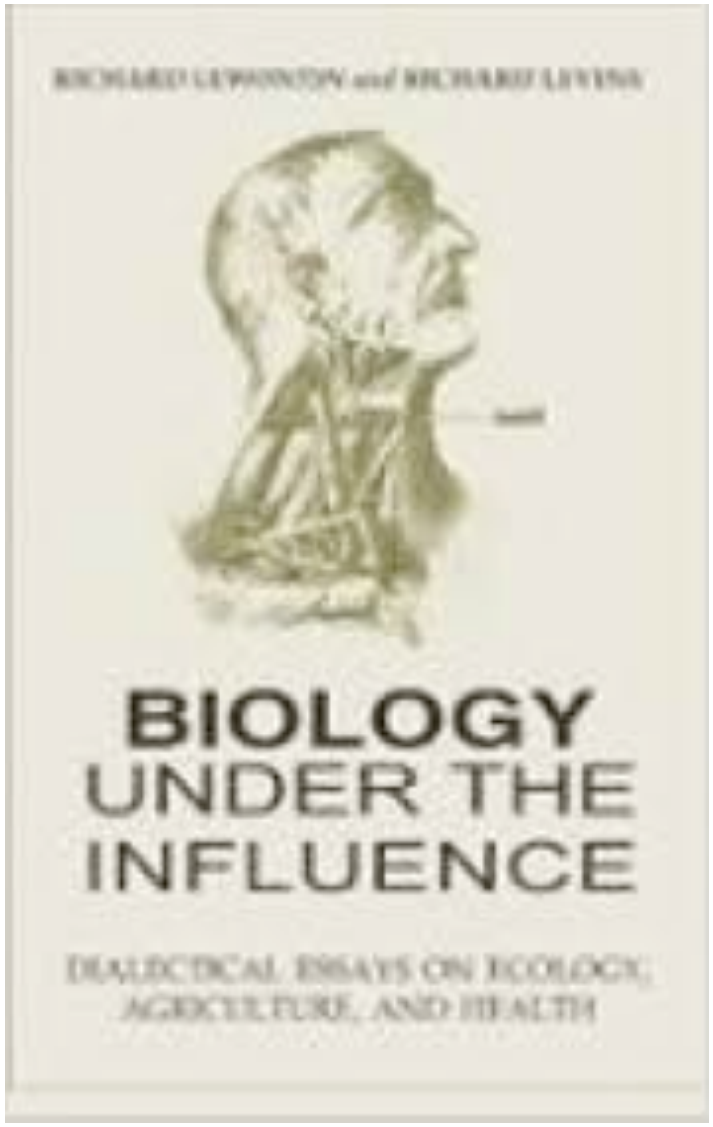
ge, and most
ative, that liv-

2

The Return of Old Diseases and the Appearance of New Ones

A generation ago, the commonsense position of public health leaders was that infectious disease had been defeated in principle and was on the way out as an important cause of sickness and mortality. Medical students were told to avoid specializing in infectious disease because it was a dying field. Indeed, the Epidemiology Department at the Harvard School of Public Health specialized in cancer and heart disease.

They were wrong. In 1961, the seventh pandemic of cholera hit Indonesia; in 1970, it reached Africa, and South America in the 1990s. After retreating for a few years, malaria came back with a vengeance. Tuberculosis has increased to become the leading cause of death in many parts of the world. In 1976, Legionnaires' disease appeared at a convention of the American Legion in



Zer da gaixotasuna?

- Pentsamolde naturalistak:
  - Gaixotasuna definitu daiteke koordenatu biologiko edo naturalen bitartez.
  - Medikuntza zientzia da.
  - Osasuna gorputz osotasun gisa

- Pentsamolde normatiboak:
  - Gaixotasuna zer den esateko gizabanakoaren balioak eta helburuak zeintzuk diren jakin behar da.
  - Osasuna gaitasun gisa, ongizatea

Osasuna eta **norma**

- *Lo normal y lo patológico* de Canguilhem (1971
- Osasuna gaitasun fisiko (edo psikiko) maximoa
- Errekuperatzeko gaitasuna
- Norma ezagutzen da galtzen denean
- Indibiduala da

George Canguilhem

> *Pensamos con Leriche que la salud es **la vida en el silencio de los órganos** y, por consiguiente, que lo normal biológico sólo es revelado […] por las infracciones a la norma, y que sólo hay conciencia concreta o científica de la vida por obra de la enfermedad.*
>
> (Canguilhem 1971, p. 86.)

“Batzuk ahalegina egin dugu ohartarazteko habitaten suntsiketa eta bioaniztasunaren galera daudela zoonosiaren agerpenaren erroan eta horien aurka balioko duen txertoa nahi badugu egin behar duguna dela aniztasun biologikoaren kolapsoa lehengoratu.”

Fernando Valladares

- Bruno Latour -- Lurreko kideak gara, *terrestrians*, eta Lurrean lur-hartu beharra dugu.
- Donna Haraway -- helburua da “bizi eta hil Lurrean bizi izan diren guztiekin”

“Birusak gogorarazi digu, azken batean, hain sutsuki ukatu dugun hori: sorkari gaixoberak garela, materia hauskorrenarekin egindakoak. Hiltzen garela –hilkorrak garela. Gure “humanitateak” ez gaituela besteengandik bereizten, ez garela salbuespen, baizik eta mundua sare itzel modukoa izanik bertan gaudela, beste izakiekin korapilaturik eta elkarturik dependentziazko eta eraginezko hari ikusezinez. Gure jatorrizko herriak zeinen urrun dauden kontuan izan gabe, edo zein hizkuntza egiten dugun, edo zein koloreko den gure azala, gaixotasun berberekin etortzen garela, beldur berberak partekatzen ditugula, heriotza berbera hiltzen dugula.”

Olga Tokarczuk, The NewYorker

Human life, just like plant and animal life, is conditioned by the microbes which populate the body. These interdependencies exist everywhere.

It's less about preparing for the worst (even though emergency response plans for epidemics are of course necessary), as more about **taking note of and learning from the consequences of this living together** and of its shared futures.

(Charlotte Brives, 2020)

Naturaren natura

- Badu naturak, izaki oso edo osotasun moduan, bere normatibitatea edo bere burujabetasuna?
- Lurreko izakien erlazioak eratzen duten sare konplexua sujetu bat da, badu burujabetza propioa?
- Canguilhemen ez dio aitortu nahi gizarteari normatibitatea
- Baina dena korapilaturik dagoela esaten dugun natura horrek badu bere normatibitatea? Gaixotu daiteke natura?

ondorioak

- Galderak esangura filosofikoa du eta baita praktikoa ere
- Canguilemek dio osasuna ez dela ezagutzen galtzen den arte.
- Lerichek zioena aipatzen du askotan: osasuna organoen isiltasunean bizitzea da.
- Zentzu horretan pandemia honek naturaren krisialdi sakona erakutsi digu, ozen.