#### THE ECONOMY OF NATURE: STRUCTURE IN BIOLOGY

The History of Science and Contemporary Scientific Realism • Indianapolis, IN • 2/19/2016

Charles H. Pence and Daniel G. Swaim

Department of Philosophy and Religious Studies



#### BIOLOGICAL STRUCTURALISM

- McMullin (1984): gene as structural concept
- French (2011, 2012, 2014): biological models as structural, grounded in natural selection

Claim: Economy of nature as an underappreciated structural element in the history of biology



## Economic and theological contexts

The animal is formed by circumstances: this explains the inner perfection and its expediency with regard to external conditions. (Goethe)

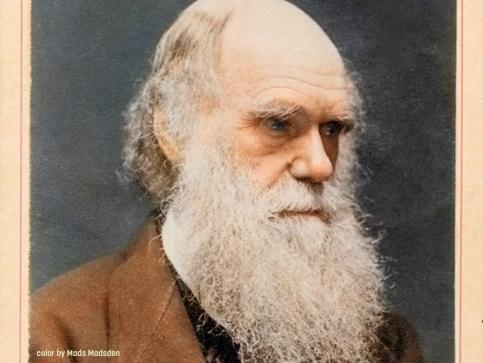
There is a law universal in Nature, tending to render every reproduction being the best possibly suited to its condition that its kind, or that organized matter is susceptible of, which appears intended to model the physical and mental or instinctive powers, to their highest perfection, and to continue them so. (Patrick Matthew)

Thus we see Nature resemble a well regulated state in which every individual has his proper employment and subsistence, and a proper gradation of offices and officers is appointed to correct and restrain every detrimental excess. (Linnaeus, *Police of Nature*)

	EGNU					
HITTAVEC HITTAMPHIDIA	E O IV	J M A	NI	M A	LE.	
Corpus Pales Quantum. Franken teinigente, Infilitente Garper plantellem. Alle dem. Franken collectes. Garper pales et figure and the collectes. Corpus policies. Franken collectes. Corpus policies. Franken collectes. Corpus policies. Corpus poli	ISCES.	V. INSECTA. Corpus crafts office costs loco technic. Copus			RMES.	de afini.
	Both sequences of the control of the	Bean   A principle   A princ	den	Gordon Train Lambrican Hevda Linne Cochlea	Copie Billiners, tears, displace.  Copie Milliners, photos, virializens.  Copie more, sensis premisest deliens.  Copie more, sensis premisest deliens.  Copie more, deligiona copies.  Copie more, deligiona copies.  Copies more, deligional, premises copies.  Note una core, Quality, subdicionals.	the spatial control of
	Anne entired market in Capitina. Capit.	Contacts.  Areadates.  Areadates.  Contacts.  Contacts.	раз разона пред раз	Cypeau.  Italiceis.  Parella.  Doursliers.  Conche.	The workeds constitute, ellen has been produced to the produce	Linea
\$\frac{1}{2} \frac{1}{2} \frac	Agines spice reflexed, From search of the Control o	Agric. Content solve stages, as a final solve sages, as a final solve specto, at a	Codes Codes Secretarios Apriles Codes de Spir Codes de Codes de Code de Codes de Cod	Lepos.	Tofa militariais, rubado desirso plane Cripo Series residido, milita, telebra	1
Collection   Contraction   C	Mente Amerik Attika. Teken seminingan Balaman. Mente seminin sanda. Mente Amerik Sanda. Mente Amerik Sanda. Mente Seminin semi	Cines. Pair 6. 26 a continue.  Notemeths. Pair 6 area pair record	Core Inhants Colonian Poli spatia Poli spa	Echinos.	Gryen felerocolom, salta substa, atta- do tremino, Gryen redorem, cerio tellam, folianza.	Pala nation frain nation seek organia, in productions in projections
	Amerika dan kerangan pendagan	Price. Pair & states hilling.  Acares, Pair & states hilling.  Acares, Pair & states hilling.	Politicis humans. Pol. 1900. Pol. pilom. Pol. pilom. Pol. pilom. Pol. politicis. Politicis pilom. Politicis	Medula Sepia Microcolous	dryw officiants; photosius, da- ve linearchit.  from stitupen; increa ation; a- ette ido entre desses.  Cryw rath beaugesk tebes.	Chica media. Chi samalinia Chi chicke. Chi altriphyse. Angle. Longs.
And Canada Grant	Cupe construint.  Cupe construint in the constru	Acastros, Ante Lóvid procession S. Ante sa prima daditimana, Oscilicos. Socilippendicia. Ante sa Socilippendicia.	Science Township  Science Meets, Control Meets, Control Spirit, Moha Branta, Control Spirit, Moha Branta, Control Spirit, Moha Branta, Control Spirit, Moha Spiri			

By the Oeconomy of Nature, we understand the all-wise disposition of the Creator in relation to natural things.... Whoever duly turns his attention to the things on this our terraqueous globe, must necessarily confess, that they are so connected, so chained together, that they all aim at the same end, and to this end a vast number of intermediate ends are subservient. (Oeconomy of Nature)

# A structure of *places* against which we should understand the distribution of life on earth



If proof were wanted let any singular change of climate [occur] here ... the pressure is always ready ... a thousand wedges are being forced into the œconomy of nature. (Sketch, 7-8)

I need hardly observe that the slow and gradual appearance of new forms follows from our theory, for to form a new species, an old one must not only be plastic in its organization, becoming so probably from changes in the conditions of its existence, but a place in the natural economy of the district must [be made,] come to exist, for the selection of some new modification of its structure, better fitted to the surrounding conditions than are the other individuals of the same or other species. (Sketch, 145)

# An empty *place* in the economy of nature as prerequisite for evolutionary change

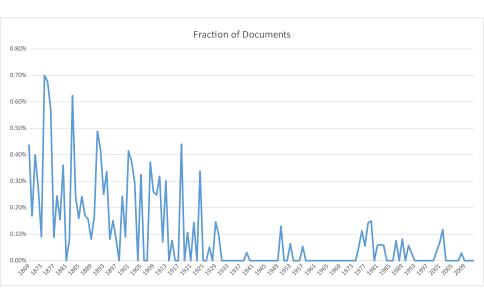
The face of Nature may be compared to a yielding surface, with ten thousand sharp wedges packed close together and driven inwards by incessant blows, sometimes one wedge being struck, and then another with greater force. (*Origin*, 67)

## Where'd the metaphor go?

The truth of the principle, that the greatest amount of life can be supported by great diversification of structure, is seen under many natural circumstances. In an extremely small area, especially if freely open to immigration, and where the contest between individual and individual must be severe, we always find great diversity in its inhabitants. (Origin, 114)

Principle of divergence still divulges information about the underlying structure present in nature

# AFTER DARWIN



Hypothesis: Structural role formerly occupied by the economy of nature taken up by genetics

The true role of the environment in evolution could not be understood until the nature of small mutations and of selection were fully comprehended (Mayr 1966, 3)

- Wright's Shifting Balance Theory
- Morrison on Fisher vs. Pearson on populations

**Take-home: Economy of nature** is a significant structural element throughout the history of evolutionary theory

#### With OSR:

- Preserved across theory change
- Modal
- Analytically prior to entities (organisms)
   Contra OSR:
- Not mathematical
- Directly intelligible
- Not evidently ontologically prior to entities

### **QUESTIONS?**

dswaim1@lsu.edu

charles@charlespence.net http://charlespence.net @pencechp