The Early History of 'Chance' in Evolution

&HPS4, Athens, Greece

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A Talk in Three Acts

- Act I: The “standard” historical narrative of chance in evolution

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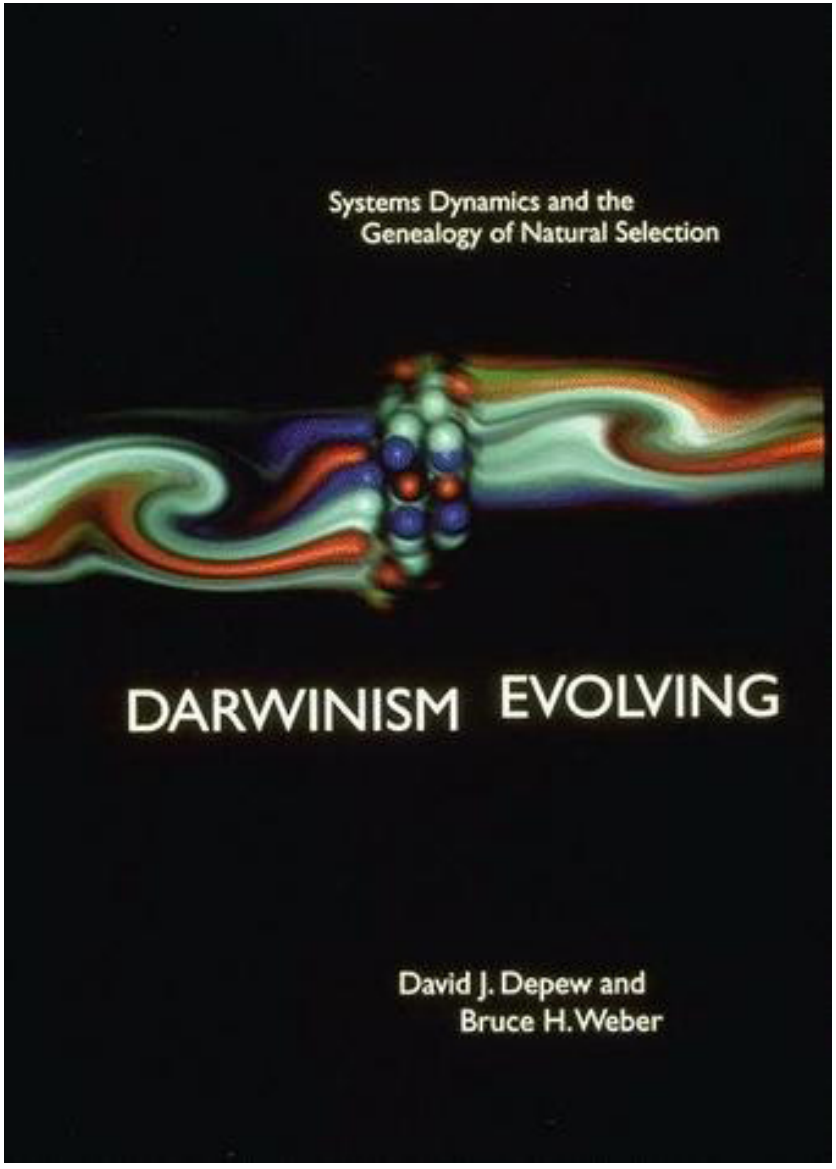
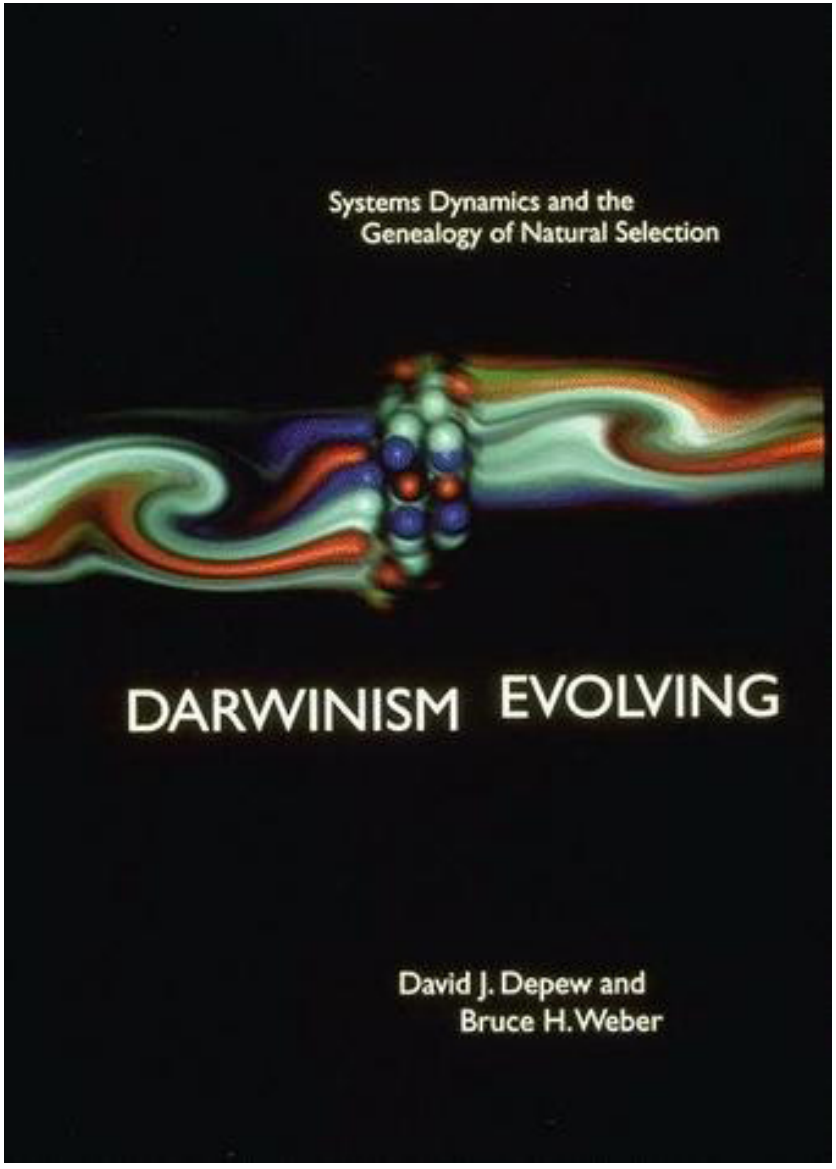
- Act II: A problem for the standard narrative: Pearson and Weldon
- Act III: A speculative philosophical conclusion

The “Standard History”



- Two questions:

The "Standard History"



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  1. When did evolution become a statistical theory?

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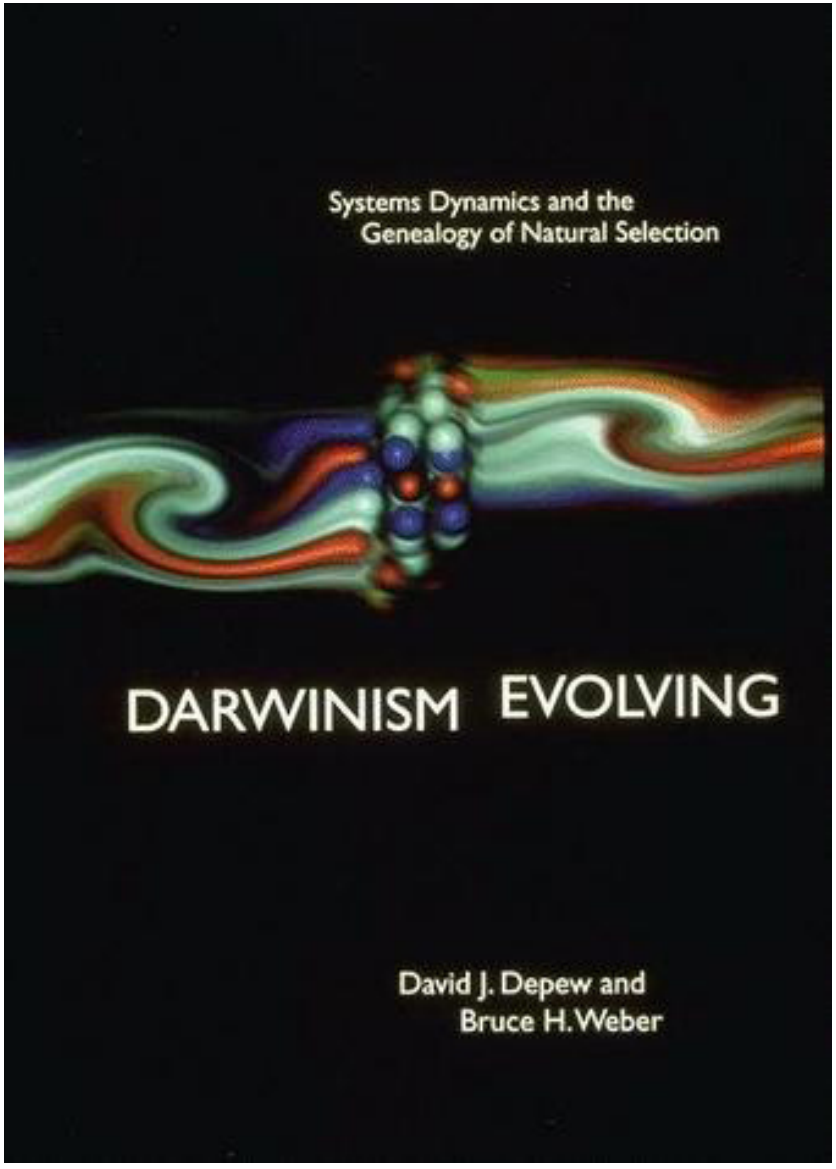
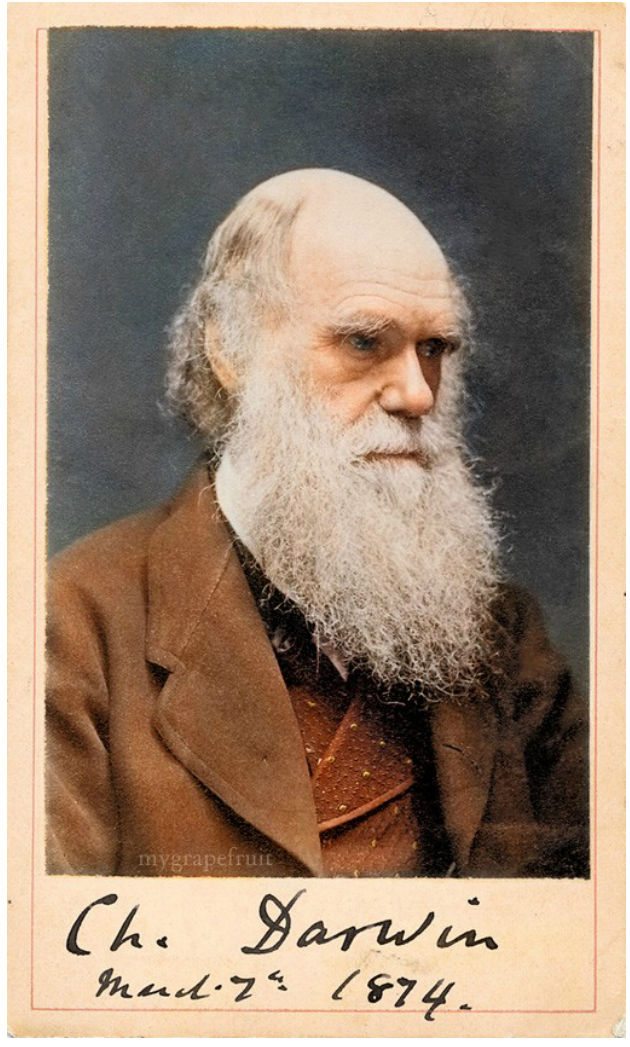


- Two questions:
  1. When did evolution become a statistical theory?
  2. When did evolution become a theory of "genuinely chancy" processes?

Some Preliminaries: Darwin



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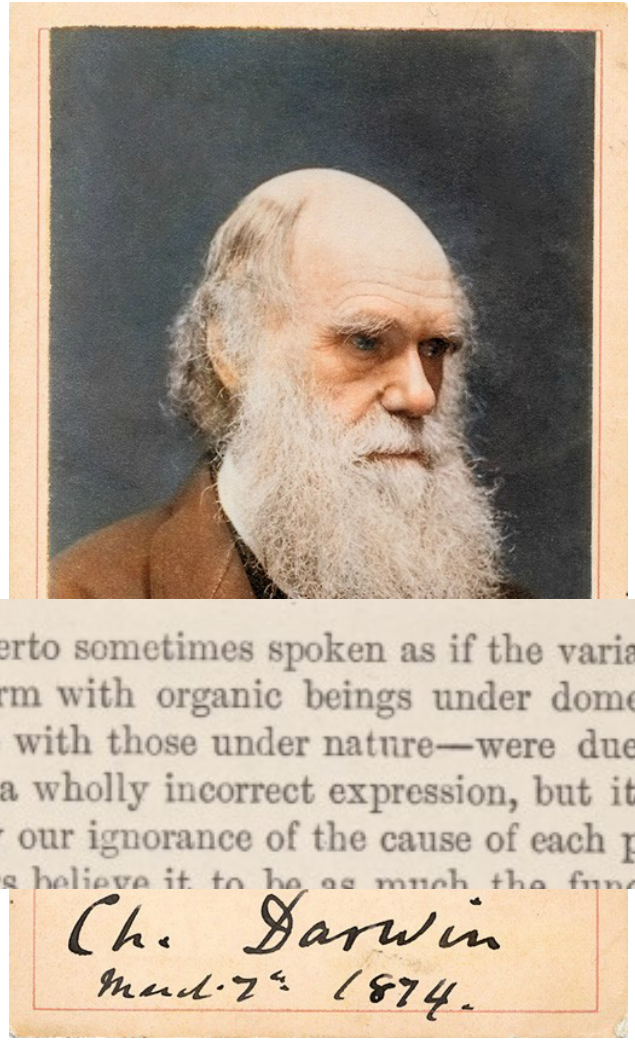
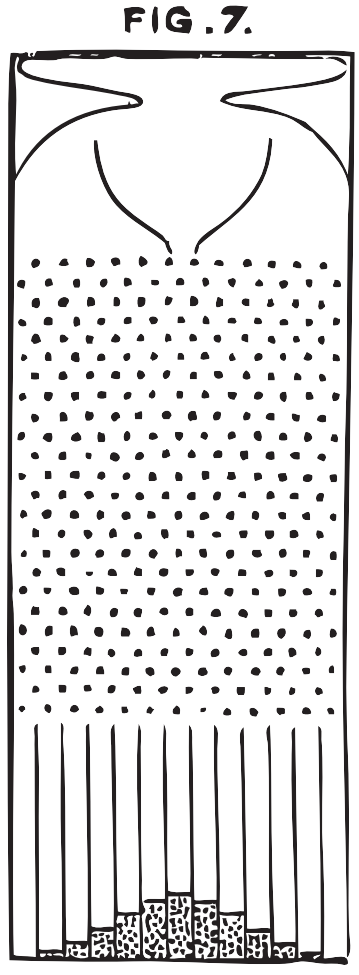


I HAVE hitherto sometimes spoken as if the variations—so common and multiform with organic beings under domestication, and in a lesser degree with those under nature—were due to chance. This, of course, is a wholly incorrect expression, but it serves to acknowledge plainly our ignorance of the cause of each particular variation. Some authors believe it to be as much the function of the repro-

Origin (1859), p. 106

Question 1: Francis Galton



Question 1: Francis Galton

The principle on which the action of the apparatus depends is, that a number of small and independent accidents befall each shot in its career. In rare cases, a long run of luck continues to favour the course of a particular shot towards either outside place, but in the large majority of instances the number of accidents that cause Deviation to the right, balance in a greater or less degree those that cause Deviation to the left. […] This illustrates and explains why mediocrity is so common.

Galton, *Natural Inheritance* (1889), pp. 64–65

Question 2: Sewall Wright

From Provine, *Sewall Wright and Evolutionary Biology*

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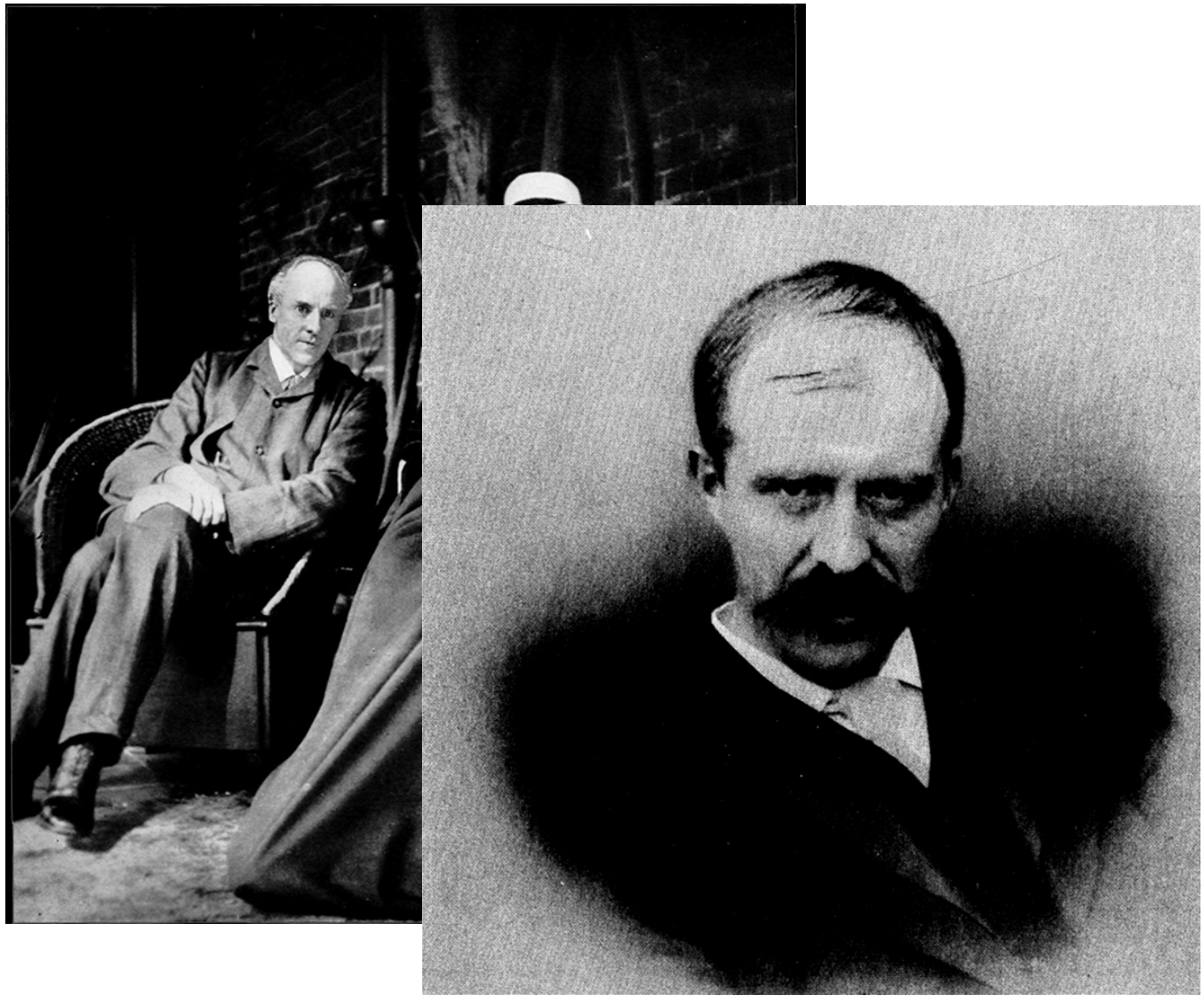
A Problematic: Pearson & Weldon



Traditional Questions: Pearson

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als Zeichen der Sympathie und Hochachtung

gewidmet vom Verfasser.

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In our ignorance we ought to consider before experience that nature may consist of all routines, all anomalies, or a mixture of the two in any proportion whatever, and that all such are equiprobable....

Pearson, *Grammar of Science,* 1st ed. (1892), p. 172

Traditional Questions: Weldon

All experience, which we are obliged to deal with statistically, is experience of results which depend upon a great number of complicated conditions, so many and so difficult to observe that we cannot tell in any given case what their effect will be.

Weldon, “Inheritance in Animals and Plants” (1906), p. 97

Pearson & Weldon on Chance

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"Describing our whole experience": The statistical philosophies of W. F. R. Weldon and Karl Pearson

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Pearson & Weldon on Chance

1. What was the content of Pearson's and Weldon's philosophical work on chance?

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2. What is the right way to understand their philosophical project?

Pearson and Biometry

[The last step of the scientific method is] the discovery by aid of the disciplined imagination of a brief statement or formula, which in a few words resumes the whole range of facts. Such a formula…is termed a scientific law. The object served by the discovery of such laws is the economy of thought.

Pearson, *Grammar of Science,* 1st ed. (1892), p. 93

Pearson and Biometry

[The lack of progress in biology is] largely owing to a certain prevalence of almost metaphysical speculation as to the causes of heredity, which have usurped the place of that careful collection and elaborate experiment by which alone sufficient data might have been accumulated, with a view to ultimately narrowing and specialising the circumstances under which correlation was measured.

Pearson, “Mathematical Contributions to the Theory of Evolution. III. Regression, Heredity, and Panmixia” (1896), p. 255

Weldon on Statistics

If we want to make a statement about the stature of Englishmen, we must find a way of describing our whole experience; we must find some simple way of describing our whole experience, so that we can easily remember and communicate to others how many men of any given height we find among a thousand Englishmen. We must give up the attempt to replace our experiences by a simple average value and try to describe the whole series of results our observation has yielded.

Weldon, “Inheritance in Animals and Plants” (1906), p. 94

Weldon on Cause

Prof. Weldon declared, with some expressions of reluctance and regret – due, as he was good enough to say, from an old pupil to the teacher whom he is about to denounce and demolish – that to attempt to say which of two or more correlated growths is the cause of survival is unreasonable, and that when I suggested, even as a matter for consideration, that a certain germ-slaying quality in phagocytes accompanying a pigmented skin, rather than the pigment itself in the skin, is the cause of the survival of dark-skinned people in malarial regions, I was "absolutely illogical." "It is," said Prof. Weldon, "impossible logically to separate these two correlated phenomena. The coloured skin is as much a cause of the survival of the dark man as is the germ-destroying property of his blood."

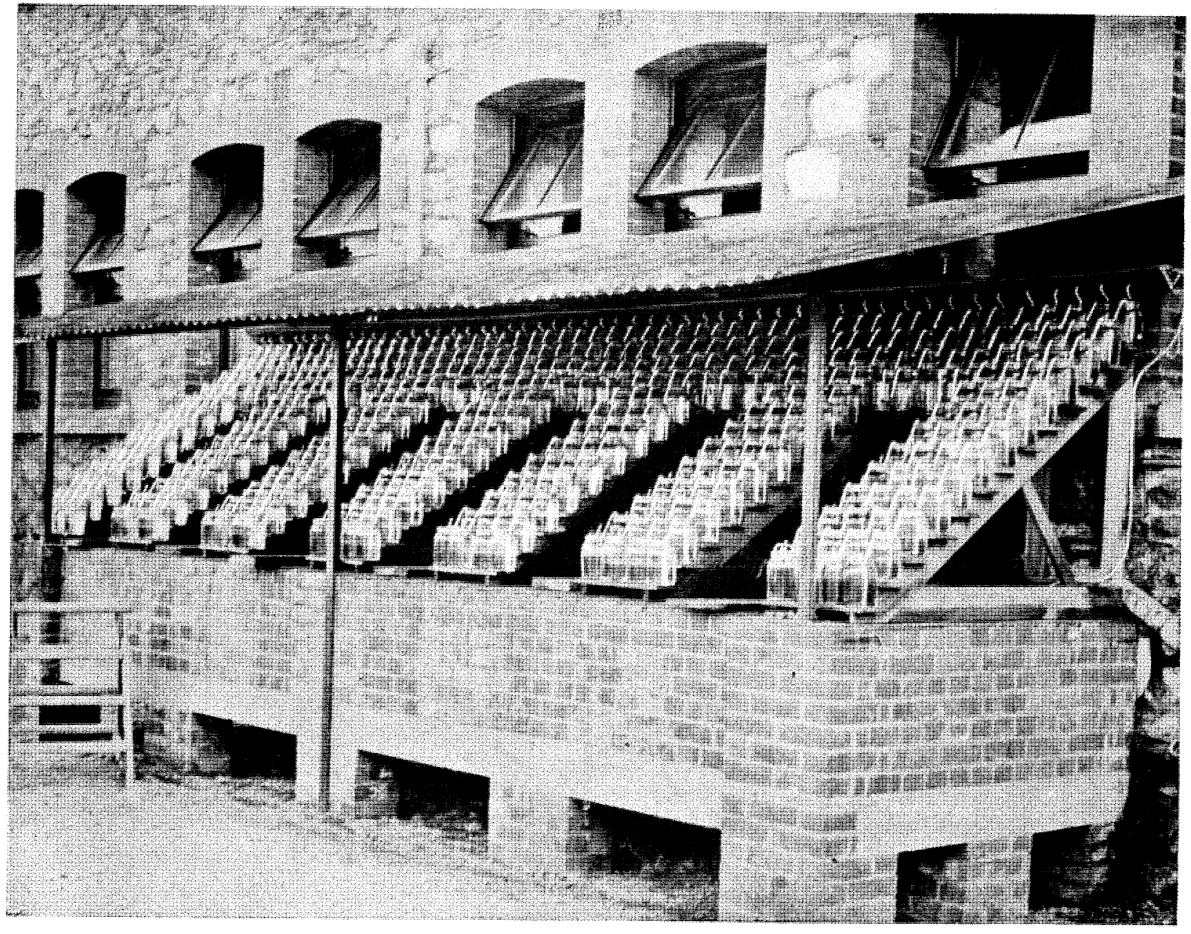
E. Ray Lankester, "Are Specific Characters Useful? [letter]" *Nature* 54:1394 (1896), p. 245

Pearson vs. Weldon

On the second point [causation], surely Prof. Lankester is entirely in the right? It is not sufficient to show that there is a correlation between a certain frontal ratio and death-rate in order to assert that the frontal ratio is a cause of death-rate. Very probably it may be, but the definition is not logically complete, or at any rate a definition of cause has been adopted which does not appear of much utility to science.

Pearson, "The Utility of Specific Characters [letter]"
Nature 54:1403 (1896), pp. 460–461

Weldon's Crabbery



A "Crabbery" at Plymouth.

Pearson & Weldon on Chance

Pearson:

- Positivist role of science for the economy of thought
- Statistics as a tool for simplification of data
- Causation as precise mathematical law (think Newton)

Weldon:

- Science as the maximally complete description of nature
- Statistics as a tool to capture all causal influences
- Causation = correlation (and experiments sharpen our correlations)

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- Pearson: acausal, anti-realist view of biological theories
- Weldon: statistical theories *as* causal descriptions of the world

Speculative Philosophical Coda

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The "causalist/statisticalist debate" in the philosophy of biology:

- Causalist: Biological theories describe causal processes of natural selection and genetic drift (Hodge, Beatty, Finsen, Millstein, Stephens, Ramsey, Abrams, Otsuka, Turner, Allen, Lloyd)
- Statisticalist: Biological theories are merely statistical summaries of genuinely causal individual-level events

  (Walsh, Matthen, Ariew, Lewens, Ernst, Krimbas, Brunnander)

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Odd case: historical case responds *better* to contemporary questions than to historical questions?

ευχαριστώ!

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