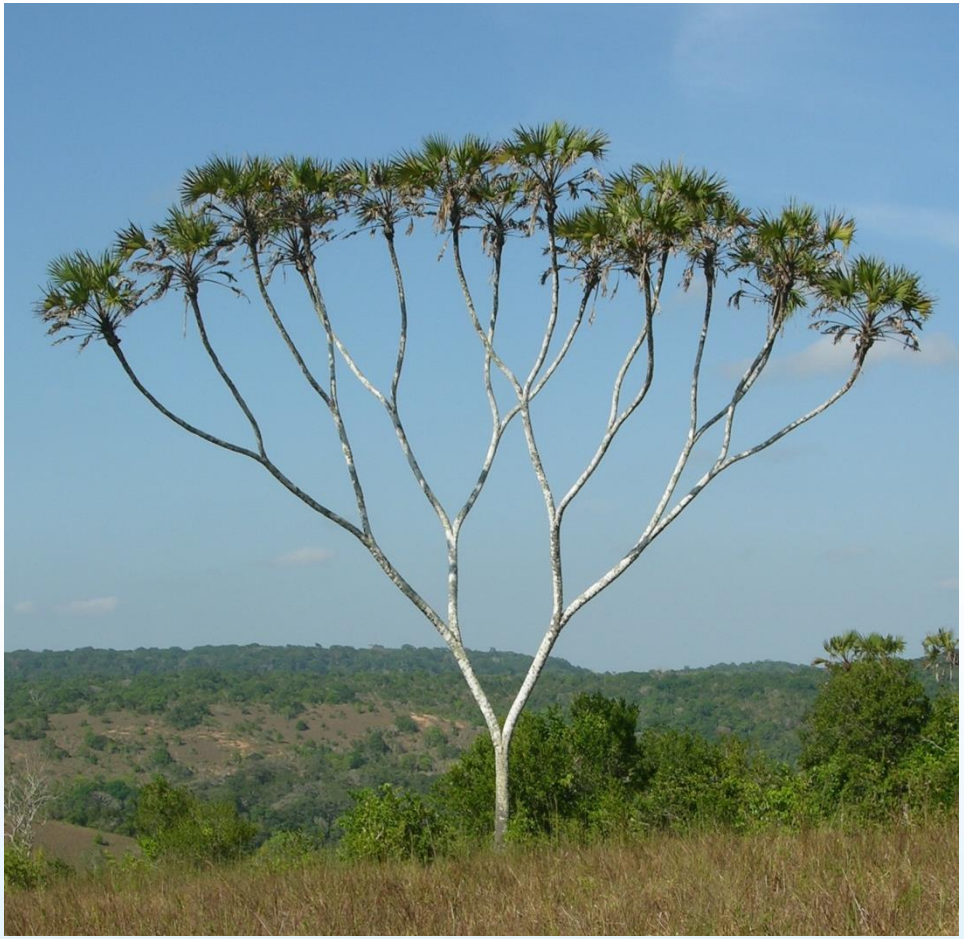
Systematics, Biodiversity & Ecology in the Internet Era

Sir John Burnett Memorial Lecture
Edinburgh Nov 18th 2016

Charles Godfray

Oxford University



$$D_E(t) = (c_{E1}L_1(t) + c_{E2}(L_2(t) + JP(t)) + d_E)E(t)$$

$$D_{L1}(t) = (c_{11}L_1(t) + c_{12}(L_2(t) + JP(t)) + d_{L_1})L_1(t)$$

$$D_{L2}(t) = (f[Pa(t)] + c_{21}L_1(t) + c_{22}(L_2(t) + JP(t)) + d_{L2})L_2(t)$$

$$D_P(t) = (c_{P1}L_1(t) + c_{P2}(L_2(t) + JP(t)) + d_P)P(t)$$

$$S_E(t) = \exp(-\int_{t-T_E}^{t}(c_{E1}L_1(t) + c_{E2}(L_2(t) + JP(t))))$$

$$S_{L1}(t) = \exp(-\int_{t-T_{L1}}^{t}(c_{11}L_1(t) + c_{12}(L_2(t) + JP(t))))$$

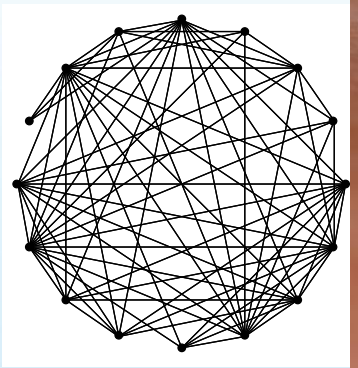
$$S_{L2}(t) = \exp(-\int_{t-T_{L2}}^{t}(f[Pa(t)] + c_{21}L_1(t) + c_{22}(L_2(t) + JP(t)$$

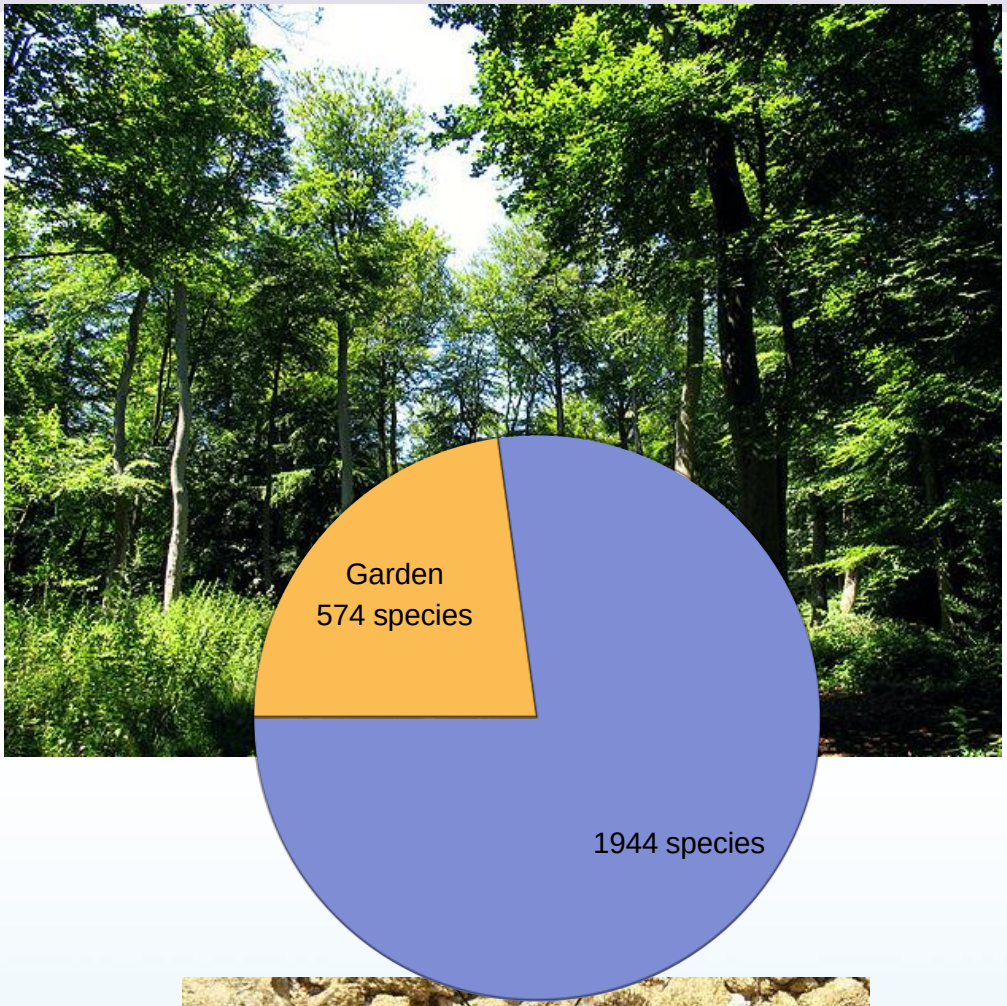
$$S_P(t) = \exp(-\int_{t-T_P}^{t}(c_{P1}L_1(t) + c_{P2}(L_2(t) + JP(t))))$$

$$\frac{dI(t)}{dt} = f[Pa(t)]L_2(t) - f[Pa(t-T_{JP})]L_2(t-T_{JP})\sigma_{JP}S_{JP}$$
$$-(c_{21}L_1(t) + c_{22}(L_2(t) + JP(t)) + d_{JP})JP(t)$$

$$S_I(t) = \exp(-\int_{t-T_{JP}}^{t}(c_{21}L_1(t) + c_{22}(L_2(t) + JP(t))))$$

$$\frac{dPa(t)}{dt} = f[Pa(t-T_{JP})]L_2(t-T_{JP})\sigma_{JP}S_{JP} - d_{Pa}Pa(t)$$





Paramesia gnomana Clerck 1759


1 mm


1 mm

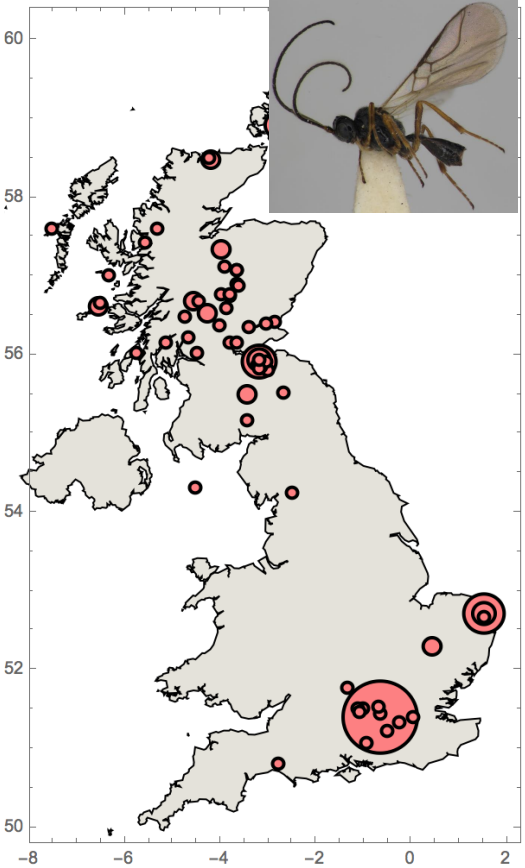

Poaceae
Dacnusa areolaris (Nees)
Dacnusa maculipes Thomson
Dacnusa longiradialis Nixon
Dacnusa laevipectis Thomson
Dacnusa confinis Ruthe
Dacnusa dryas (Nixon)
Dacnusa pubescens (Curtis)
Dacnusa faeroeensis (Roman) (= lestes Nixon)
Dacnusa stramineipes (Haliday)
Dacnusa tarsalis Thomson (= nitetis Nixon)

The Future of Taxonomy and Related Biodiversity science

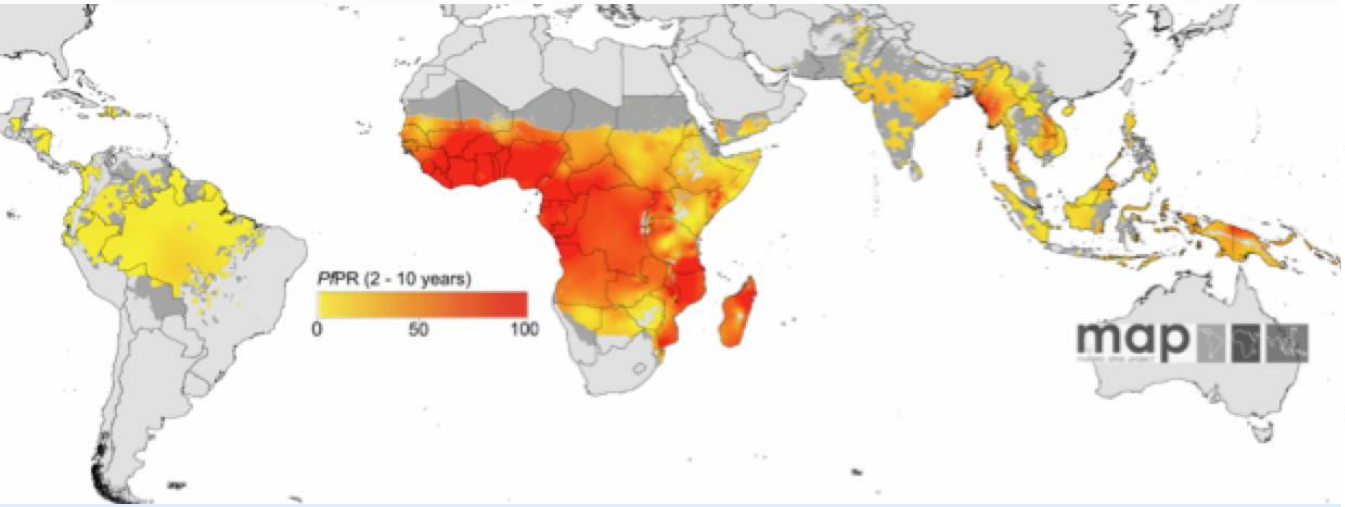
- Technological challenges
  - Digital revolution
  - Molecular revolution
- Human challenges
  - Engaging the young
  - Funding taxonomy and systematics

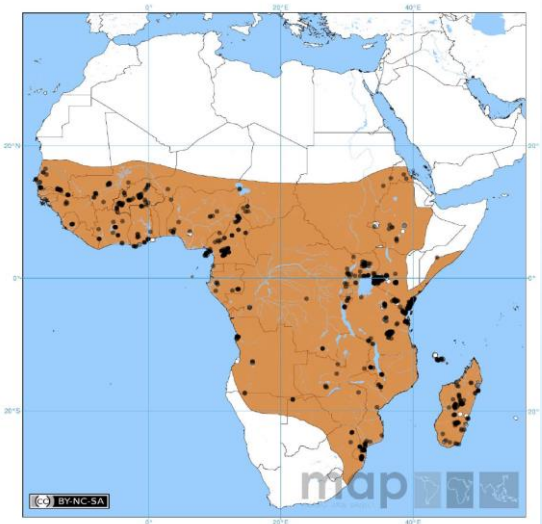
Digital Challenge

- Organising knowledge
- NBN
  - Data access
  - Data analysis



Anopheles (*Cellia*) *funestus* Giles, 1900





Digital Challenge

- The two bioinformatics crises
- Web-based taxonomy

commentary

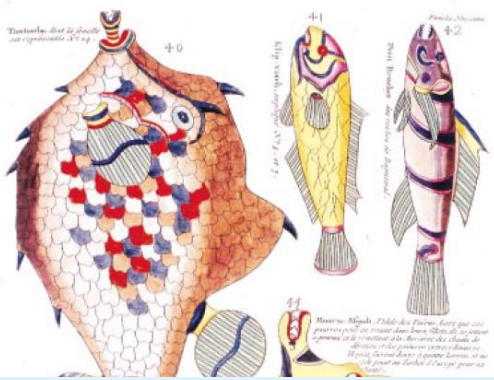
Challenges for taxonomy

The discipline will have to reinvent itself if it is to survive and flourish.

H. Charles J. Godfray

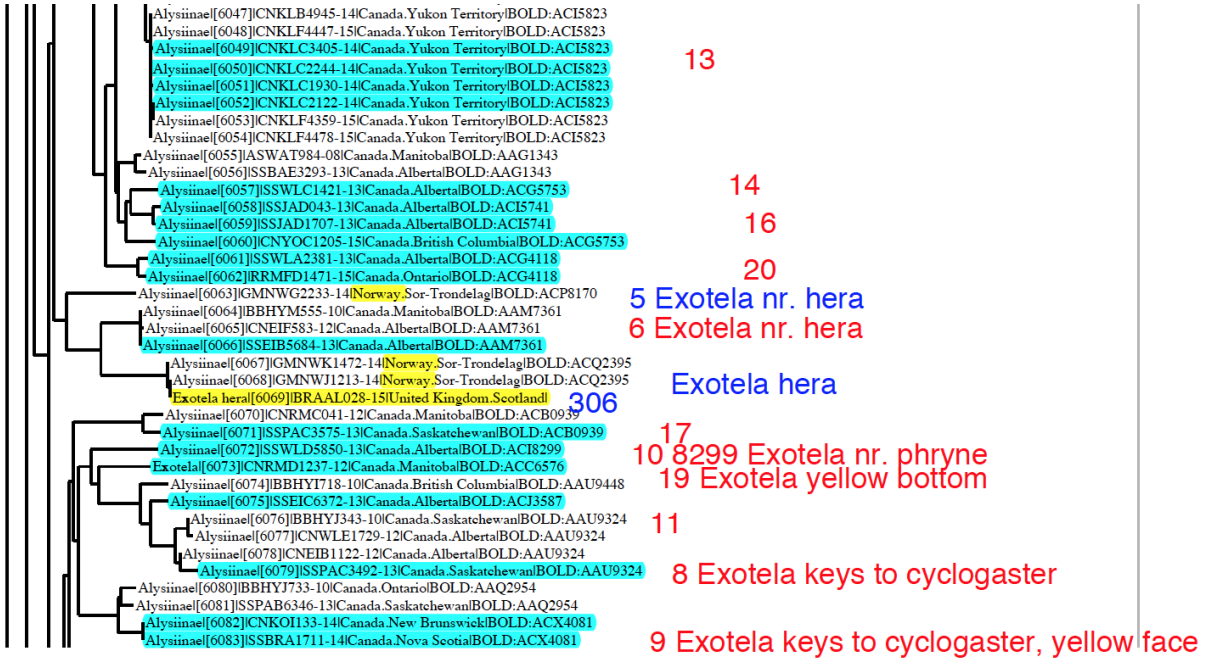
Taxonomy, the classification of living things, has its origins in ancient Greece and in its modern form dates back nearly 250 years, to when Linnaeus introduced the binomial classification still used today. Linnaeus, of course, hugely underestimated the number of plants and animals on Earth. As subsequent workers began to describe more and more species, often in ignorance of each others' work, the resulting confusion and chaos threatened to destroy the whole enter-

One reason is that taxonomists lack clearly achievable goals that are both realistic and relevant. Of course it would be great to describe every species of organism on Earth, but we are still monumentally uncertain as to how many species there are (probably somewhere between 4 million and 10 million); this goal is just not realistic at present. There are various projects aimed at listing, for example, all the valid described species of animal in Europe, or butterflies on Earth (see Box 1, overleaf). These aims are eminently achievable and very worthwhile, but the results are like raw, un-



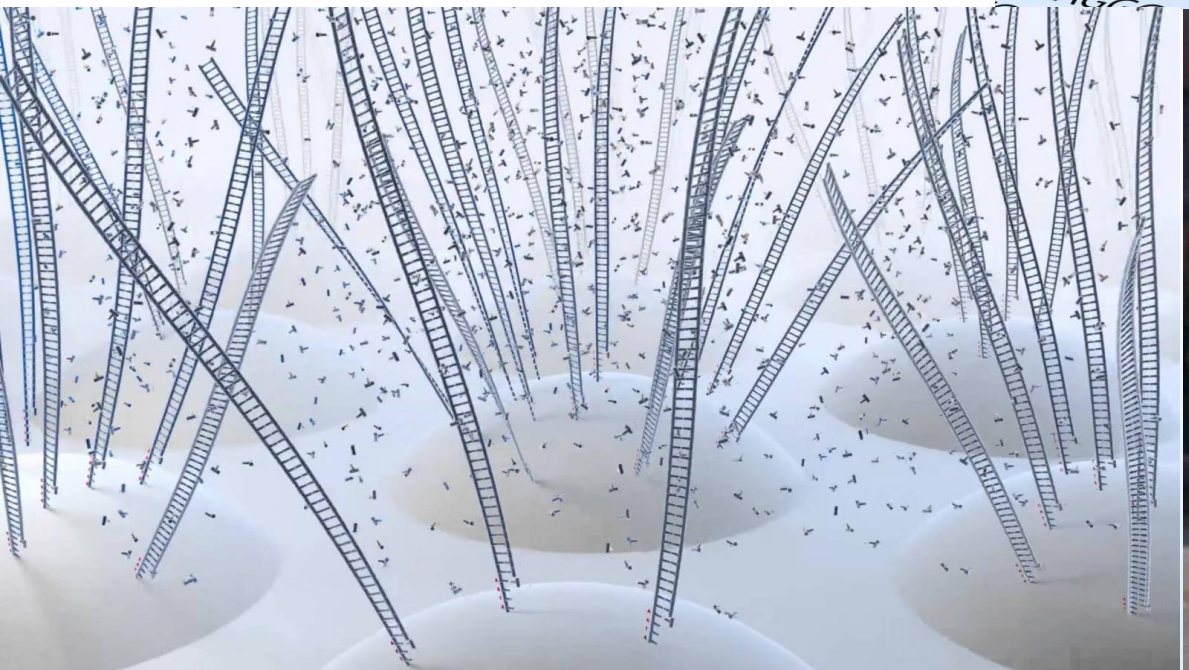
Molecular Challenge

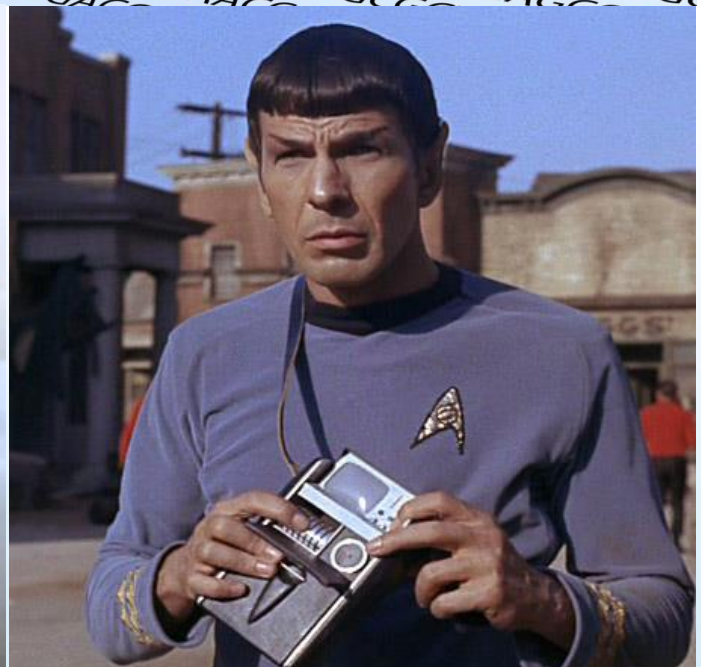
- What we can do now
  - Barcodes
  - “Finished” phylogenies
  - Microbes



Molecular Challenge

- What’s down the road
  - Massive sequence acquisition
  - Everyday sequencing
  - An alternative to Linnean taxonomy





A Brave New World?

- What is a 21st Century taxonomist?
- Who will fund him and her
- New Naturalists
- NBN