

The Challenge of Breadth

EMBL Graduate Conference, 2019.11.29

Charles H. Pence

@pencechp · @pencelab

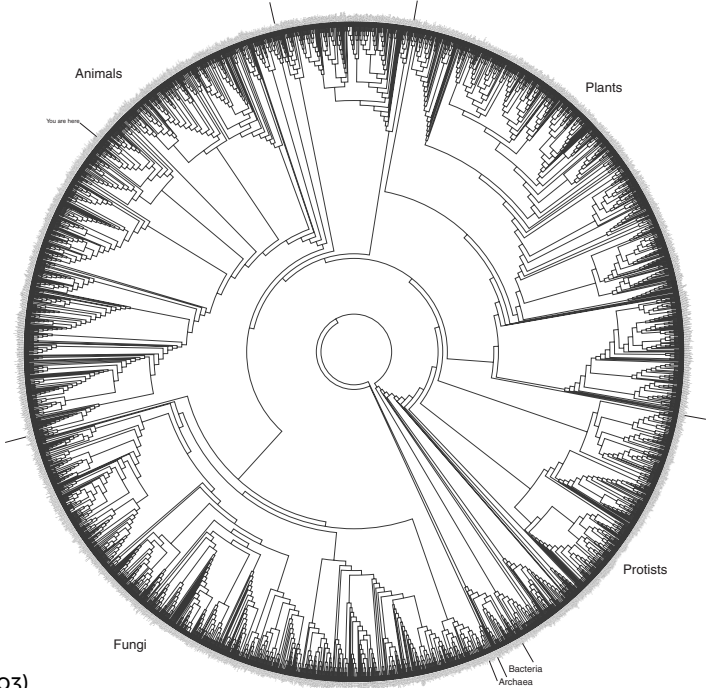
Outline

1. Two Darwins
2. Philosophy, Biology and Big Data
3. The Ethics of Breadth

The take-home: Biology faces a unique set of conceptual and ethical challenges that will shape it for the rest of our century.







Hillis (2003)

Abb. 131

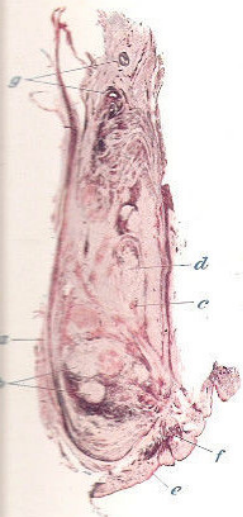


Abb. 132

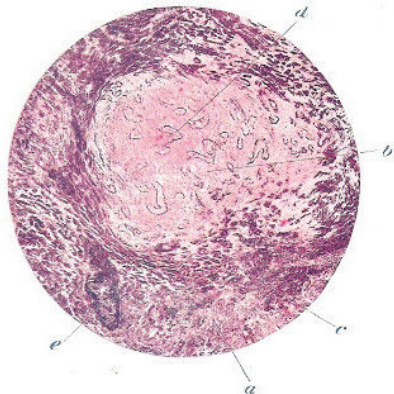
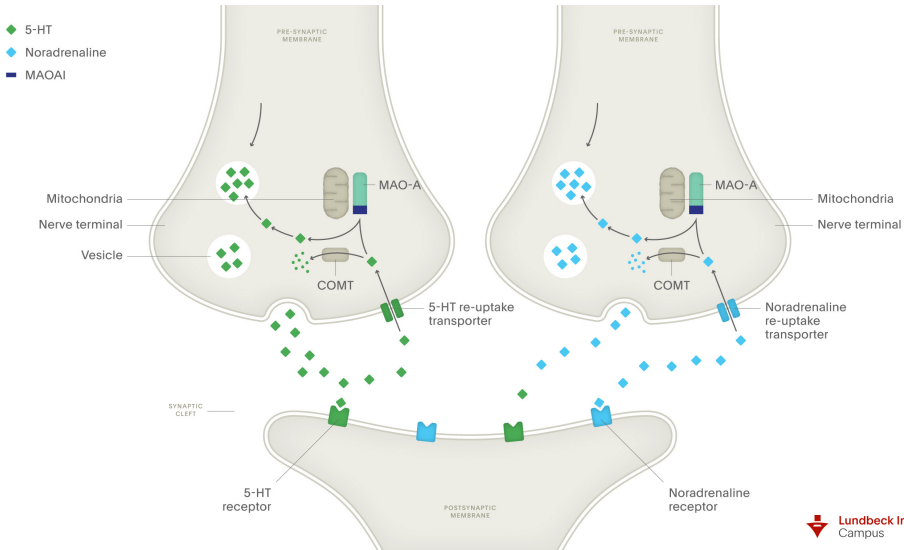
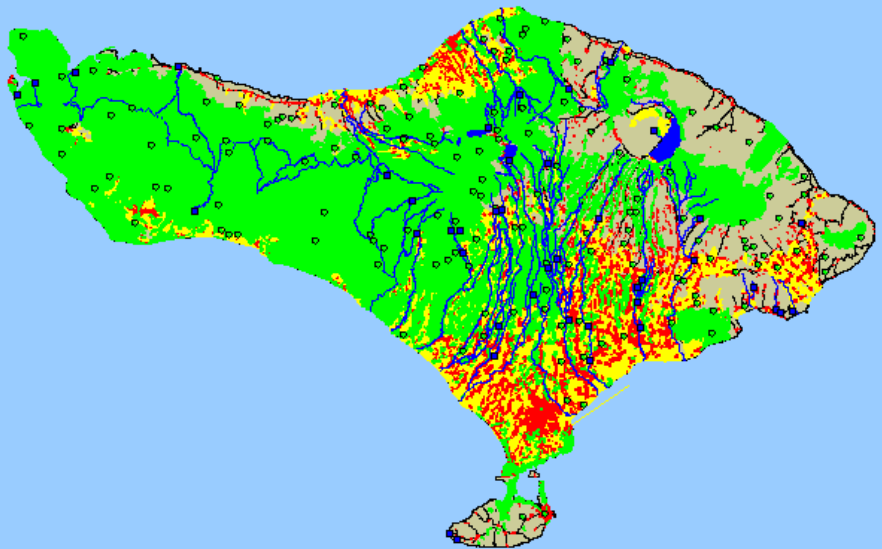


Abb. 133

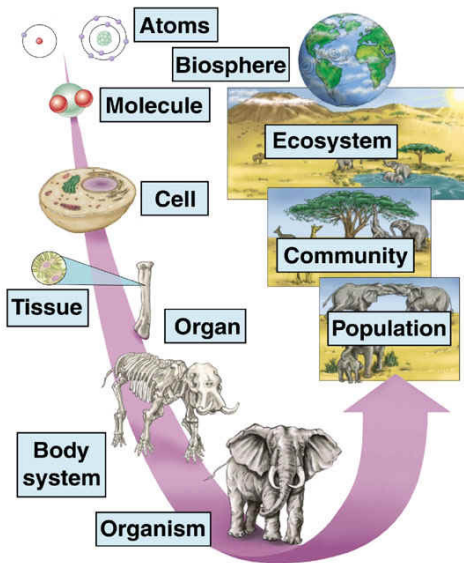


Mouse Mode
Navigation

1:801,665



Kennedy et al. (2009)



horizontal breadth: across the entire tree of life,
present and historical

vertical breadth: across scales of organization
from ecosystem to biochemistry

How should biology approach the
challenge of breadth?

Two Darwins



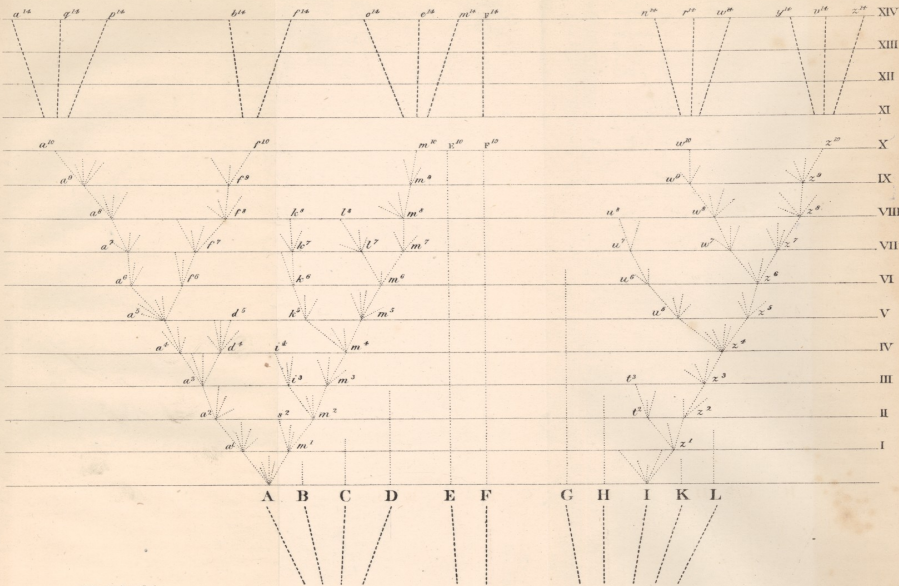
ON

THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

PRESERVATION OF FAVOURED RACES IN THE STRUGGLE
FOR LIFE.



W. West. 14th. Eaton Court.

a **sub-genus** or even a distinct **genus**

Origin, p. 123

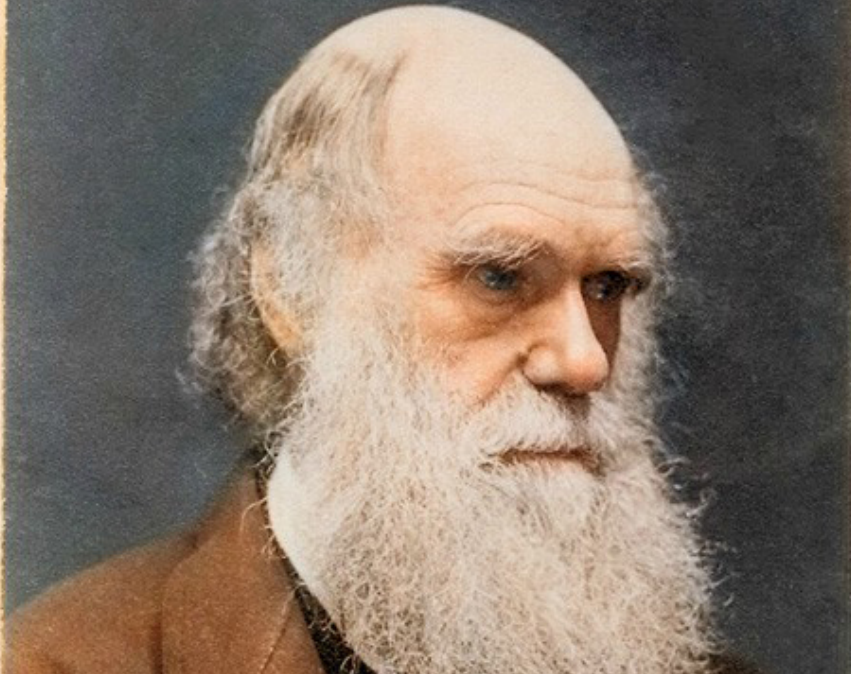
very distinct **genera** or even distinct **sub-families**

Origin, p. 123

two distinct **families** or even **orders**

Origin, p. 125

Darwin the Generalizer



ON

THE VARIOUS CONTRIVANCES

BY WHICH

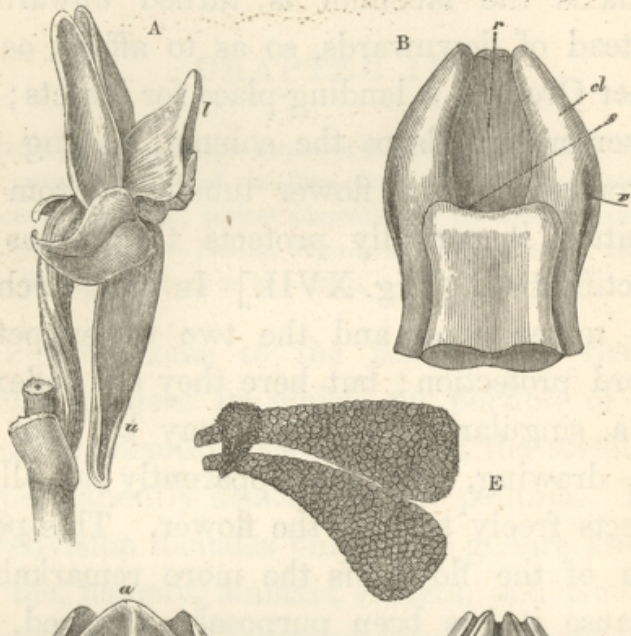
BRITISH AND FOREIGN ORCHIDS

ARE

FERTILISED BY INSECTS,

AND ON THE GOOD EFFECTS OF INTERCROSSING.

Fig. XVII.





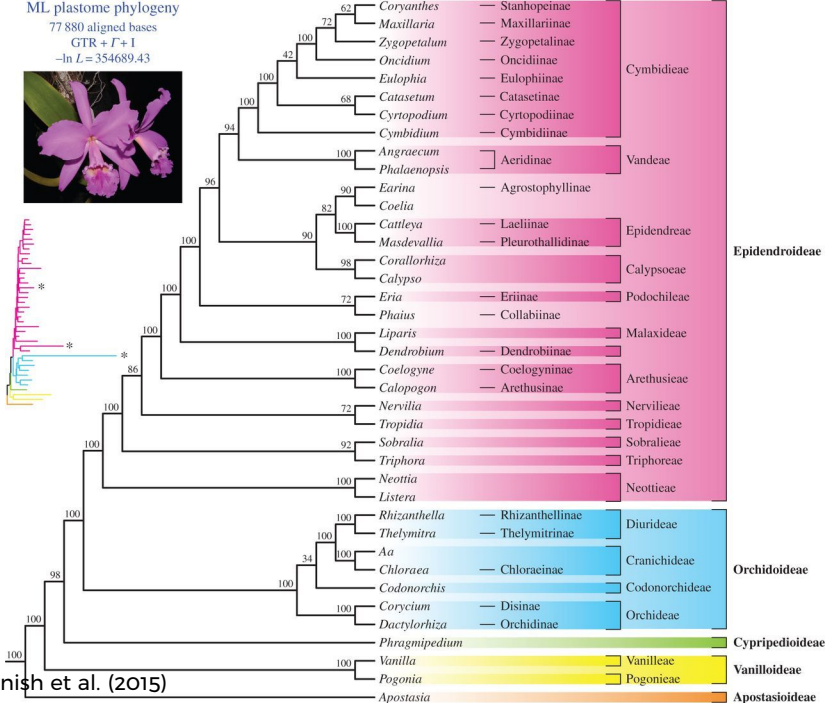
WP:Orchi

ML plastome phylogeny

77 880 aligned bases

GTR + Γ + I

$-\ln L = 354689.43$



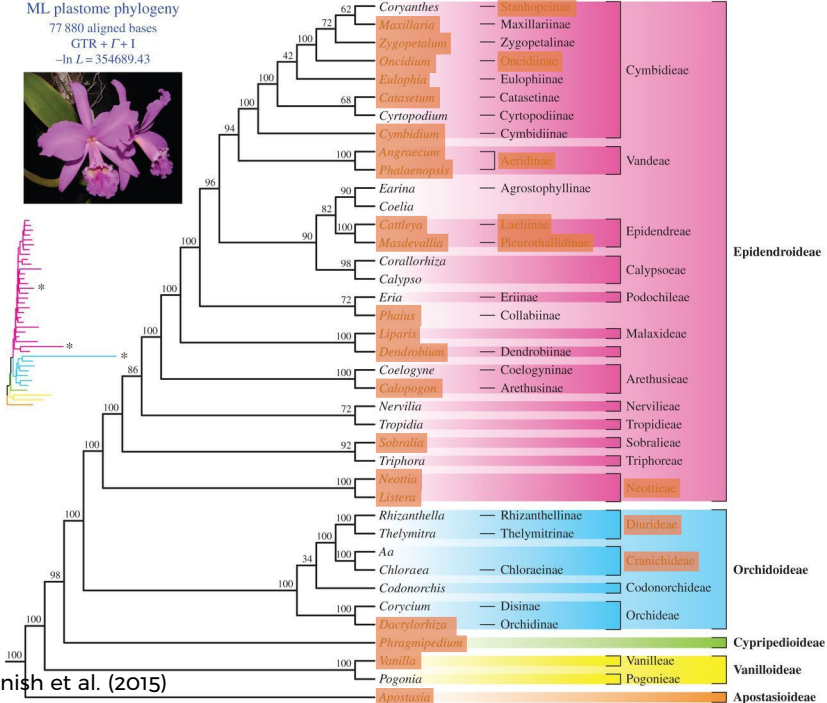
Givnish et al. (2015)

ML plastome phylogeny

77 880 aligned bases

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$-\ln L = 354689.43$



Givnish et al. (2015)

Darwin the Big Data Analyst

big theory and **big data**

generalizing and **analyzing**

Philosophy, Biology and Big Data

What exactly does a philosopher of
biology *do*, anyway?

Classic philosophy of biology question:

What do biologists mean when they use the concept of **biodiversity**?

The generalizing approach

The diversities of biodiversity

**James Maclaurin and Kim Sterelny: What is Biodiversity?
The University of Chicago Press, Chicago, 2008, xii + 217 pp,
US\$ 24 PB**

James Justus

Published
© Springer

A more
biological
interest
endeavor
within
philosophy
and...

Biol Philos
DOI 10.1007/s10539-014-9426-2

Save the planet: eliminate biodiversity

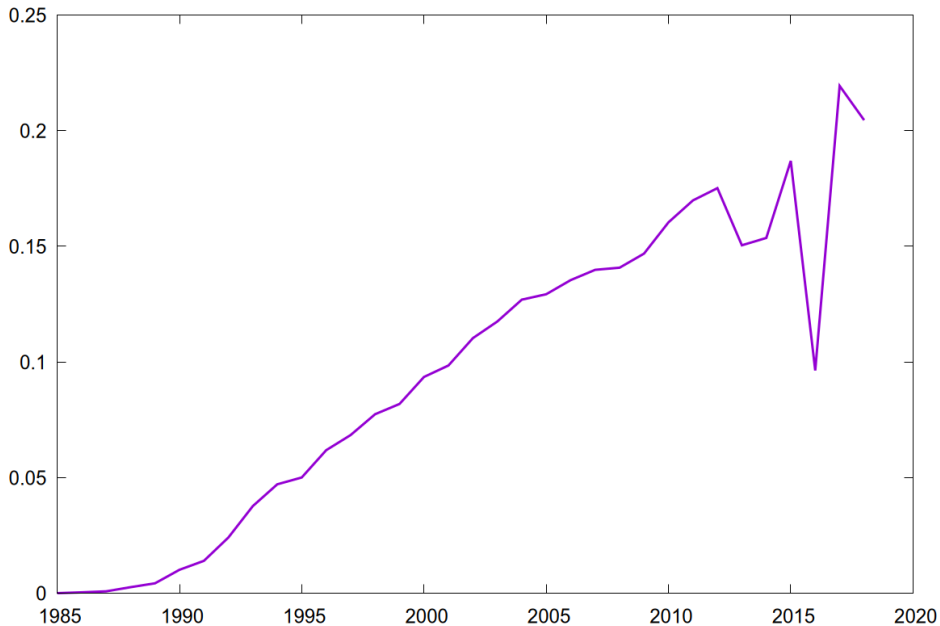
Carlos Santana

The analyzing approach



The evoText Project

<https://www.evotext.org/>



Conservation Biology

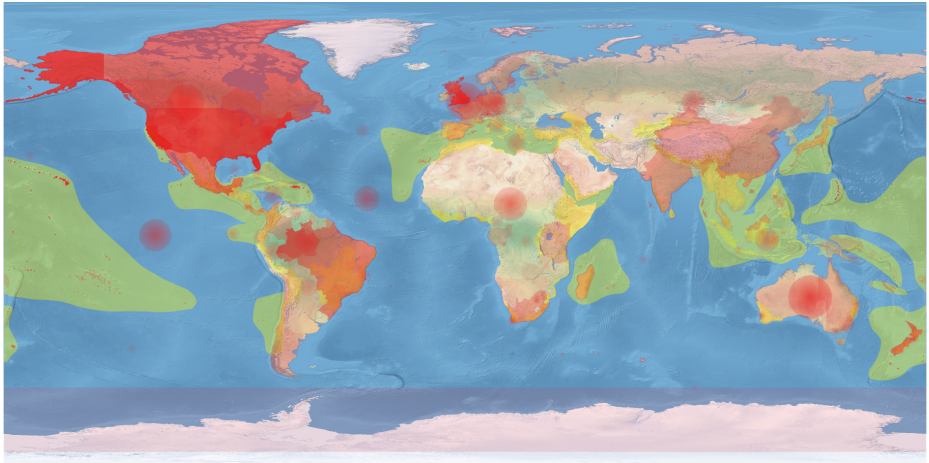
Volume 33, Number 1, February 2019

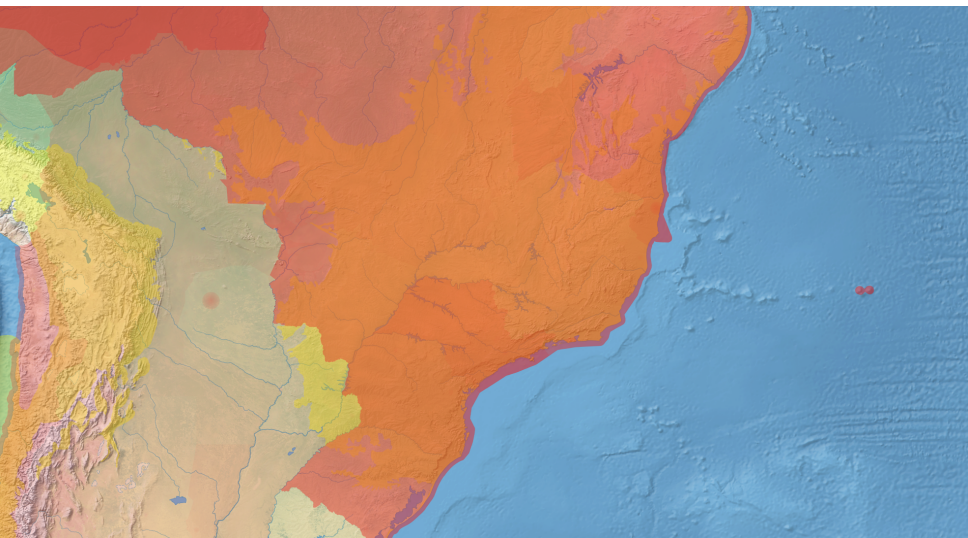


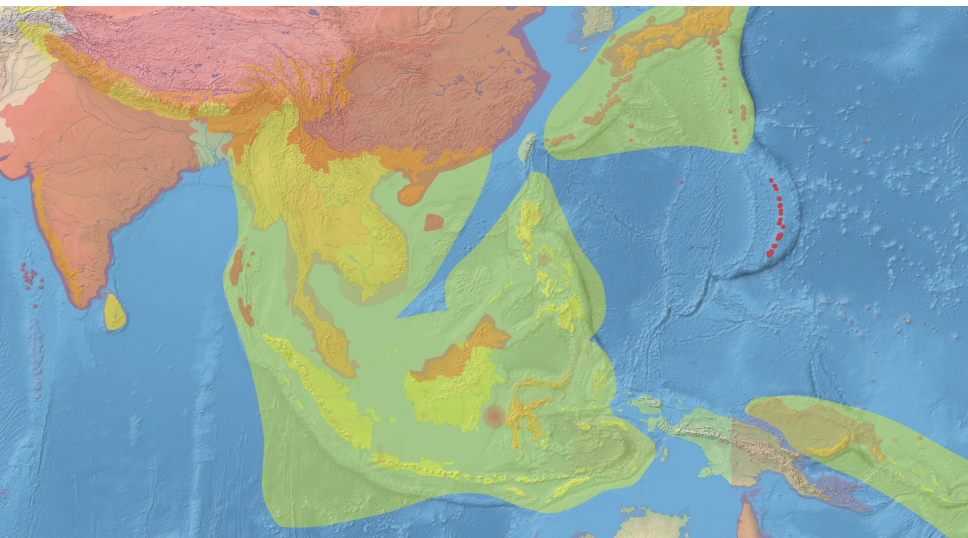
A journal of the Society for Conservation Biology • Published by Wiley Blackwell, Inc. • ISSN 0888-8892

5,459 articles, 1987–2012

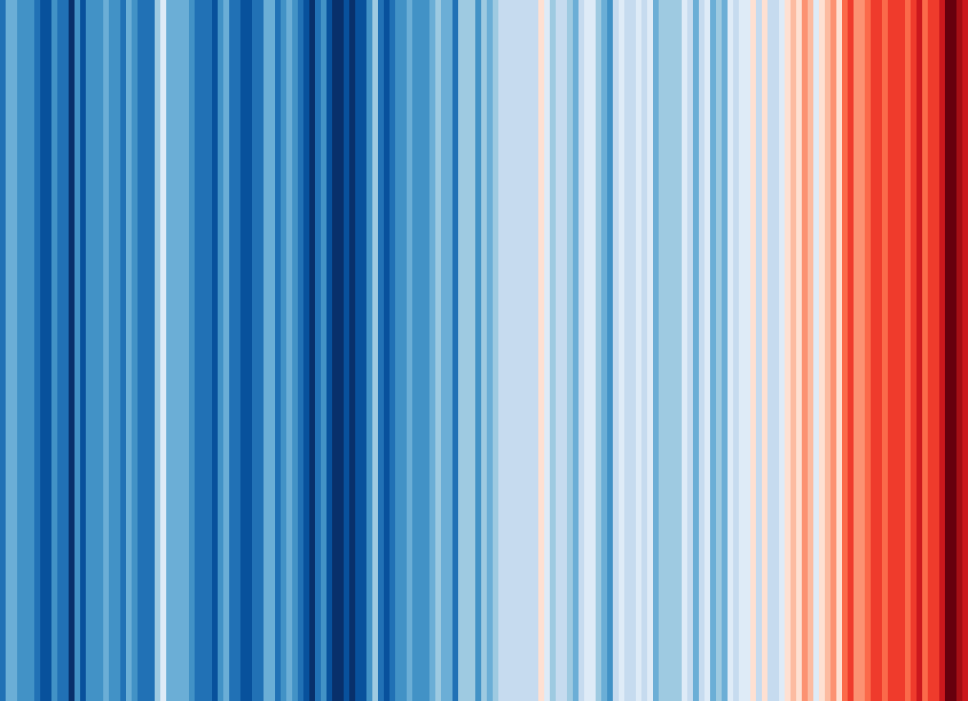
Are scientists and policy-makers understanding biodiversity in the same way?







The Ethics of Breadth





FRONTLINE > Health / Science / Technology > Hunting the Nightmare Bacteria >

Dr. John Rex: The Drug Pipeline Is “Very, Very Thin”

October 22, 2013, 9:29 pm ET



Science and society

Drug discovery in jeopardy

Pedro Cuatrecasas

Departments of Pharmacology and Medicine, University of California San Diego, San Diego, California, USA.



Despite striking advances in the biomedical sciences, the flow of new drugs has slowed to a trickle, impairing therapeutic advances as well as the commercial success of drug companies. Reduced productivity in the drug industry is caused mainly by corporate policies that discourage innovation. This is compounded by various consequences of mega-mergers, the obsession for blockbuster drugs, the shift of control of research from scientists to marketers, the need for fast sales growth, and the discontinuation of development compounds for nontechnical reasons. Lessons from the past indicate that these problems can be overcome, and herein, new and improved directions for drug discovery are suggested.

The decreasing output of new drugs and the drying up of industry pipelines are well established (1–4). To maintain profitability, the pharmaceutical industry has resorted to practices that have drawn public criticism, including markedly increasing drug prices, increas-

Likewise, we cannot blame the current state of scientific advances, which in the last 20 years have been revolutionary. These advances offer mind-staggering new opportunities in innovative drug discovery and development. It is also fallacious

The Deluge of Spurious Correlations in Big Data

Cristian S. Calude¹ · Giuseppe Longo^{2,3}

microbial biotechnology

Open Access

Opinion

Can hypothesis-driven research survive the sequence-data deluge?

Mark Sagoff*

Institute for Philosophy and Public Policy, George Mason University, Fairfax, VA, USA.

This satirical Opinion questions funding trends that perpetuate massive infrastructures the value of which to science has become increasingly less obvious over time.

NHGRI awarded \$1.5 million to ethicists at Case Western Reserve University 'to enhance guidelines for ethical human-animal chimera research'.¹ Whatney added that Zucchini *et al.*, by putting the human posterior aft, created an animal that may produce less methane than a conventional centaur. 'All project proposals will be required to state their impact on climate change'.

Future directions in science will require
an integrated approach bringing
together **technical, conceptual,**
historical, and ethical perspectives.

Questions?

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