# Theory of Evolution : principles and History

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# Introduction

To understand the darwinian theory of evolution :

- Theoretical basement,
- and History.
- problèmes.

The following talk is Gayon 1991.

# Darwinian Theory of Evolution

For Darwini it's a :

> *Theory of descent with modification by variation and Natural Selection*

Two component :

- Descente w/ Modification : random variation & heredity.
- Hypothesis of natural selection :"survival of the fittest" (Spencer's words).

Finally we have : a theory which explains how species change & diverge

# Descent with modifications

The Darwin's theory of evolutions is built on

- parents to offsprings transmission of characters,
- character's variations.

That's what Darwin call *desent with variation*.

In Darwin's time :

- No theory of heredity !

But Darwin admit some properties to variations : they have to be *random* and *gradual* (quasi continue variations).

# Jenkin's critic

This caracterisation of the variation raise numerous problems that Jenkin show :

- If variation is as Darwin want it :
  - no new caracters' fixation
  - no evolution.
- the most serious critic for Darwin.

This has the woth to :

- Raise statistic as a tool to study Biology.
- Engage Biologist to focus on the origin of variations.

# The Natural Selection Hyopthesis

The Hypothesis : *if* descent with modification and restricted ressources *so* :

*Survival of the fittest* (Spencer 1864)

, il la *Natural Selection* can act.

Problem : hard to prove (Darwin won't).
To strengthen it, Darwin develop :

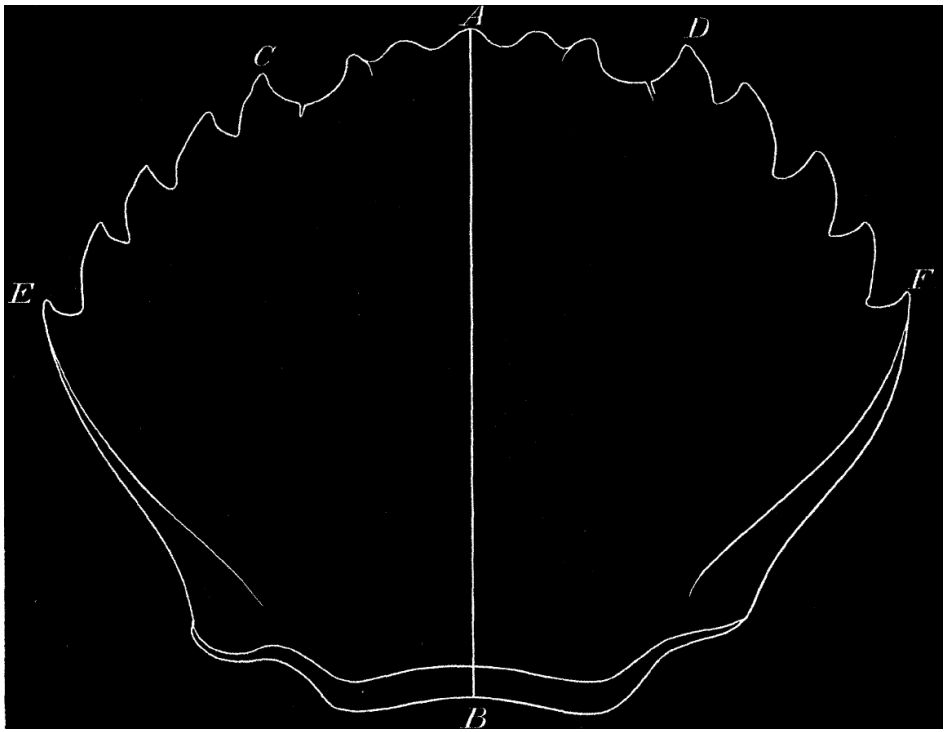
- Analogy with Artificial Selection : if AS allow races modification, so SN does.

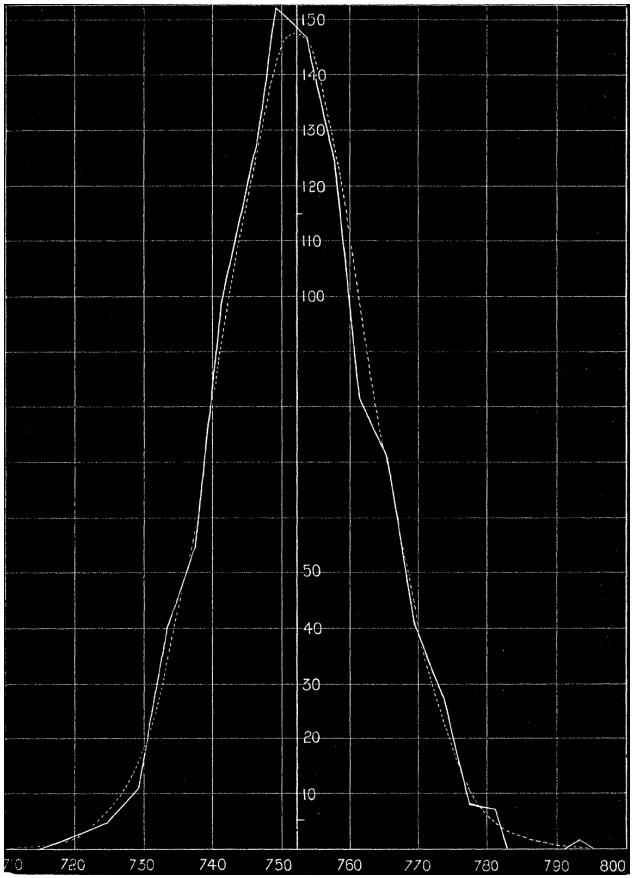
→ A strong of evolution but lacking of proof and empirical support.

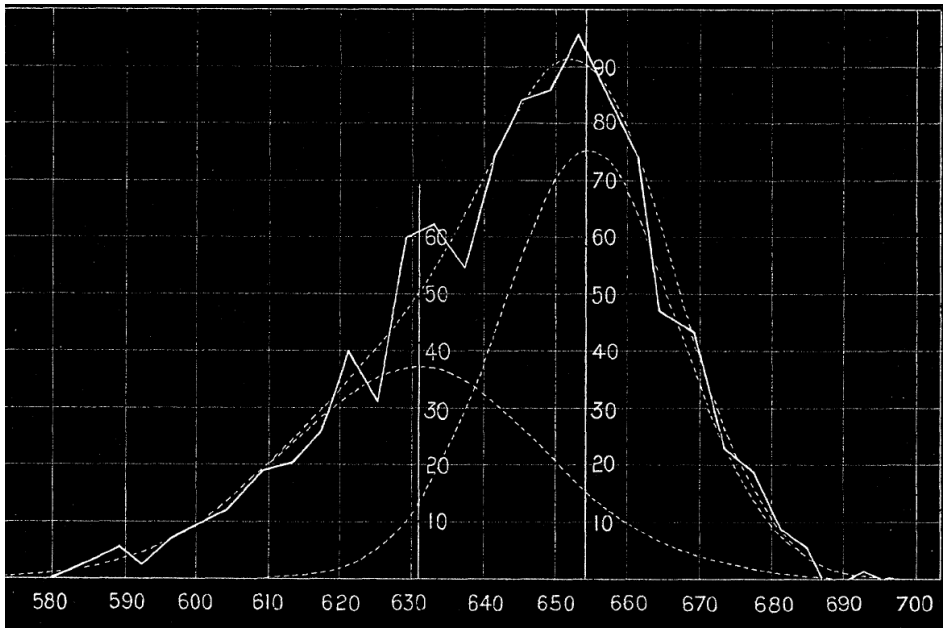
# Biometricians

School initiated by Galton (Darwin's cousin), performing between 1890 - 1916 : Pearson, Weldon.
Aims : prove the action of Natural Selection.

- "Mathematical (Statistical) Proof.
- Indepedant of any physiological theories.
- Really different philosophy (vs Darwin).






(from Weldon 1893)

# Mendelism

Beggining of XXe : rediscovery of Mendel's works (by de Vries) :

- no continu variations,
- hybridation of discontinuous traits
- evolution : jump & large mutation (saltationism)

In contradiction with Darwin :
$\rightarrow$ species appear with large mutations, by "jumps" : not by the action of Natural Selection .

# Modern Synthesis

Reconciliate Mendel & Darwin through the genetc theory of evolution Fisher 1918, Haldane & Wright.
$\rightarrow$ Population genetics.

Even between actor some vision are differents :

- Fisher : Newton-like ideal "the Fundamental Theorem of Natural Selection".
- Wright : local adaptation : the model of "Adaptative Landscapes".

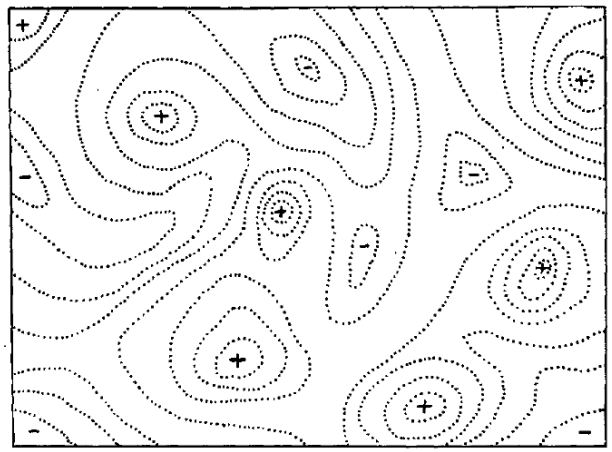


FIGURE 2.—Diagrammatic representation of the field of gene combinations in two dimensions instead of many thousands. Dotted lines represent contours with respect to adaptiveness.

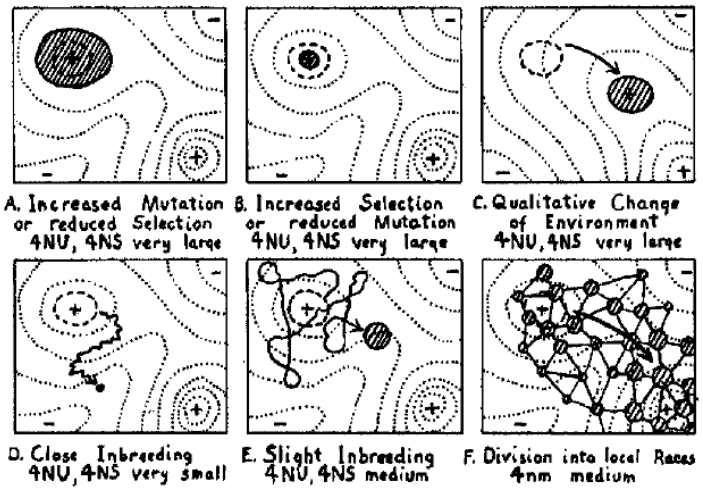



FIGURE 4.—Field of gene combinations occupied by a population within the general field of possible combinations. Type of history under specified conditions indicated by relation to initial field (heavy broken contour) and arrow.

Years of synthesis : all biological related domains are rattached to the genetec theory of evolution (30's 60's).

# An evolutionary synthesis

Modern synthesis, emergence of a consensus

- Biological individual are the product of genetical information transmitted by the germ line (Followin Weisman and central dogma) :

$$\text{DNA} \rightarrow \text{transcription} \rightarrow \text{traduction} \rightarrow \text{protein}$$

- Genetical information spread from $G^-$ to $G^-$ via DNA which randomly vary.
- Evolution is change in allele frequencies.

# Level and unit of selection

Lewontin (1972) :

In a population,

1. indiv. $\neq \rightarrow$ morpho., physio., behavior $\neq$ (phenotypic variation).
2. phenotypes $\neq \rightarrow$ survival or reproductive rates $\neq$ in $\neq$ env. (differential fitness).
3. correlation btw parents & offsprints each $G^-$ futur (fitness heredity).

This definition don't impose a level of biological organisation.
So which one is the right one ? (gene, chromosomes, organism, organes, species. . . ) ?

# Level & Unit of selection

Different approach of the pb (Gould : human cognitive limitation)

- Hull-Dawkins : replicator/interactor.
- Superorganism (Wilson & Sober).
- ...

Questions that have to be answered when applying Darwin to Musical structures.

# Godfrey-Smith, darwinian population

Peter Godfrey-Smith thinks that "recipes" have problems

- Mix to hardly councilable goals :
  - "Universal"algorithm
  - Be able to describe eveyr evolutives tales.

It's impossible, so : $\rightarrow$ Darwinian Population

1. Minimals (Lewontin's recipes)
2. Paradigmatics (clear multicell. orga. w/ sexual reproduction (Darwin analogy) . . . )
3. Marginals

# PGS' space

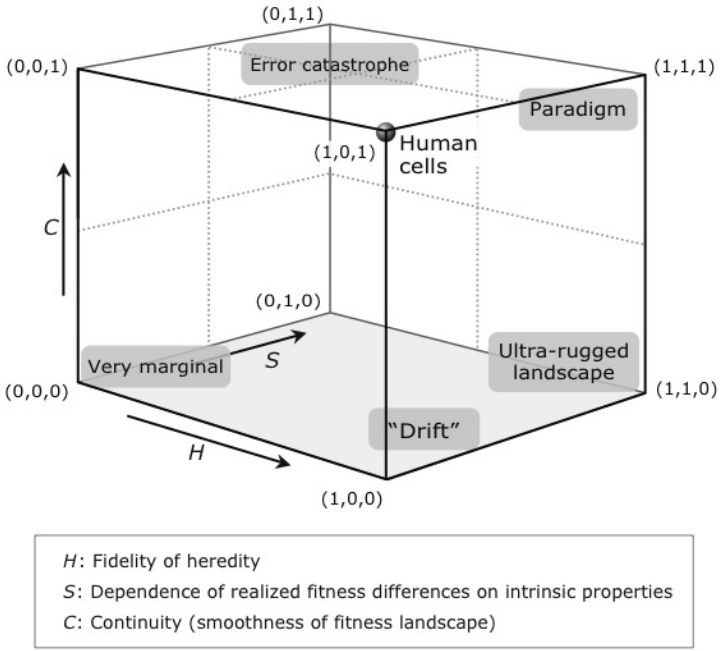



Figure: from PGS (2009, p.64)

Decomposition into sub properties, ideal frame to include radically differents objects.

# Conclusion

The questions handeled by darwinian theory of evolution are huge and complexes. Export the theory out of is orginal bounds can be valuable for many reasons but one have always to keep in mind *what* he is trying to use and *how* he will use it.