

語言工程實驗室

Language Engineering Laboratory



LANGUAGE, *EVOLUTION* and the *BRAIN*

Nanyang Technological University
February 2011

William S-Y. Wang 王士元
wsywang@ee.cuhk.edu.hk

语言、演化 与 大脑

download from

www.ee.cuhk.edu.hk/~lel/

YYDN110202.pdf

114fig6per.pdf

Comments would be appreciated!

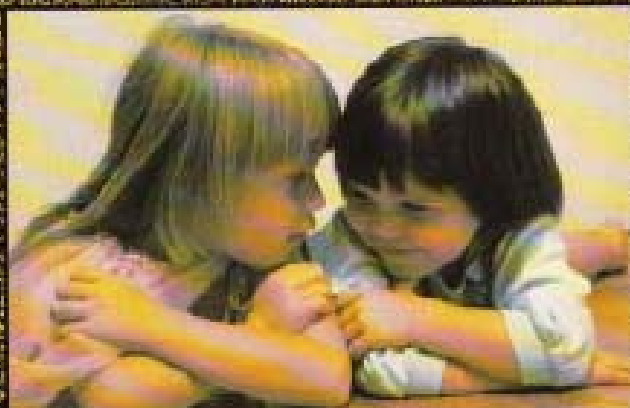
	19th century	20th century (first half)	20th century (second half)	21st century
<u>Evolution</u>	Darwin, Mendel	Synthetic theory of evolution	Watson-Crick (1962)	Decoding human genome
<u>Neuro-science</u>	Broca, Wernicke	Cajal (1906) Sherrington (1932)	Sperry (1981) Hebb Penfield	Brain imaging
<u>Linguistics</u>	Schleicher Schmidt	Saussure Sapir Jakobson Greenberg	Generative grammar (MIT) Construction grammar (Berkeley)	Evolutionary linguistics

READINGS FROM

SCIENTIFIC
AMERICAN

The Emergence of Language Development and Evolution

WILLIAM S.-Y. WANG



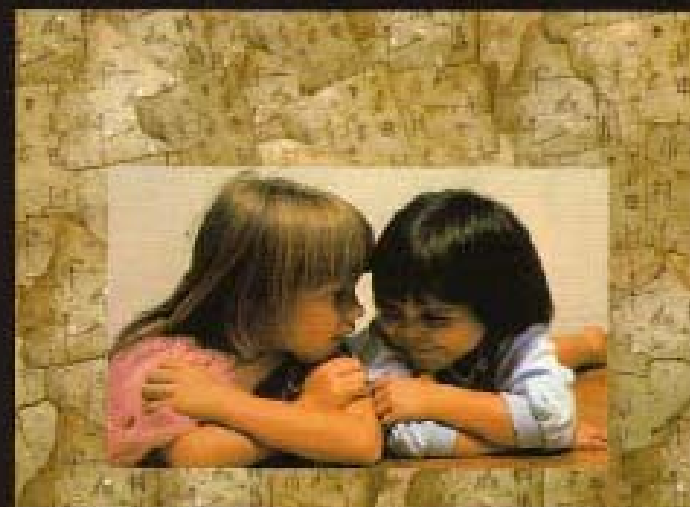
《語言暨語言學》專刊 D-1

LANGUAGE AND LINGUISTICS MONOGRAPH D-1

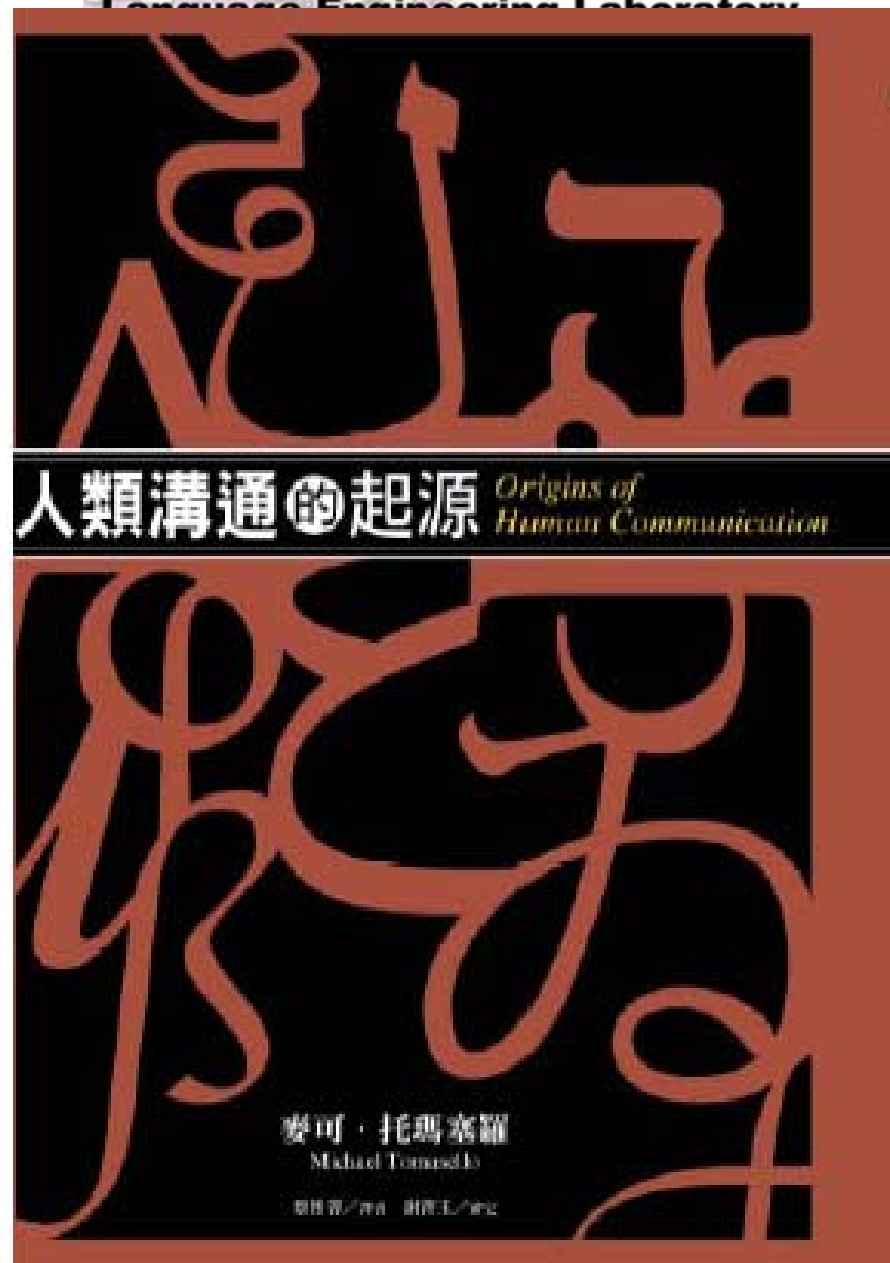
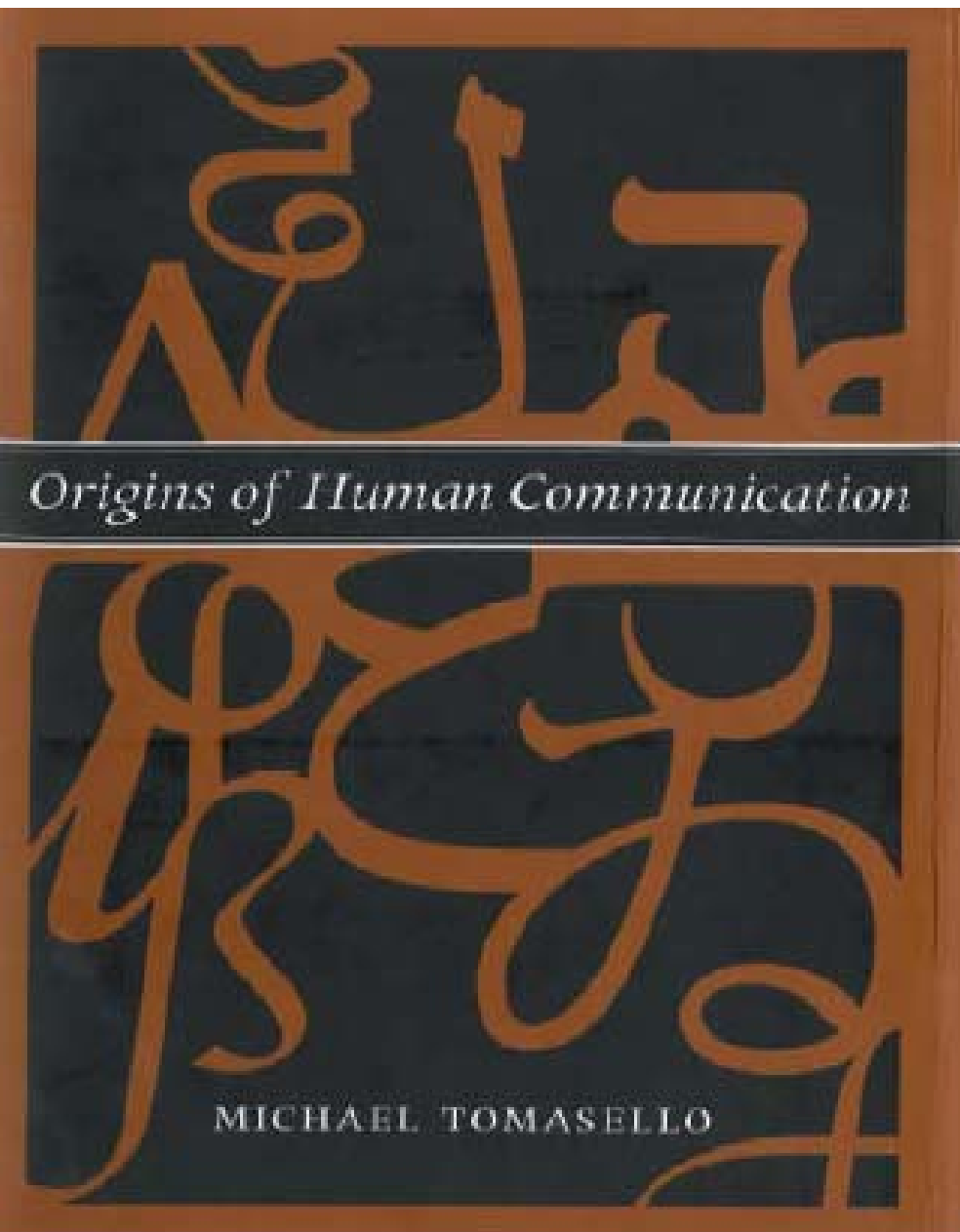
語言湧現：發展與演化

編輯：王士元

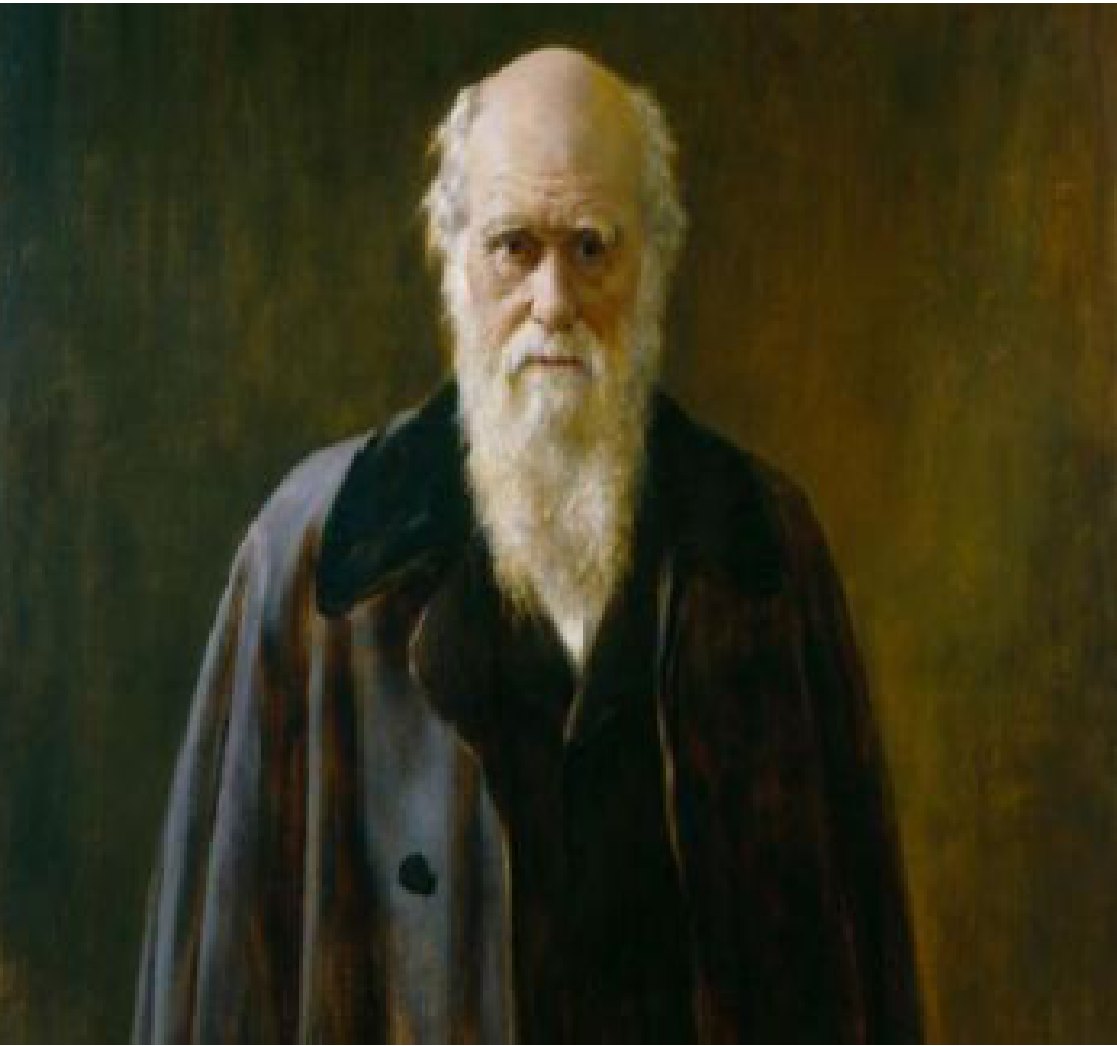
翻譯：林幼菁



中央研究院 語言學研究所
Institute of Linguistics, Academia Sinica
2008



Founders of Theory of Evolution



Charles Darwin 1809 - 1882

Gregor Mendel 1822 - 1884



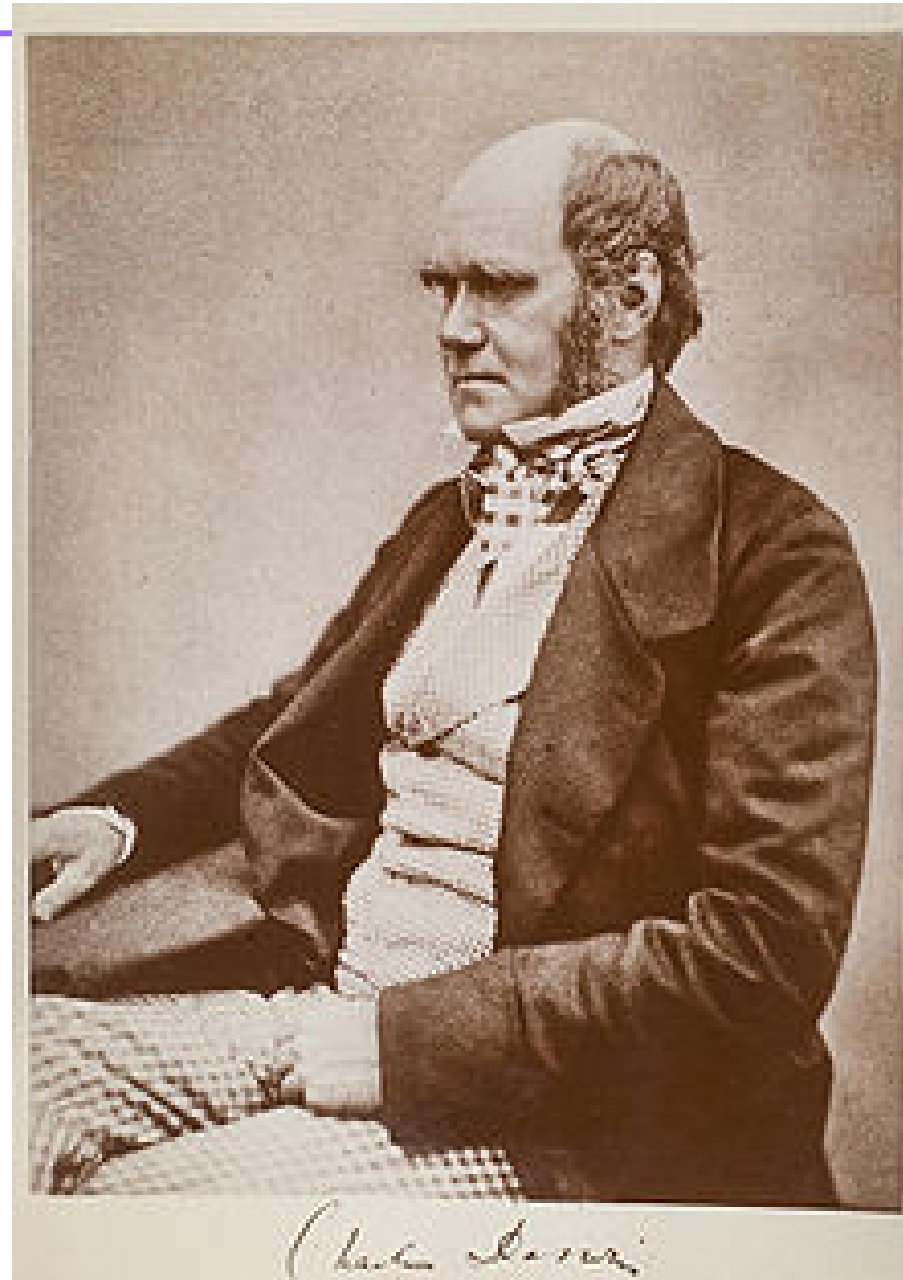
Charles Darwin 1809-1882

1859. On the Origin of Species by Means of Natural Selection or The preservation of Favored Races in the Struggle for Life.

1871. The Descent of Man, and Selection in Relation to Sex.

1872. The Expression of the Emotions in Man and Animals

物竞天择，适者生存



Gregor Mendel

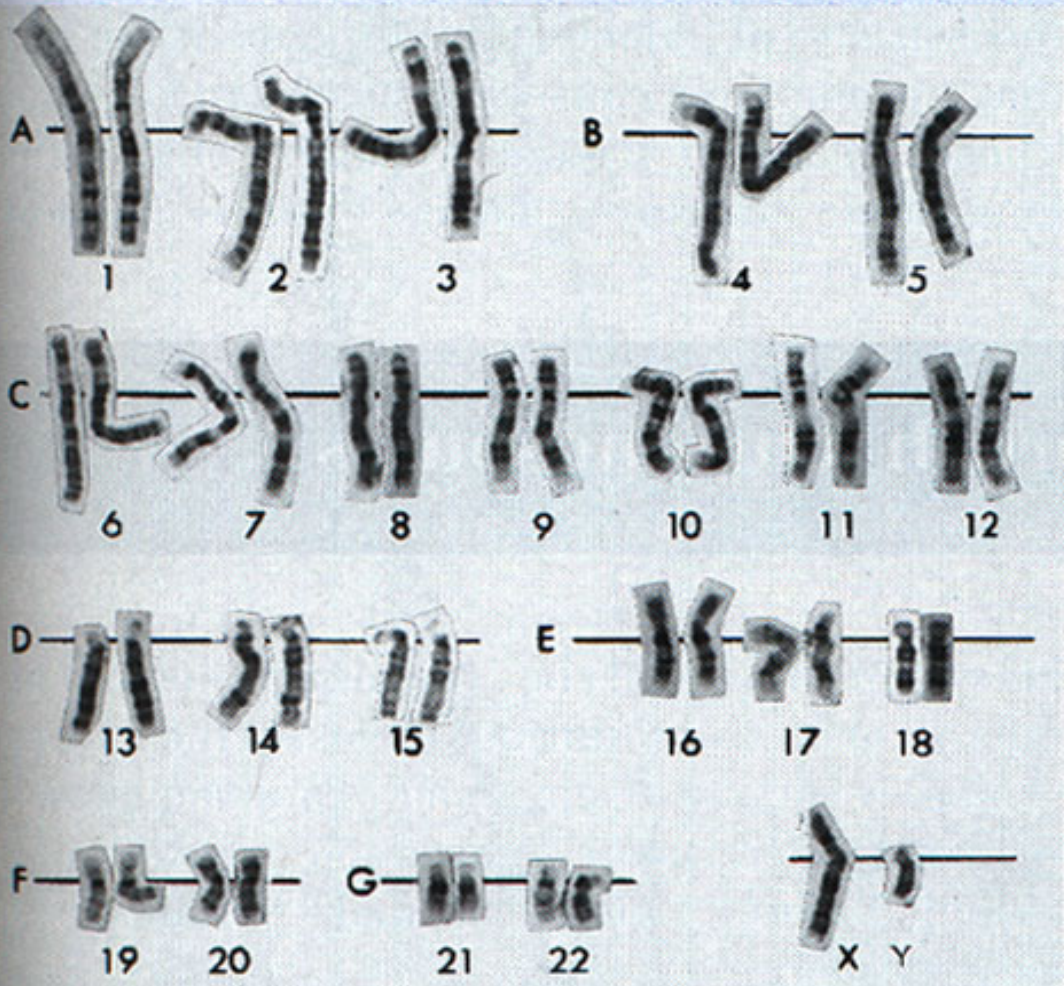
1822- 1884

**EXPERIMENTS IN PLANT
HYBRIDIZATION. 1865.**

**Verhandlungen des
naturforschenden
Vereines in Brünn. 3-47.**



Figure 26.10 G-banding generates a characteristic lateral series of bands in each member of the chromosome set. Photograph kindly provided by Lisa Shaffer.



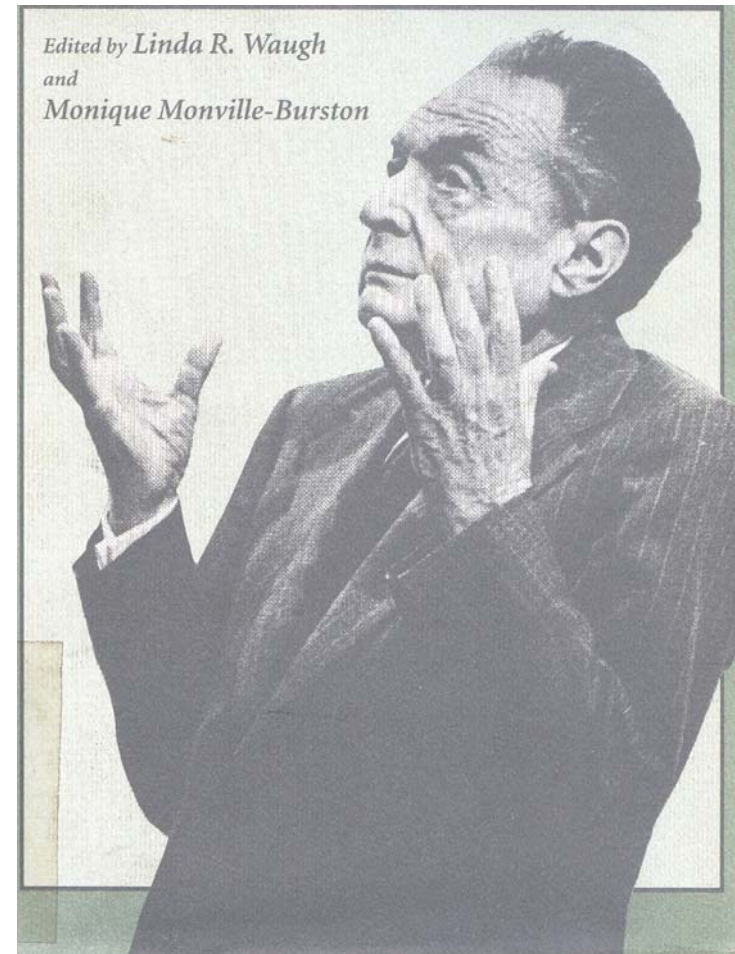
Human
chromosome
set

Roman Jakobson, 1896 -1982.

*1929. Remarques sur
l'évolution phonologique
du russe comparée à
celles des autres langues
slaves.*

*1941. Kindersprache,
Aphasie und allgemeine
Lautgesetze.*

*1951. Preliminaries to
Speech Analysis. [with
Gunnar Fant & Morris
Halle].*



On Language. *Linda Waugh, ed.*

"Among all the *information-carrying* systems, the genetic code is the only one which shares with the verbal code a sequential arrangement of discrete units - *phonemes* in language and *nucleotides* in the genetic code - which by themselves are devoid of inherent meaning but serve to build minimal units endowed with their own, intrinsic meaning."

gene :: alleles = meaning :: words

hair color :: blond
 brunette
 redhead

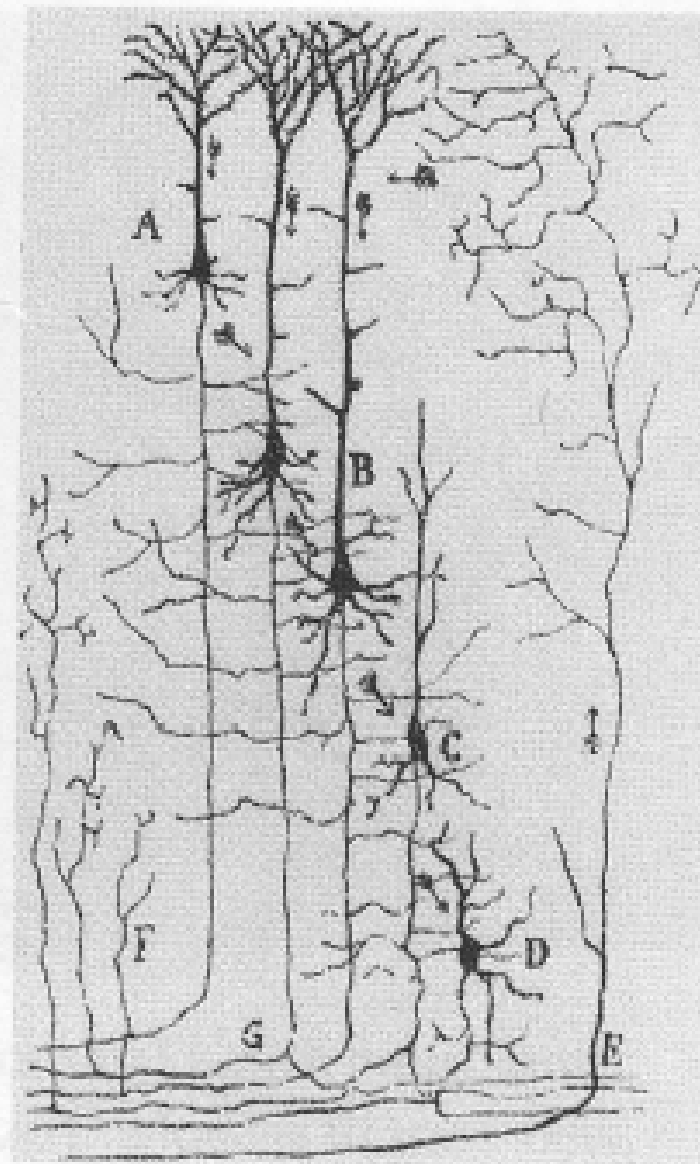
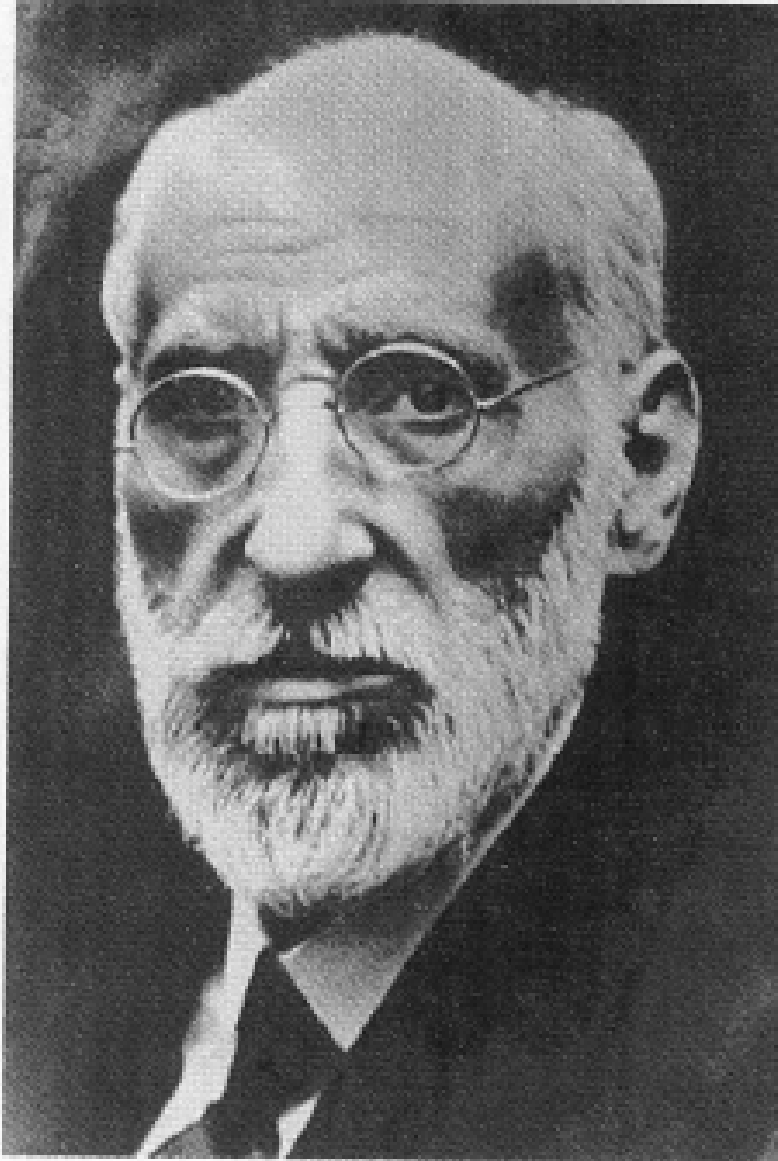
H₂O :: water
 vada
 mizu
 shui
 agua



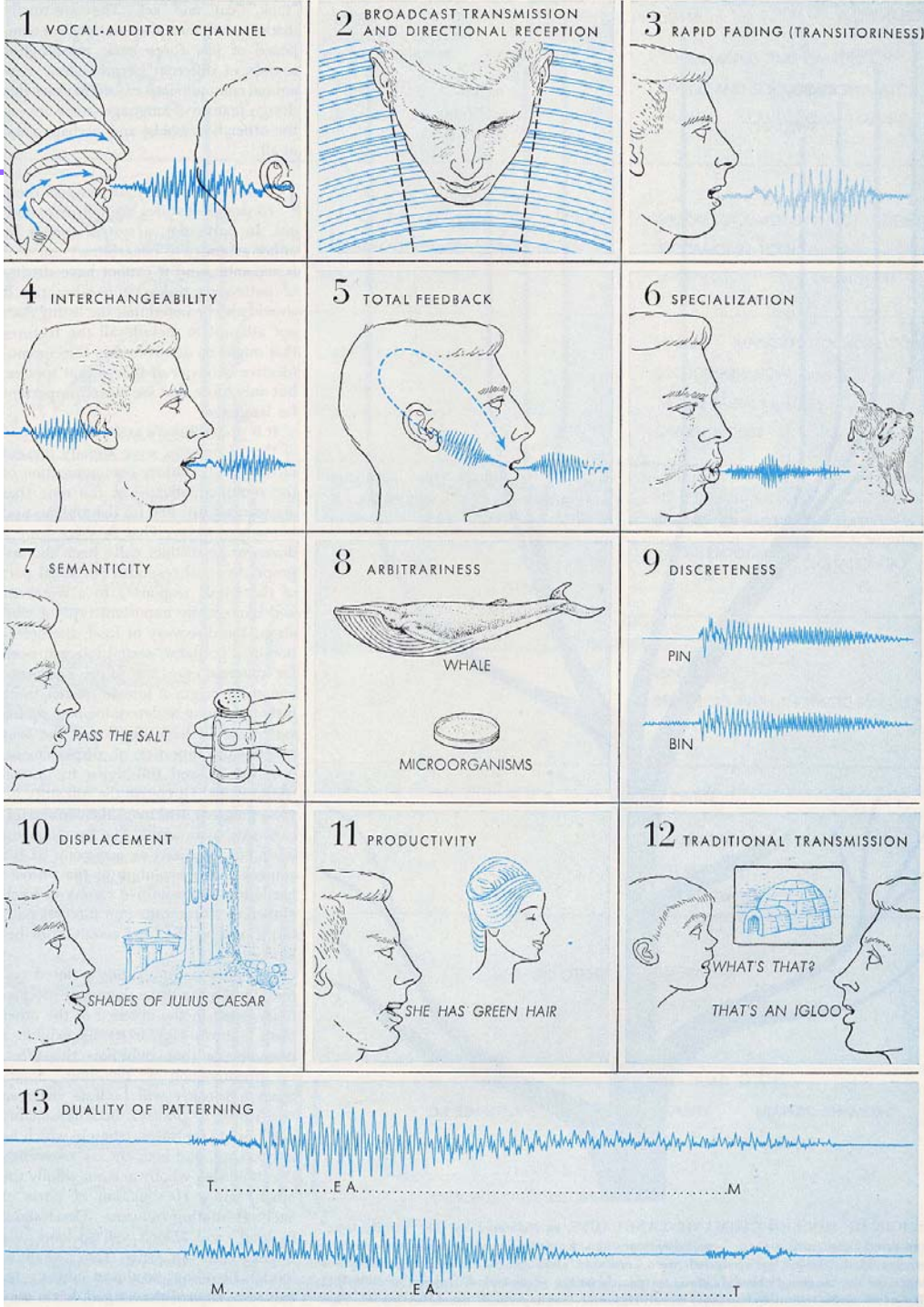
Edward Sapir 1884-1939

“It is peculiarly important that linguists, who are often accused, and accused justly, of failure to look beyond pretty patterns of their subject matter, should become aware of **what their science may mean for the interpretation of human conduct in general.**”

*The status of linguistics
as a science.
Language. 1929.*

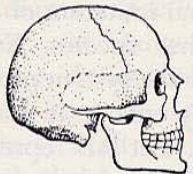
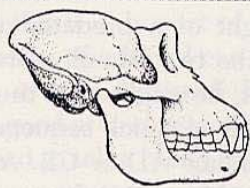
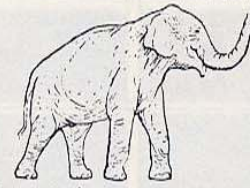
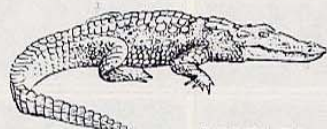


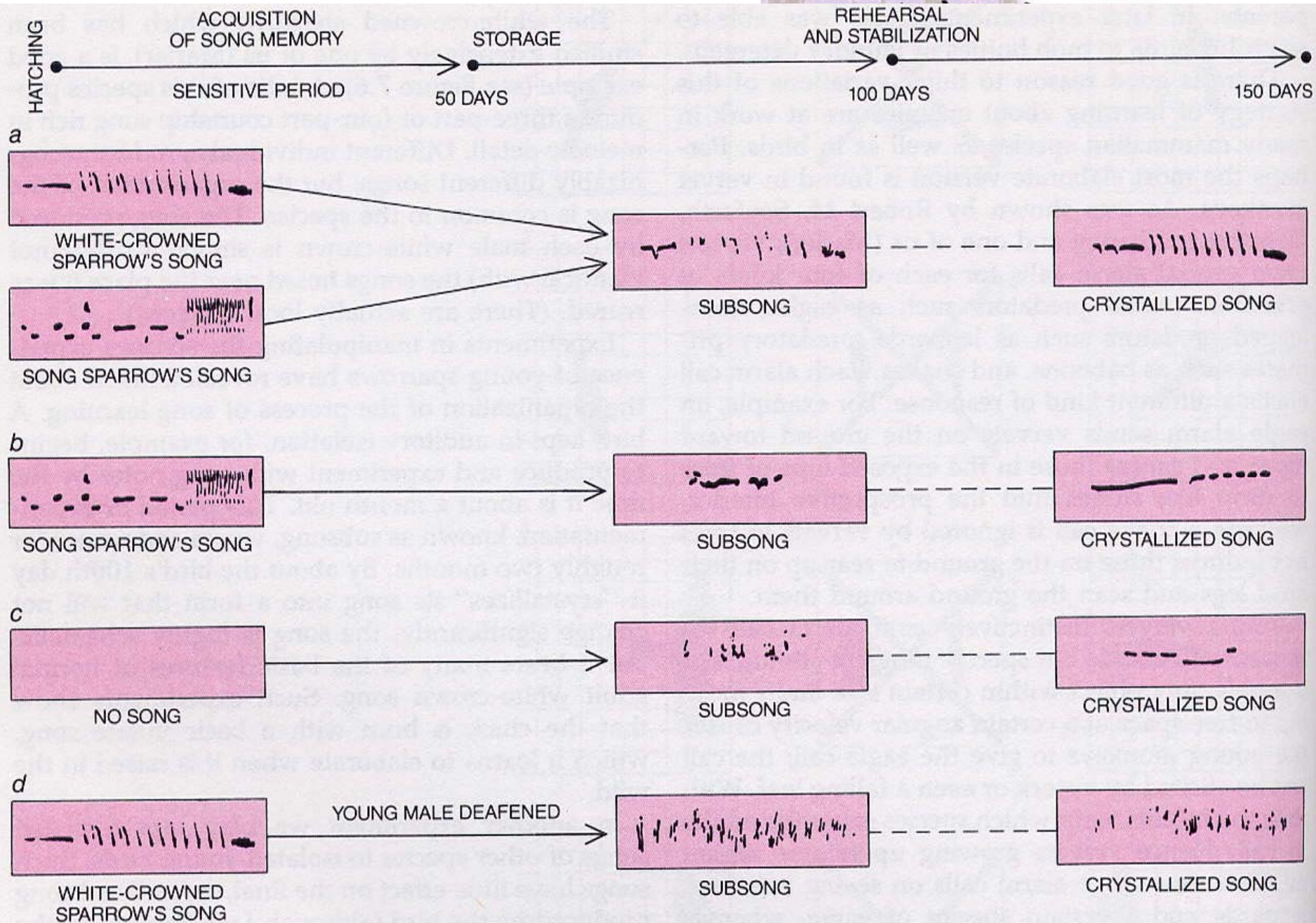
Left: Santiago Ramón y Cajal (1852–1934), co-winner of the Nobel Prize in 1906. **Right:** Cajal's drawing of the afferent inflow to the mammalian cortex.

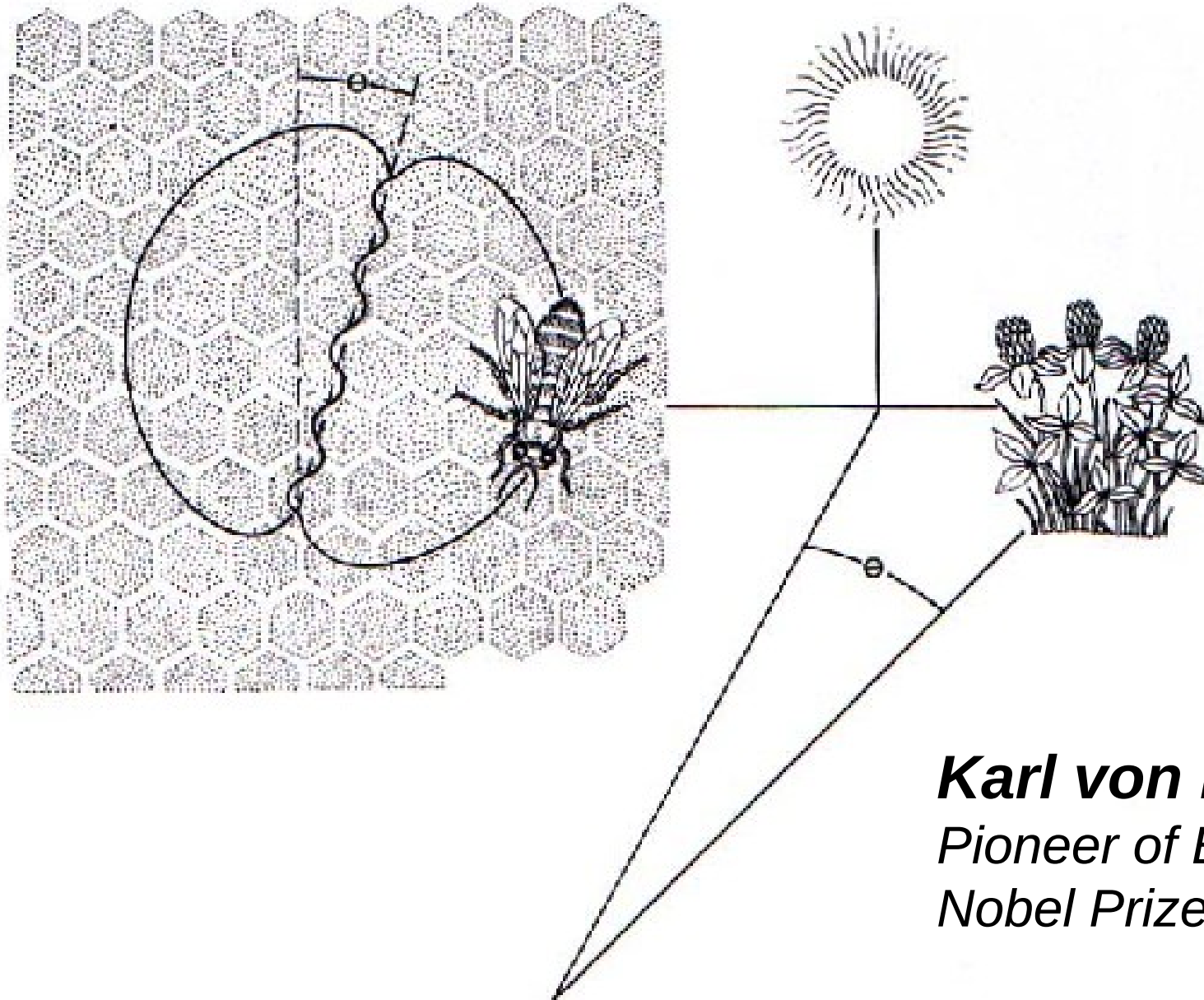


C.F.Hockett, 1960 Origin of Speech

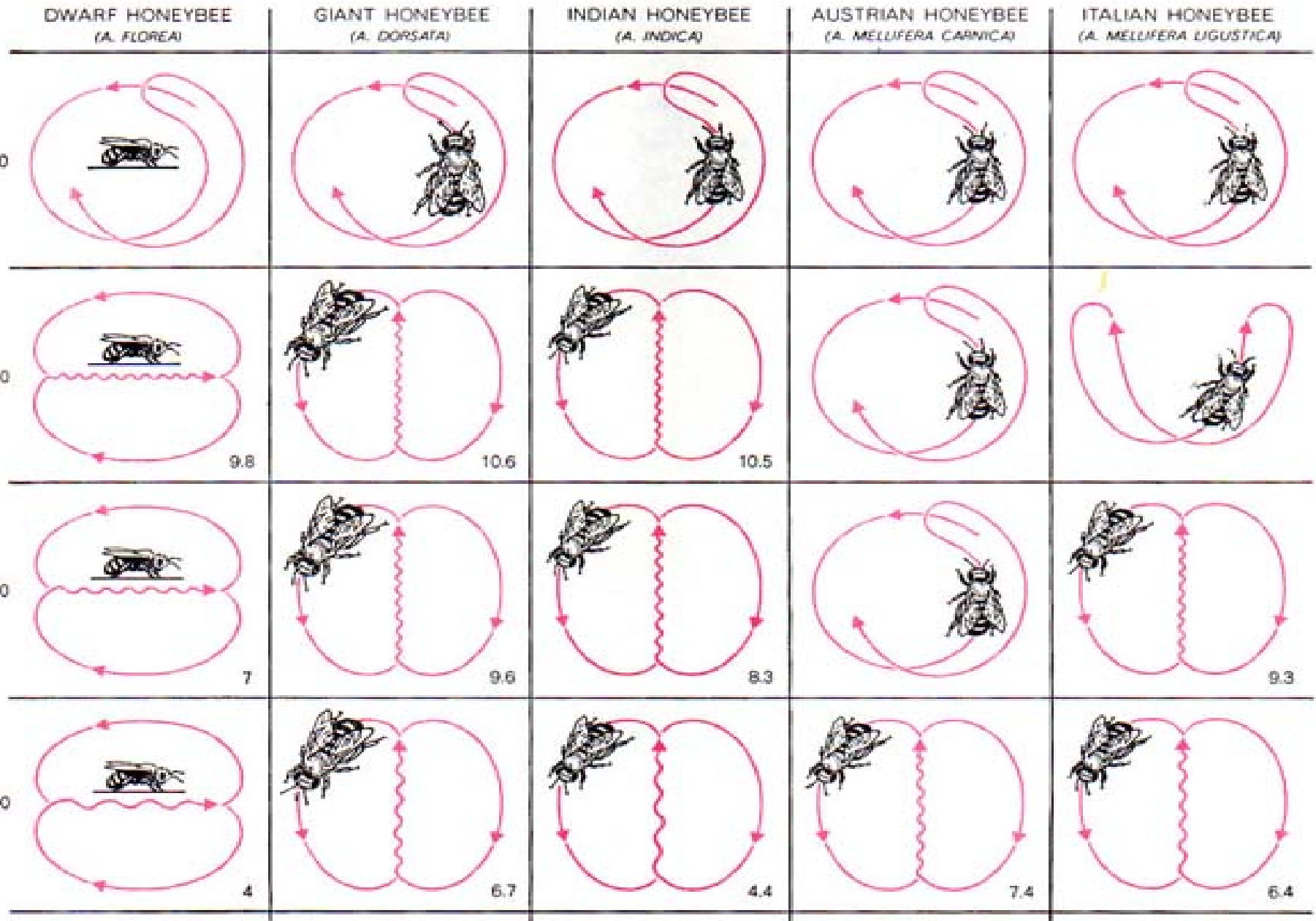
Human Communication.
Language and its
Psychobiological Bases.
W.S-Y.Wang, ed. p.7.

 MAN	DISPLACEMENT PRODUCTIVITY DUALITY OF PATTERNING	TOOL-MAKING AND CARRYING LARYNX AND SOFT PALATE SEPARATED HUMOR VOWEL COLOR MUSIC
 HOMINIDS	DISCRETENESS TRADITIONAL TRANSMISSION	BIPEDAL LOCOMOTION, NOT UPRIGHT OCCASIONAL TOOL USING
 PRIMATES	SPECIALIZATION SEMANTICITY ARBITRARINESS	HANDS HAND-EYE COORDINATION BINOCULAR VISION MOBILE FACIAL MUSCLES OMNIVOROUS?
 (LAND) MAMMALS	BROADCAST TRANSMISSION AND DIRECTIONAL RECEPTION INTERCHANGEABILITY RAPID FADING TOTAL FEEDBACK VOCAL-AUDITORY CHANNEL	SOCIAL BEHAVIOR "PLAY" WARM BLOODEDNESS
 REPTILES		LAND EGG BREATHING WITH THORACIC MUSCLES



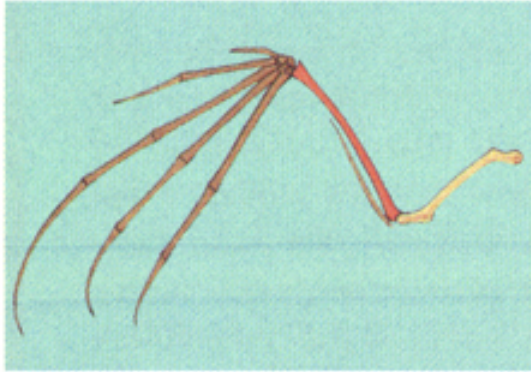


Karl von Frisch
Pioneer of Ethology
Nobel Prize 1973

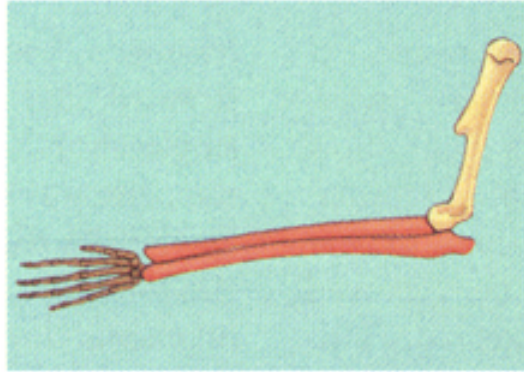


HOMOLOGY

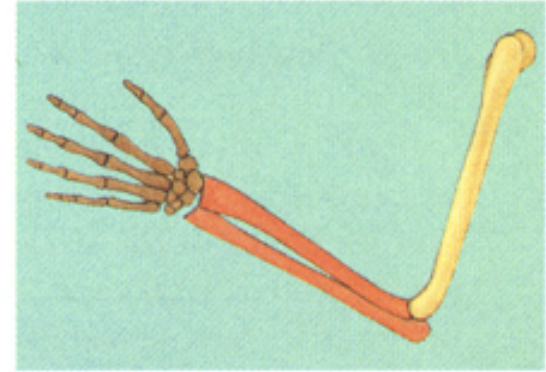
Bat wing



Mouse forelimb



Human arm



ANALOGY

Bat wing



Bird wing

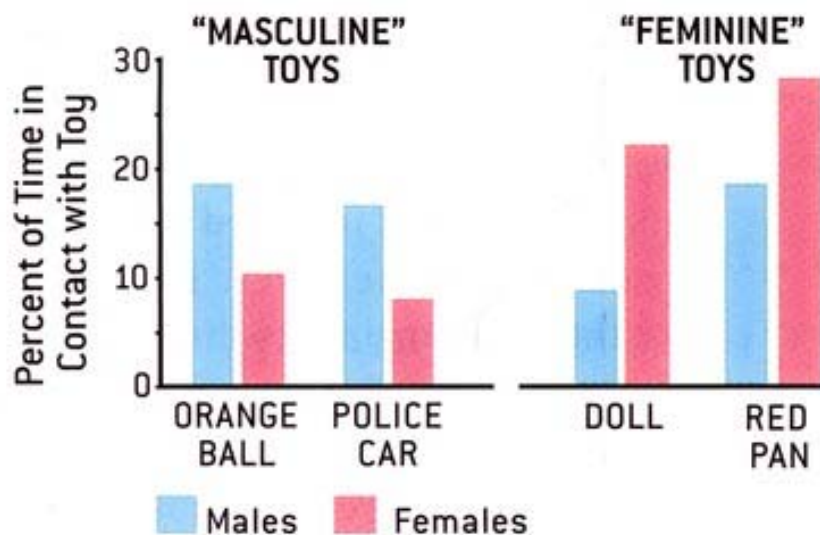


Butterfly wing

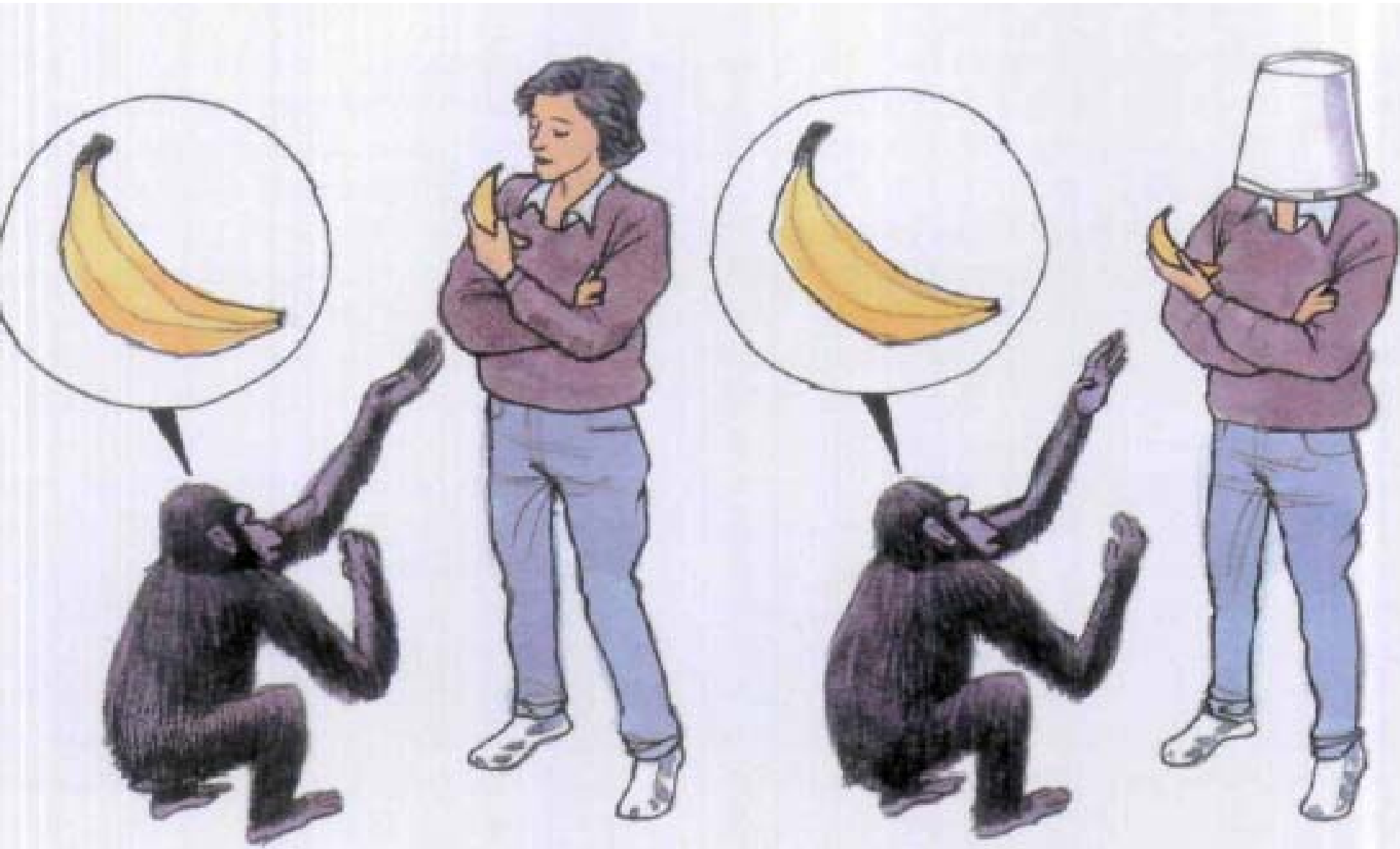


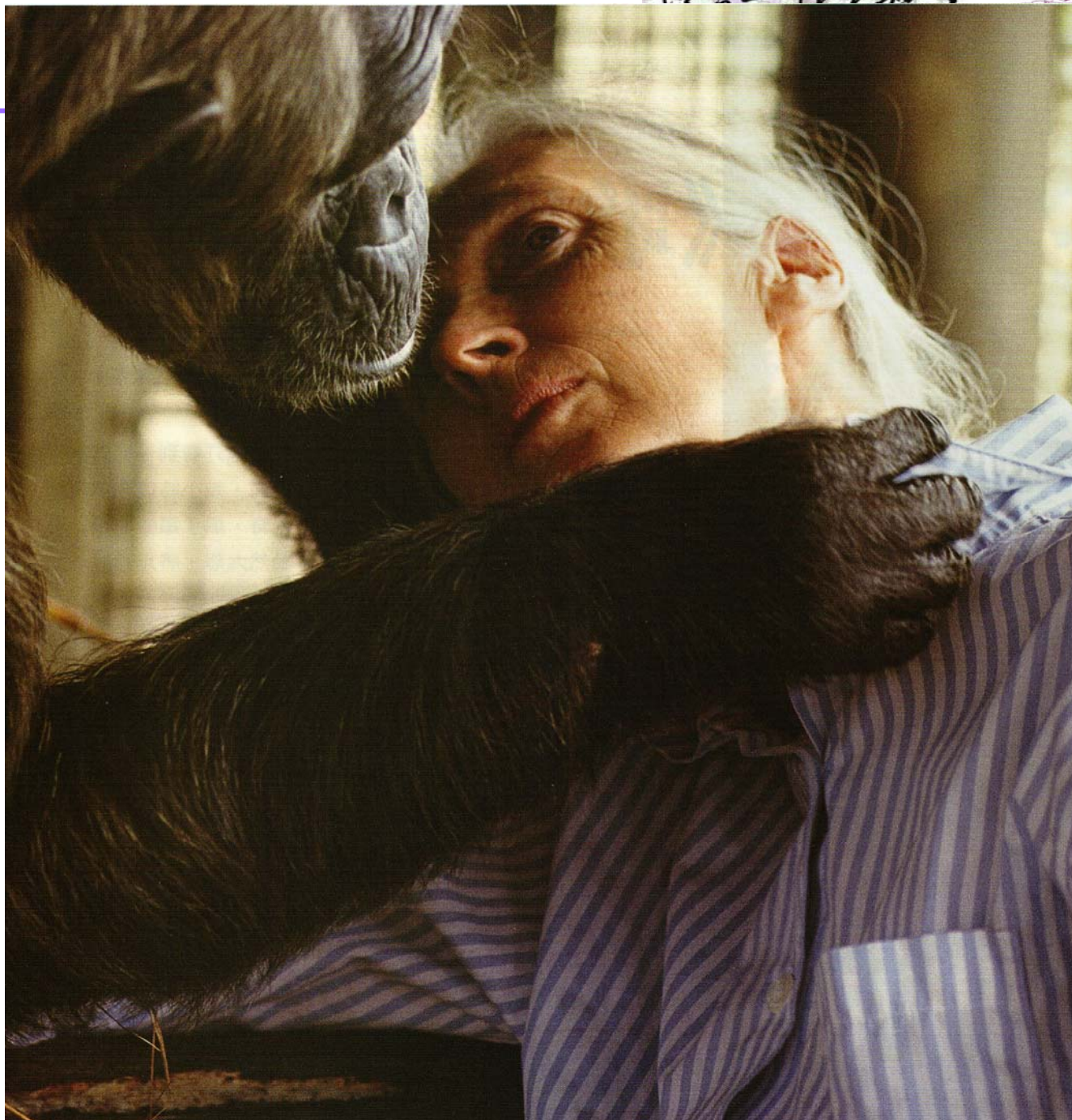
WIRED PREFERENCES?

Vervet monkeys observed by Gerianne M. Alexander of Texas A&M University and Melissa Hines of City University London displayed toy preferences that fit the stereotypes of human boys and girls: the males (*top photograph*) spent more time in contact with trucks, for example, whereas the females (*bottom photograph*) engaged more with dolls (*graphs*). Such patterns imply that the choices made by human children may stem in part from their neural wiring and not strictly from their upbringing.



**Scientific
American**
May 2005







NATIONAL GEOGRAPHIC

A CURIOUS
KINSHIP

APES AND HUMANS 2

BONOBOS,
CHIMPANZEES
WITH A
DIFFERENCE 46

DOUGLAS
MACARTHUR 54

SACRED PEAKS
OF THE ANDES 84

LAKE TAHOE—
PLAYING FOR
HIGH STAKES 113

Homo sapiens

**Homo neanderthalensis*

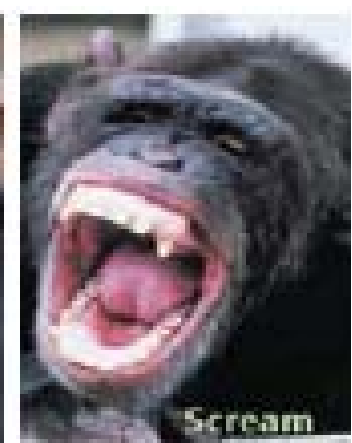
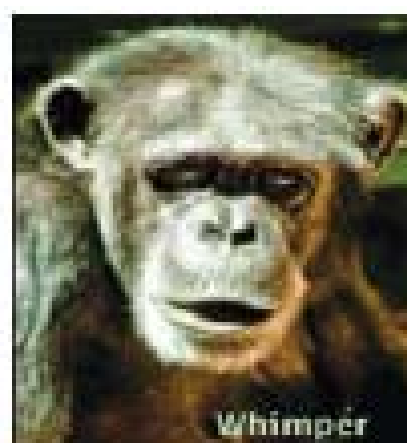
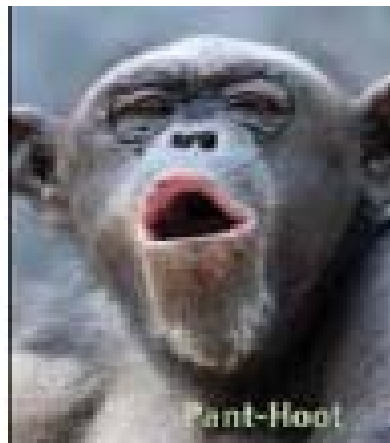
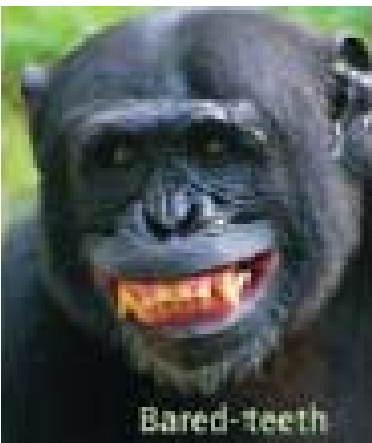
**Homo erectus*

Pan troglodytes

(Common chimp)

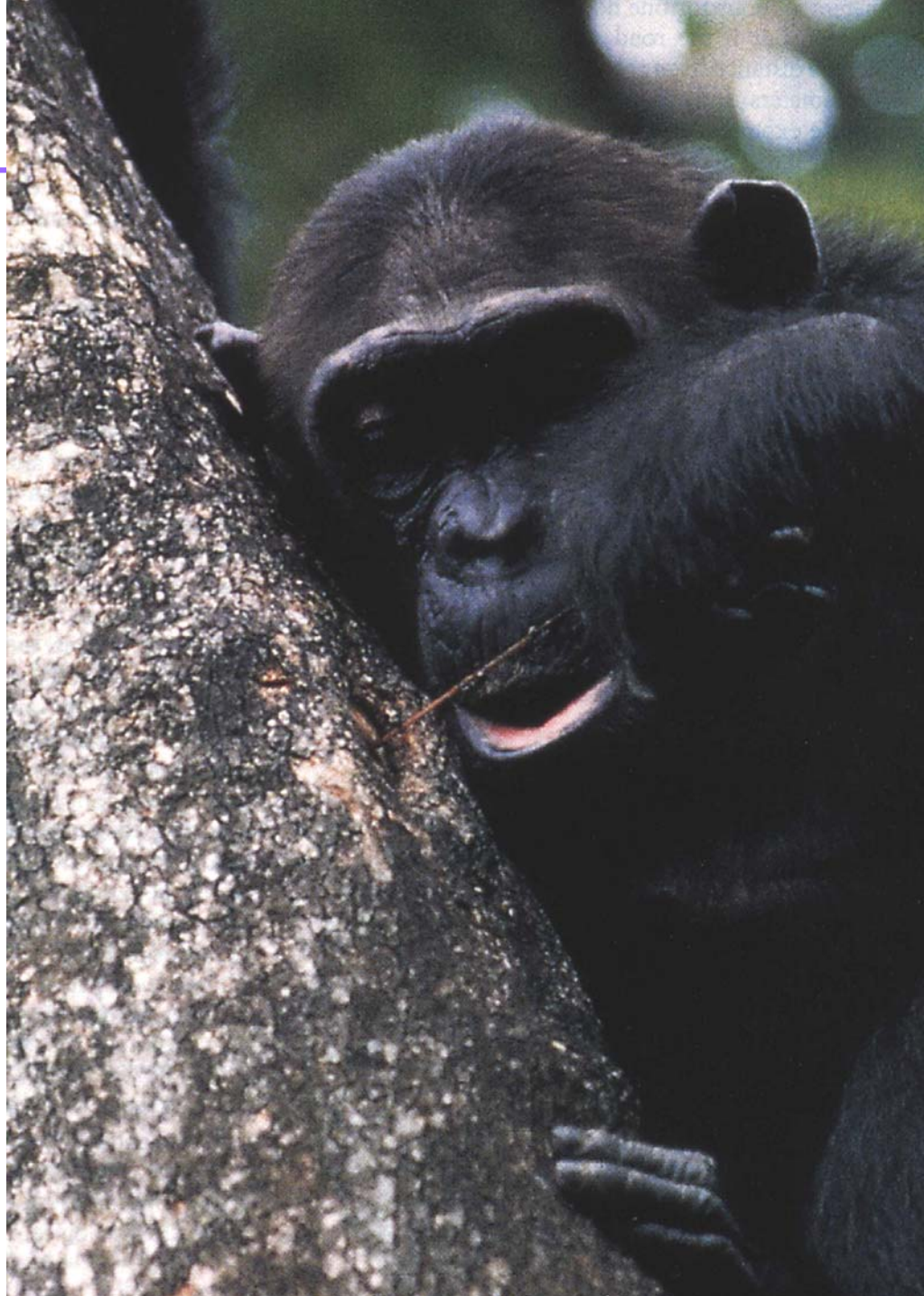
Pan paniscus

(Bonobos, pygmy chimp)



Chimpanzee fishing

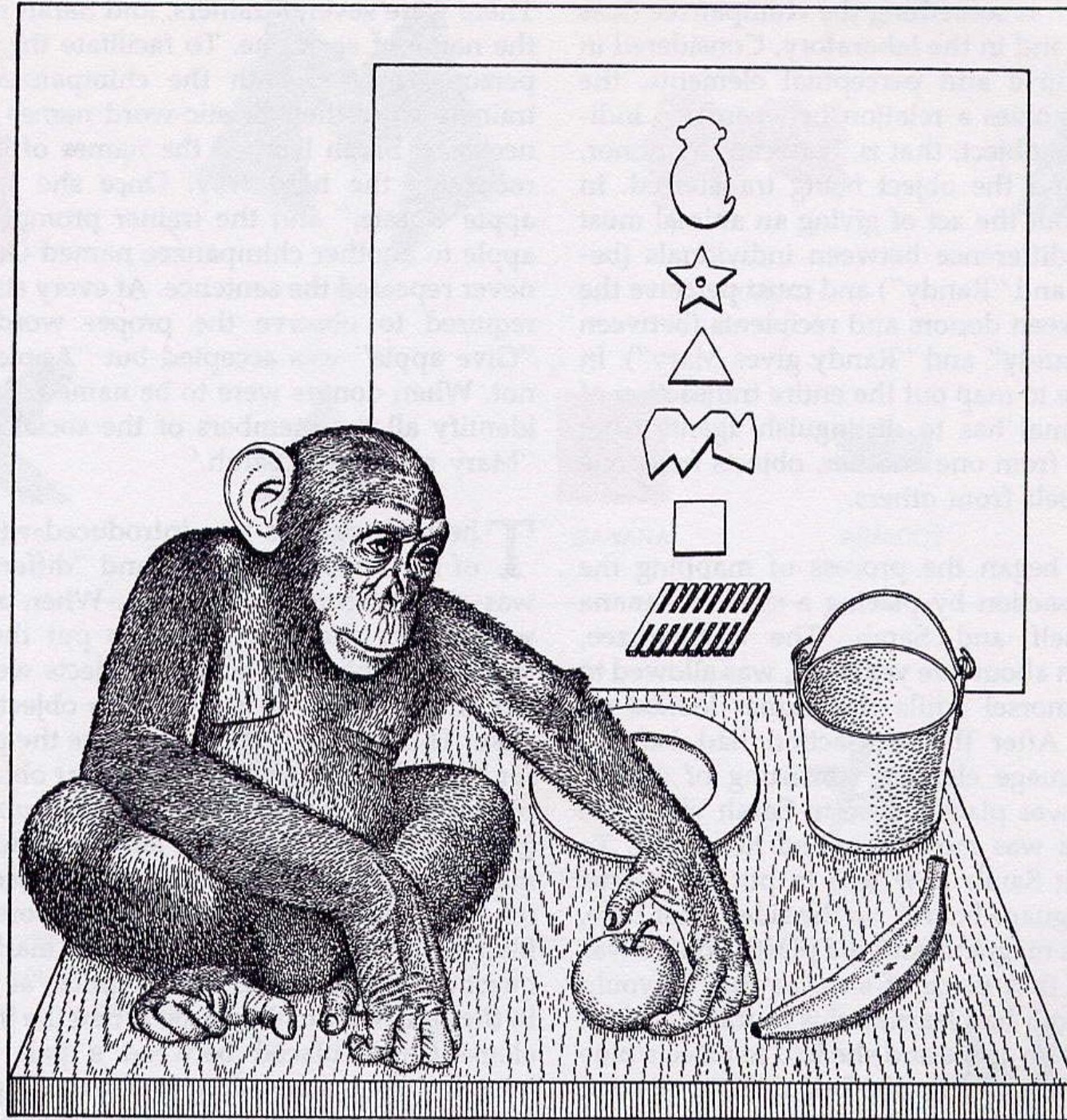
from
Scientific American
Jan.2001.



Kanzi and his reflection in mirror.

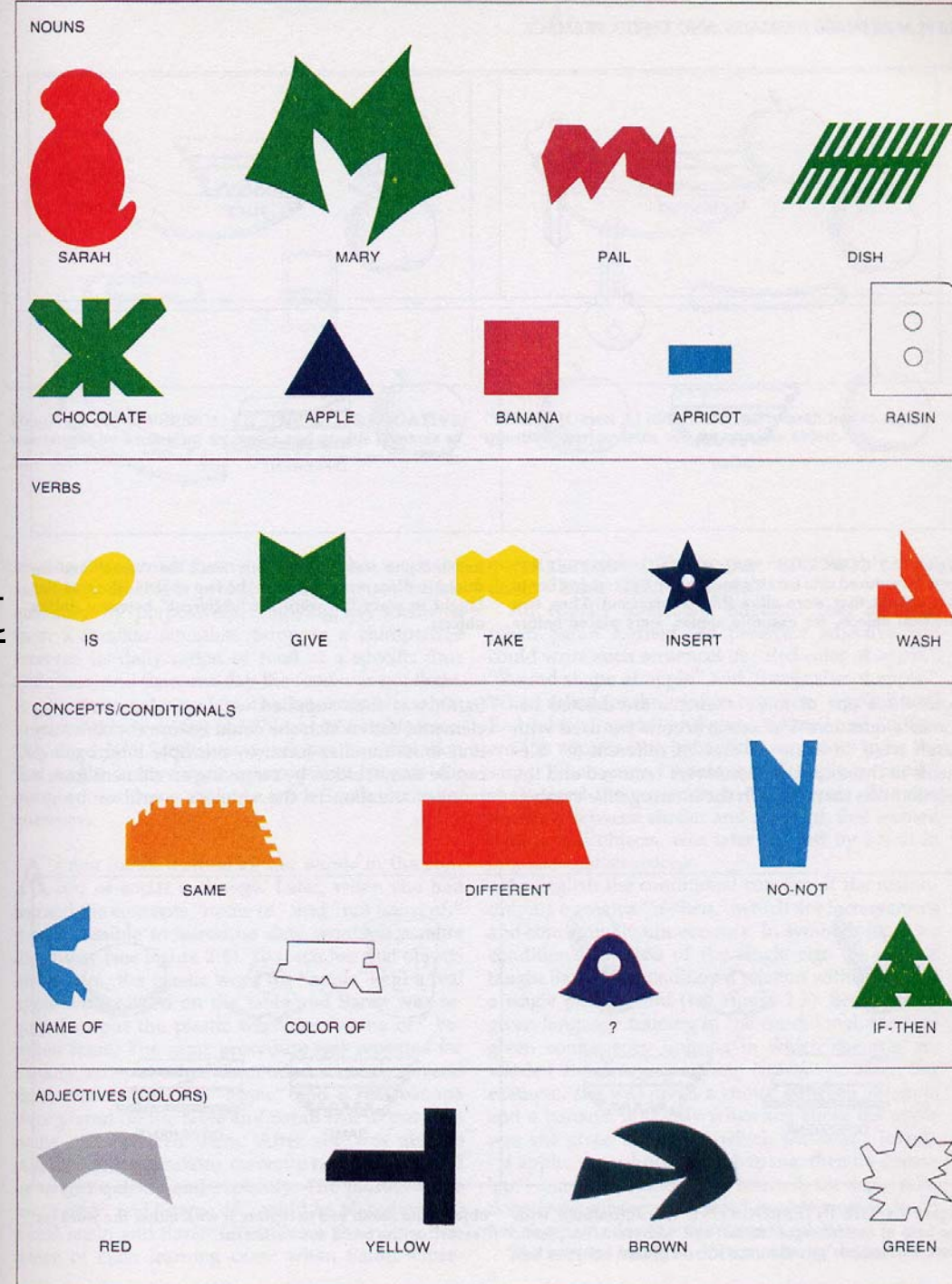


The Emergence
of Language:
Development
and Evolution.
W.S-Y.Wang,
ed. p.17.



The Emergence of Language: Development and Evolution.

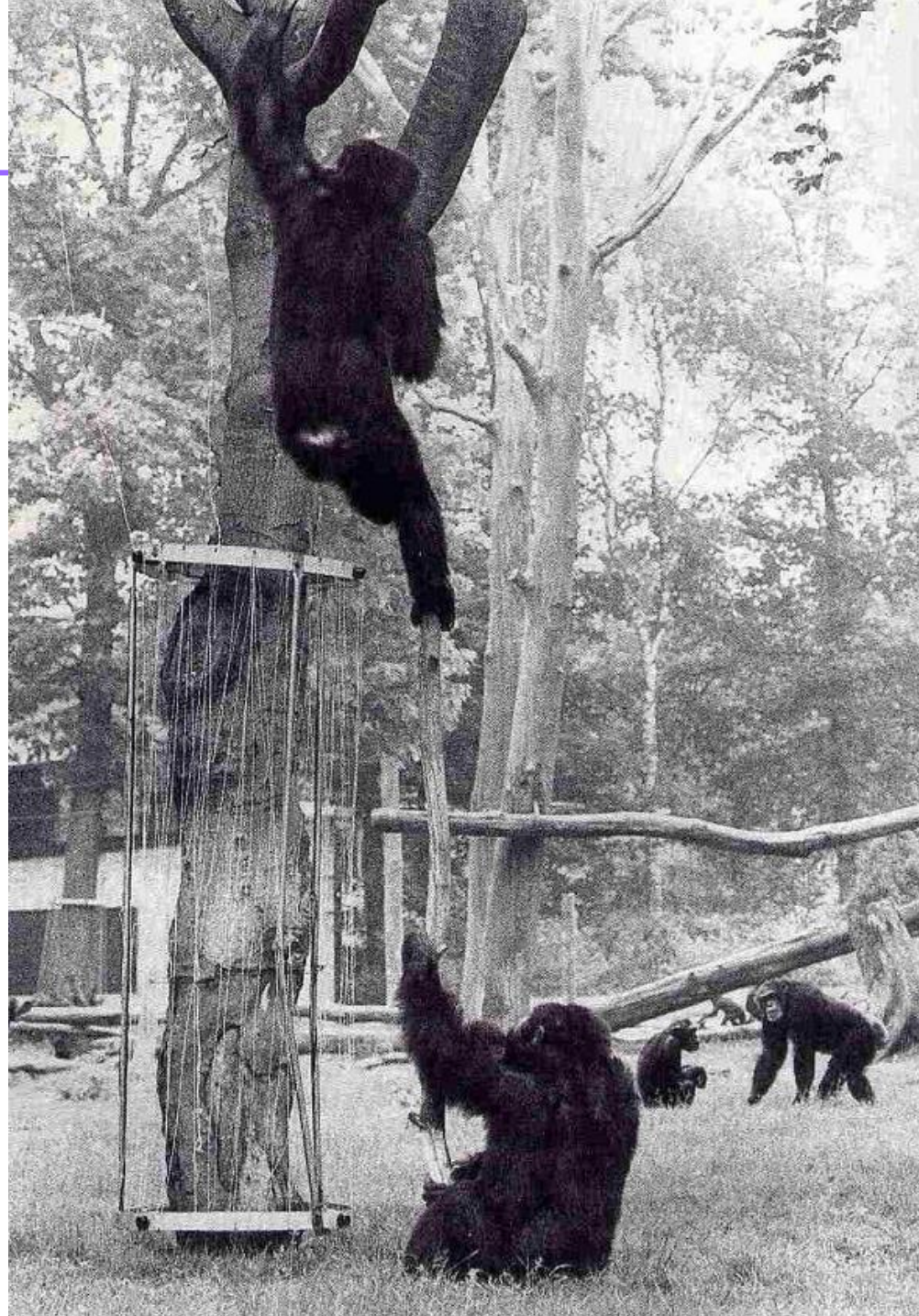
W.S-Y.Wang, ed. p.19.



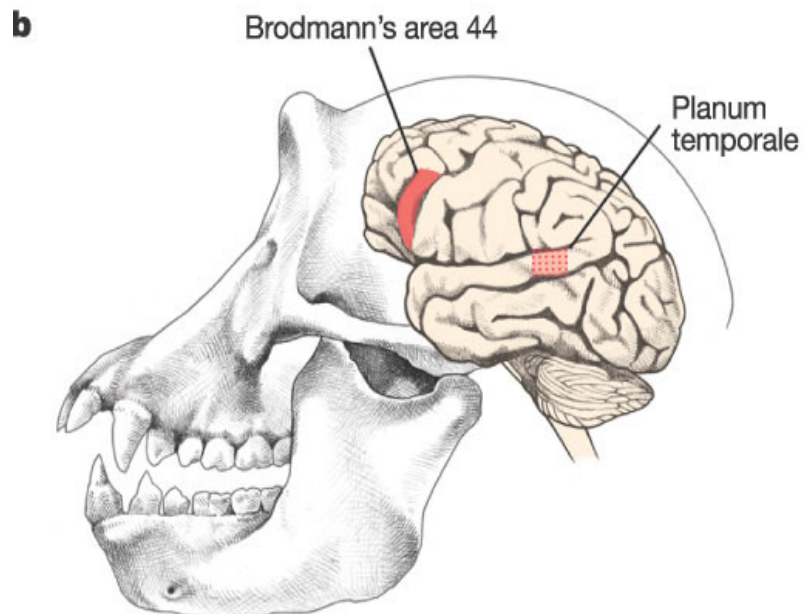
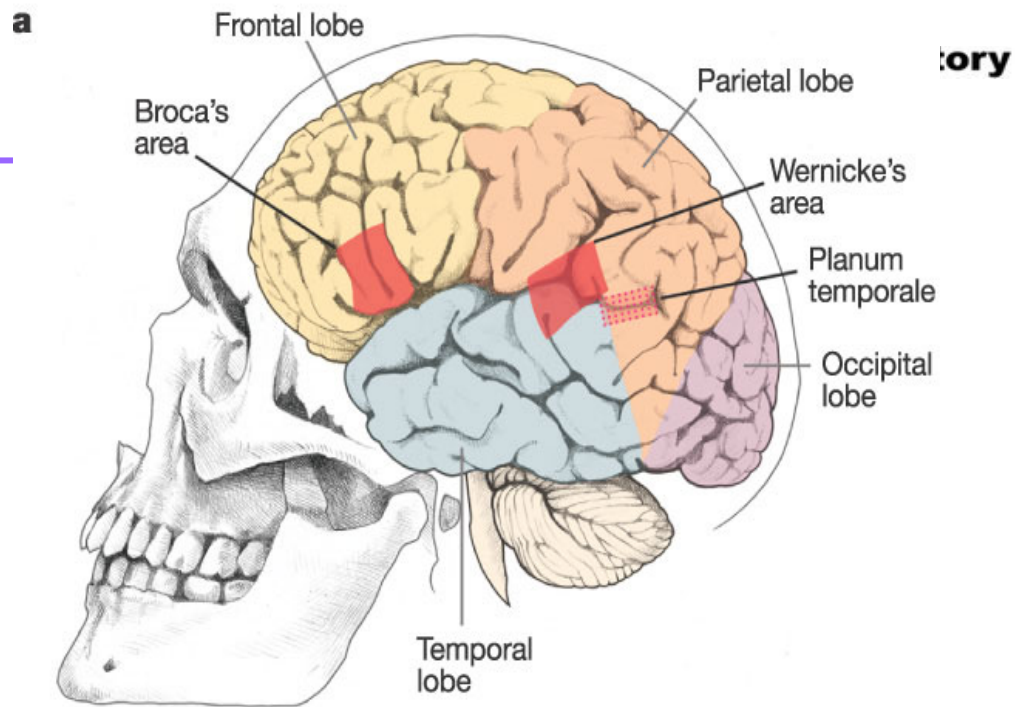
Frans de Waal
Chimpanzee Politics
1998:193.



Frans de Waal
Chimpanzee Politics
1998:194



S.B.Carroll. Nature.
Apr.24, 2003.



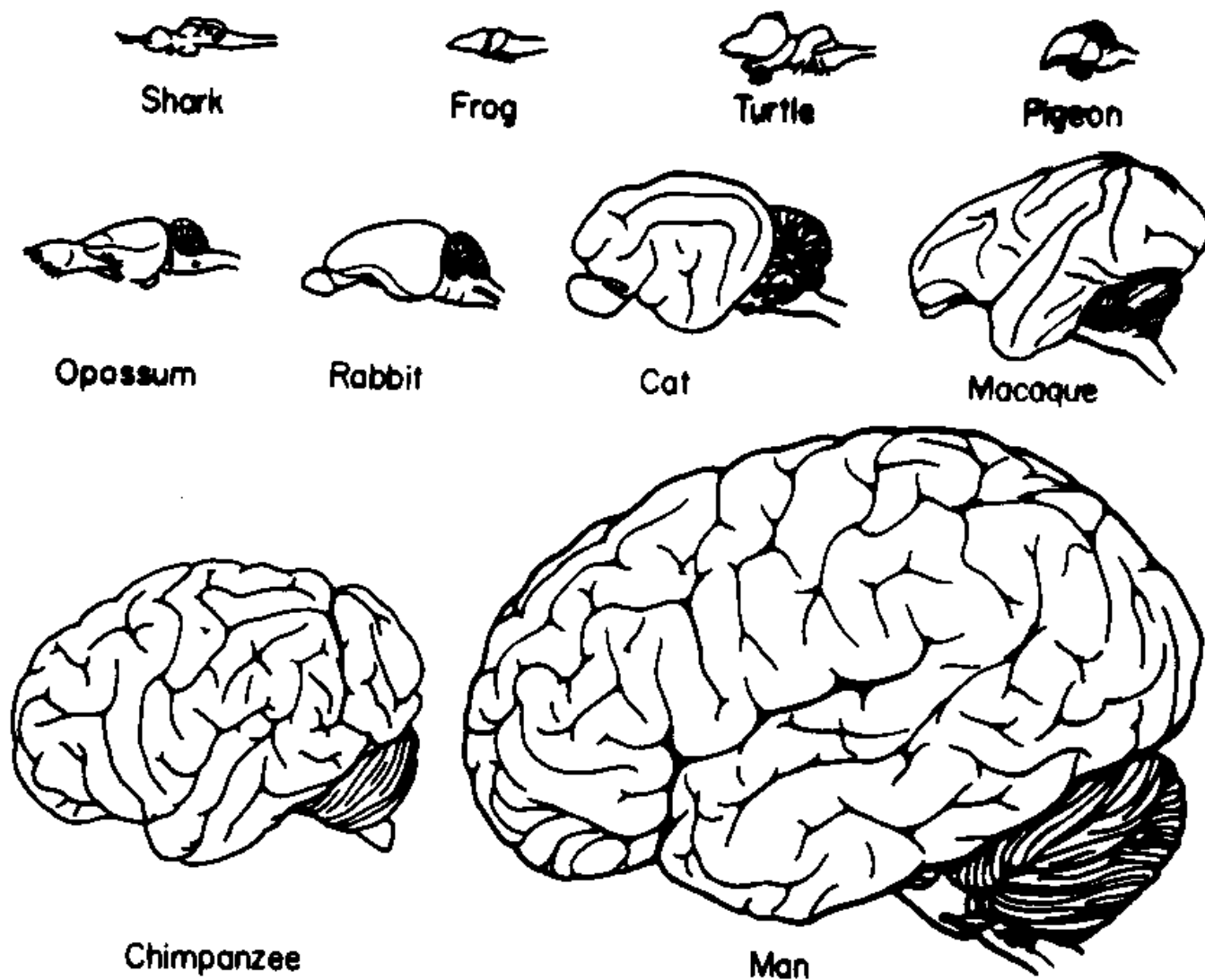
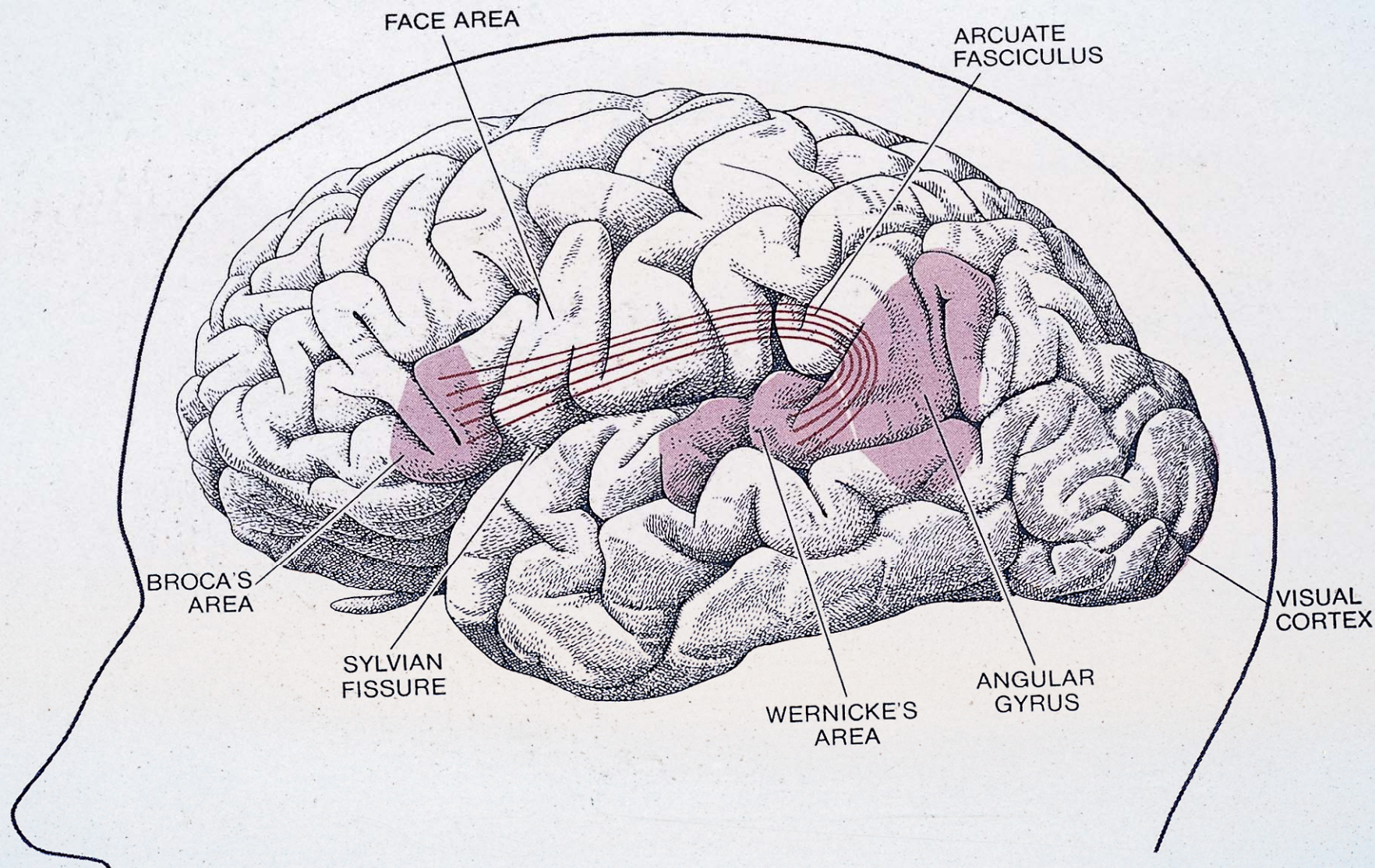
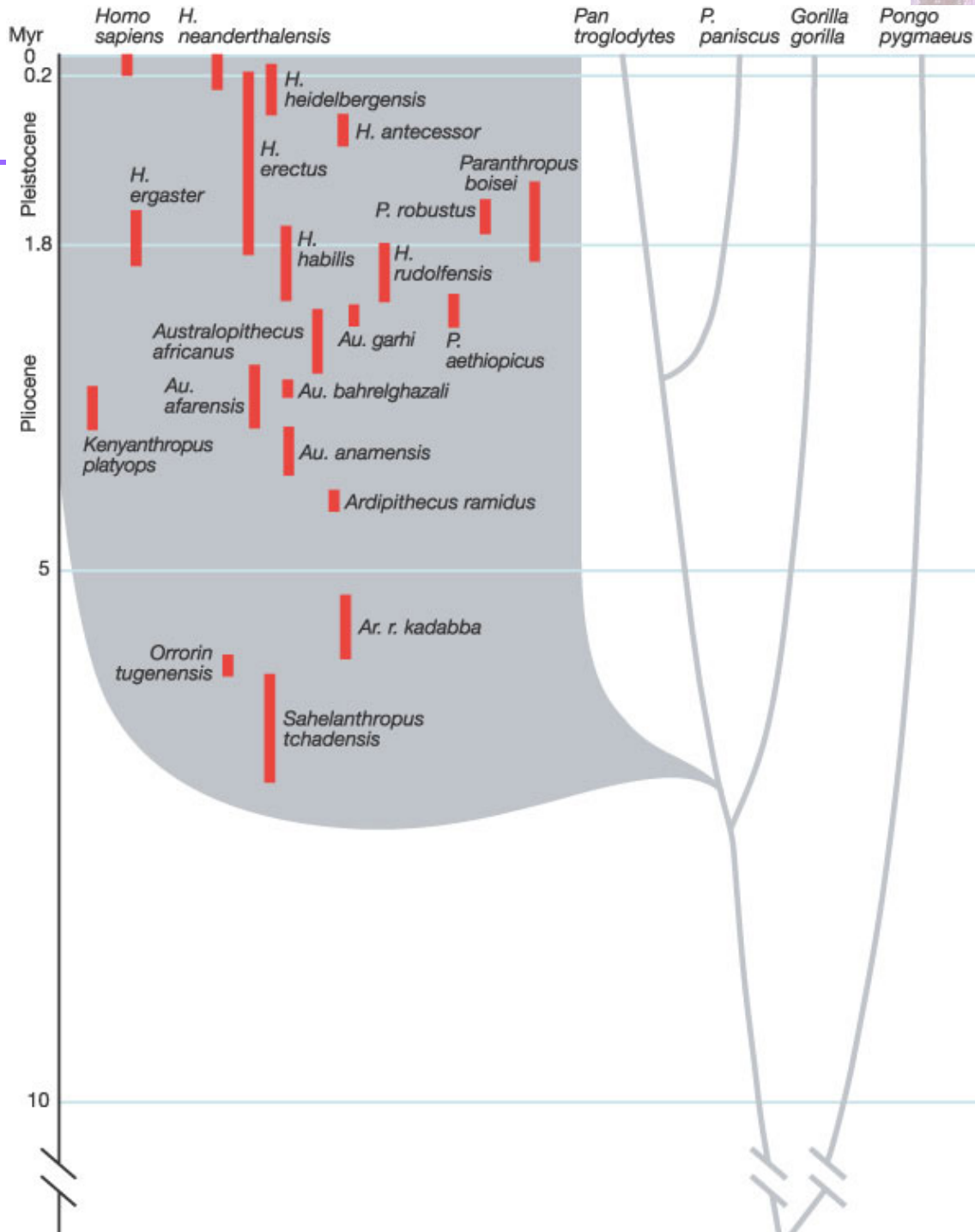


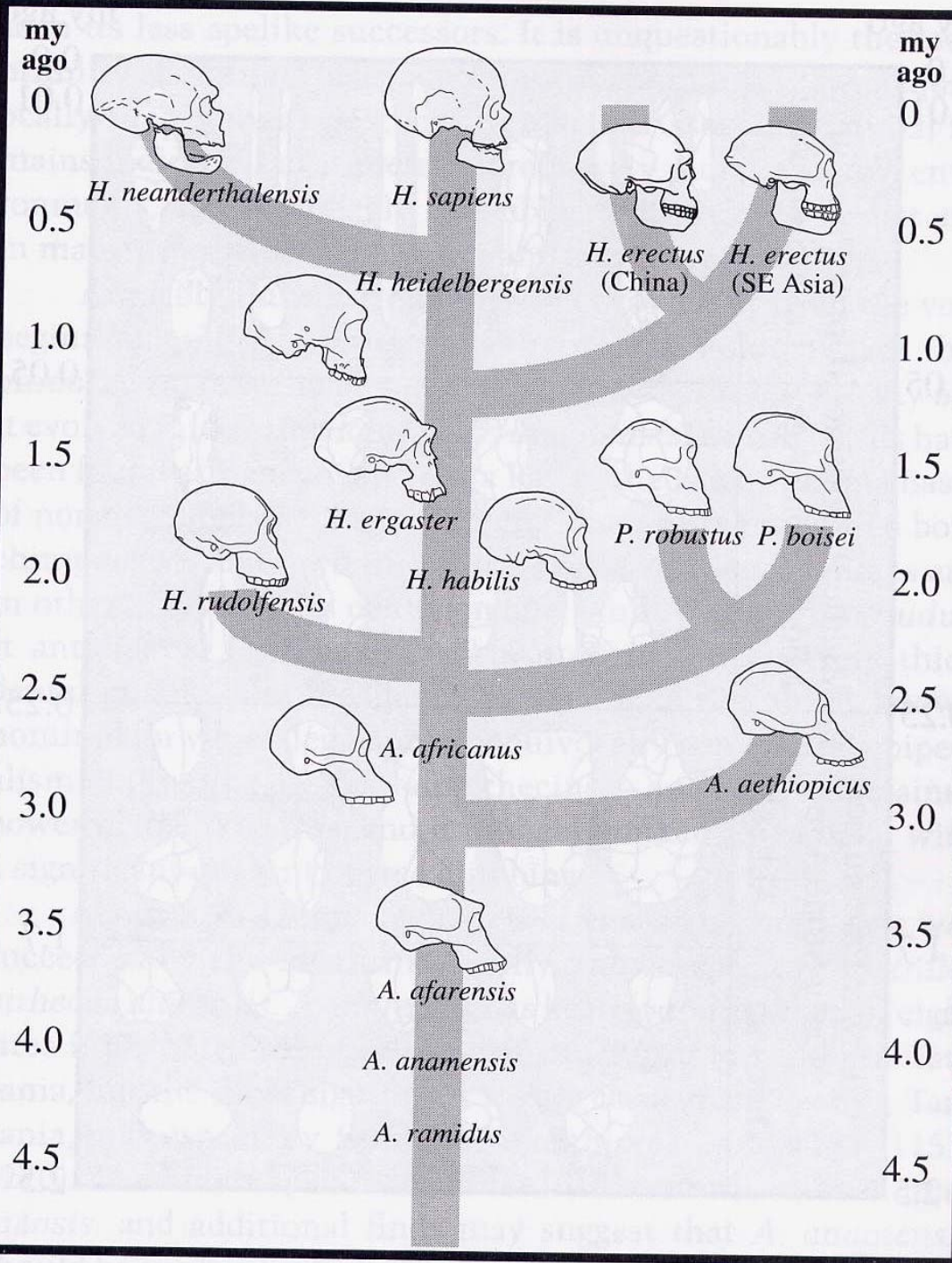
Figure 1-1 Brains of vertebrates drawn on the same scales.
(Courtesy of Professor J. Jansen.)

Geschwind 1968





S.B.Carroll. Nature.
Apr.24, 2003.



from
Australopithecus
to
Homo

Johanson, D. &
B. Edgar. 1996.
From Lucy to
Language.
Simon & Schuster.



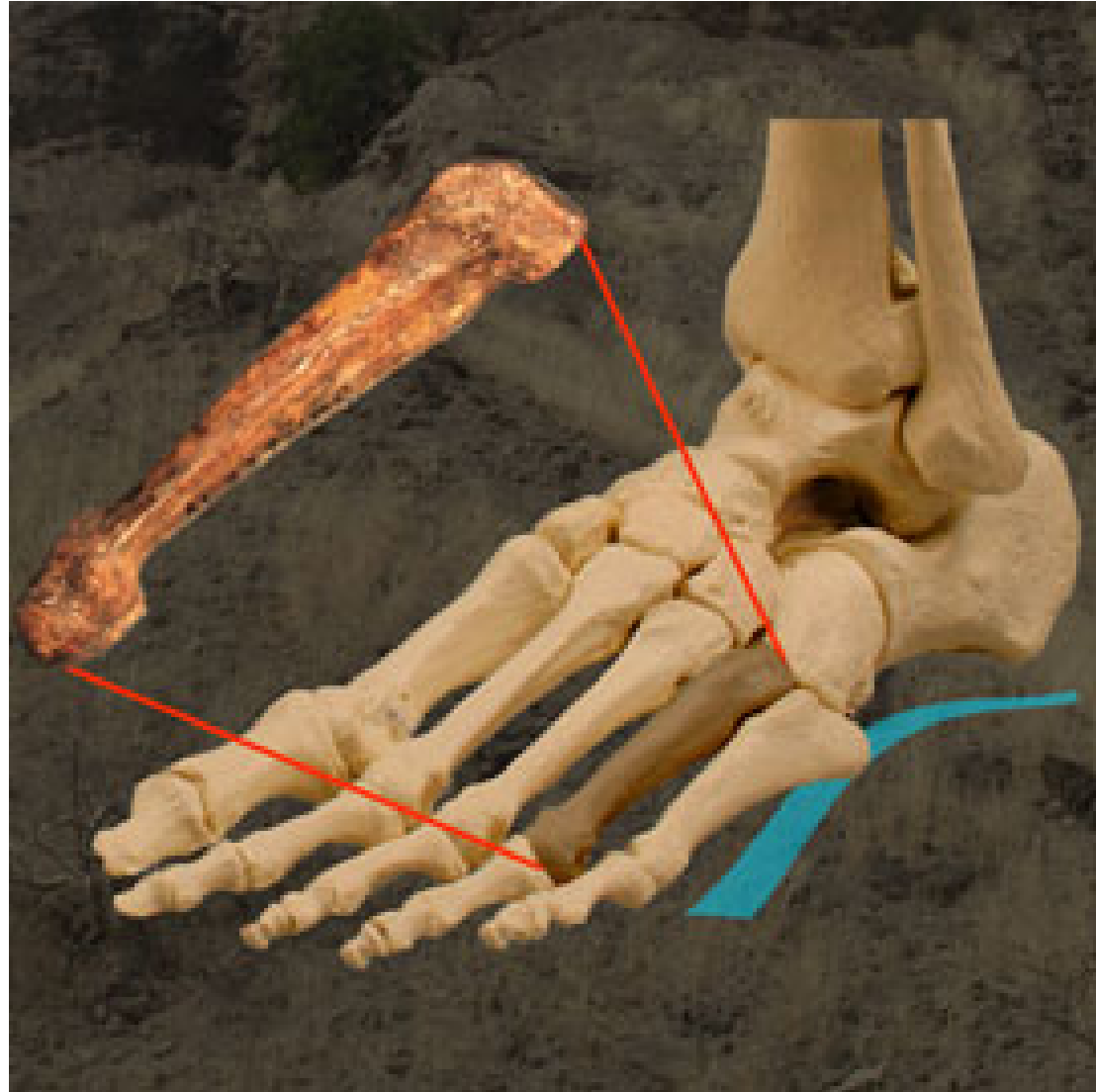


**Footprints in Laetoli
from 3,500,000 b.p.**



Carol V. Ward, et al. **Science** Feb.11, 2011.

**Complete Fourth
Metatarsal & Arches
in the Foot of
*Australopithecus
afarensis***



Sinanthropos
Pekinensis

北京猿人



Biological Foundations of Language. Wiley.

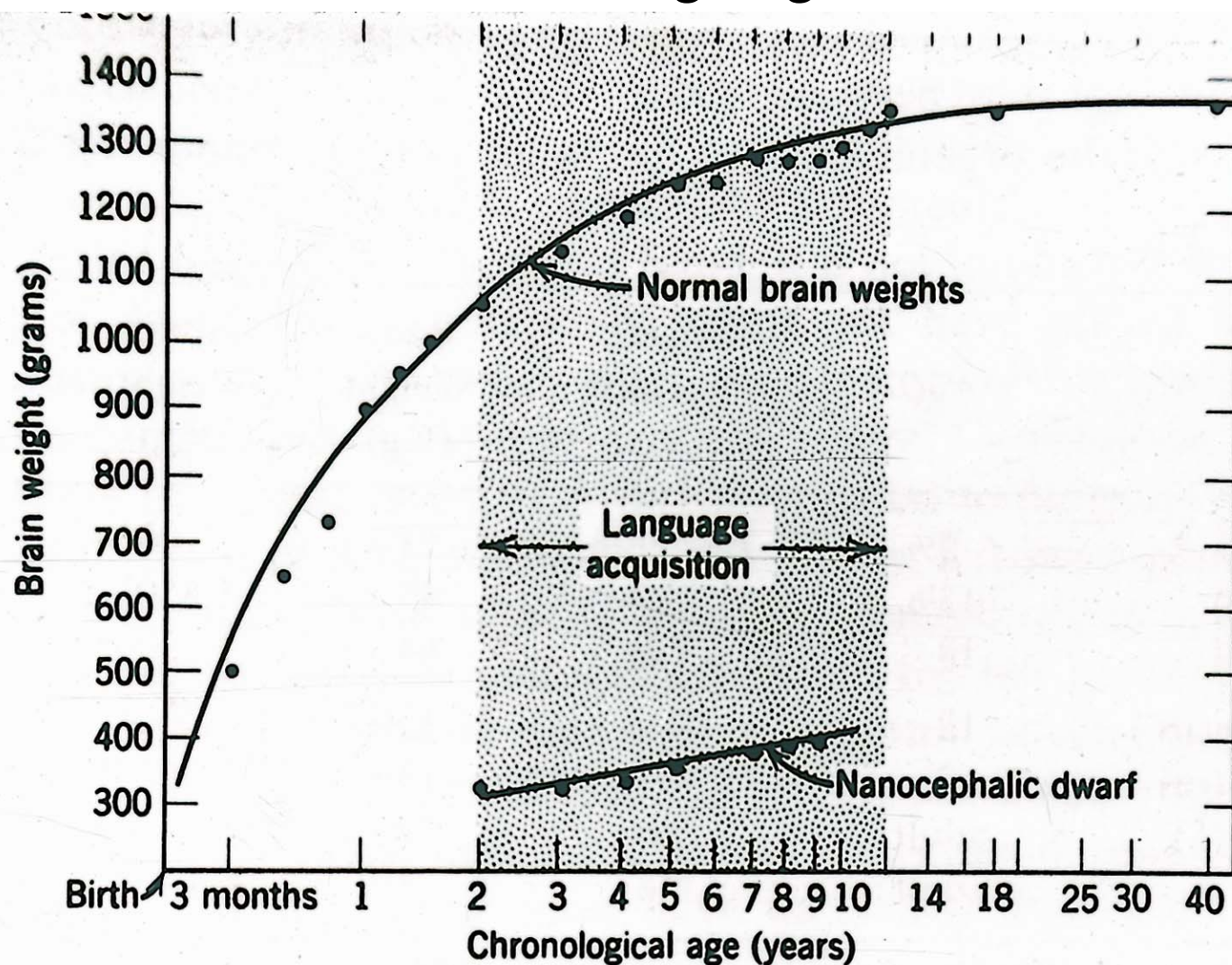
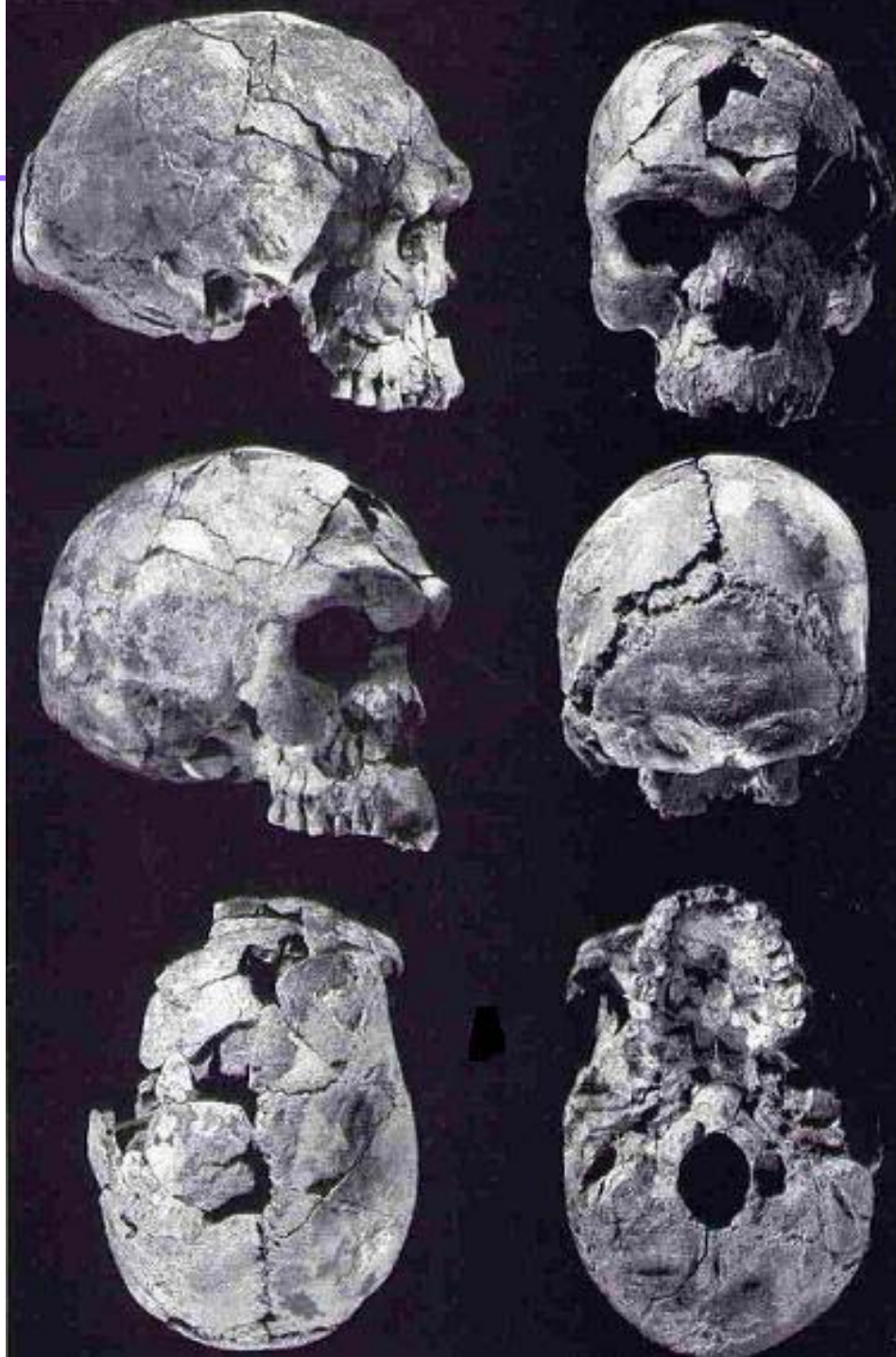


FIG. 2.25. Brain weights determined at autopsy plotted as function of patients' chronological age; data from Coppoletta and Wolbach (1933). *Bottom plot:*

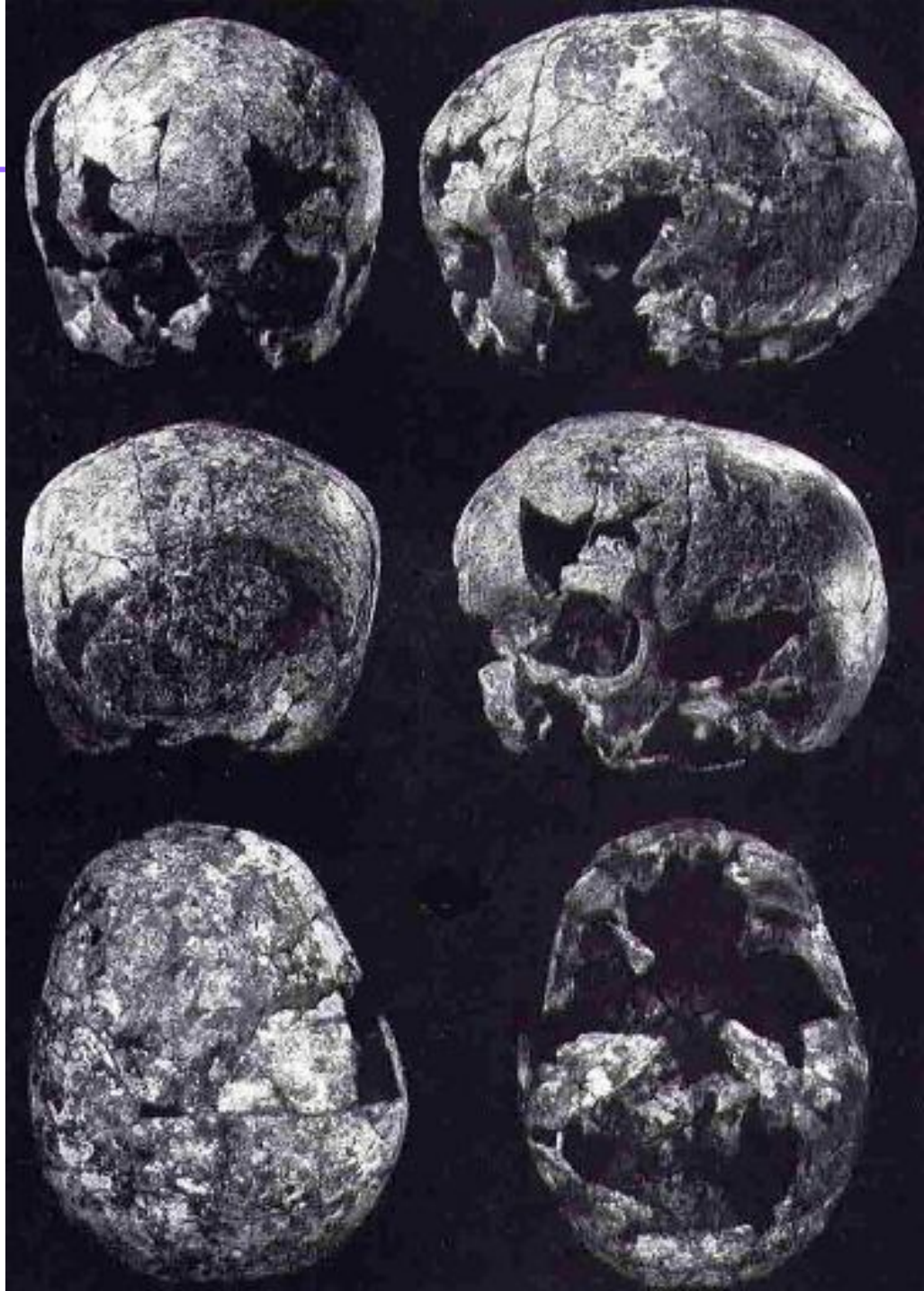


Earliest physical
remains of
Anatomically
Modern
Humans.

Adult cranium from
Herto, ca.160,000 BP.
Tim White et al, 2003.
Nature June 12, p.743.



Child cranium from
Herto, ca.160,000 BP.
Tim White et al, 2003.
Nature June 12 p.744.

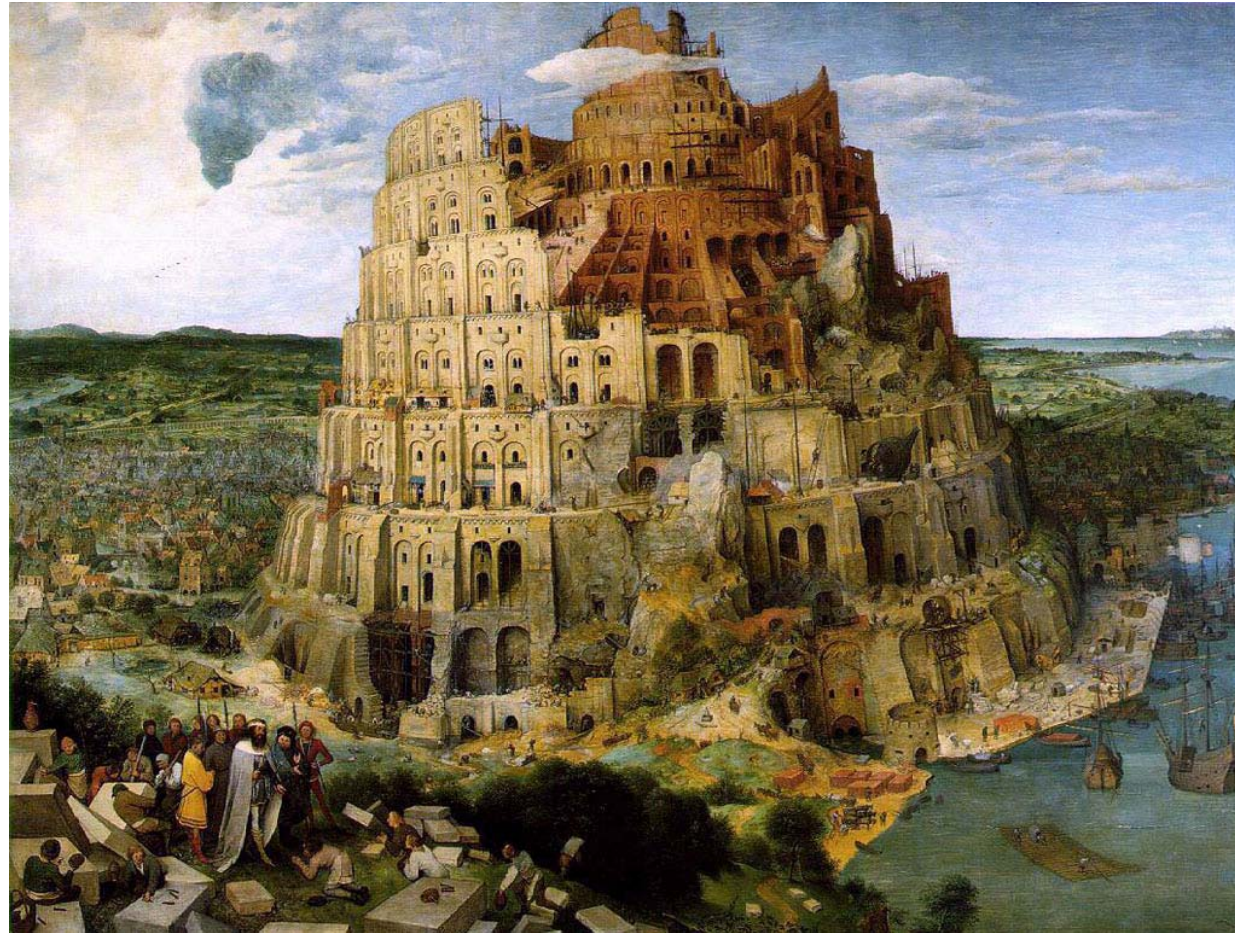


Cave art, Music, Burial, etc.



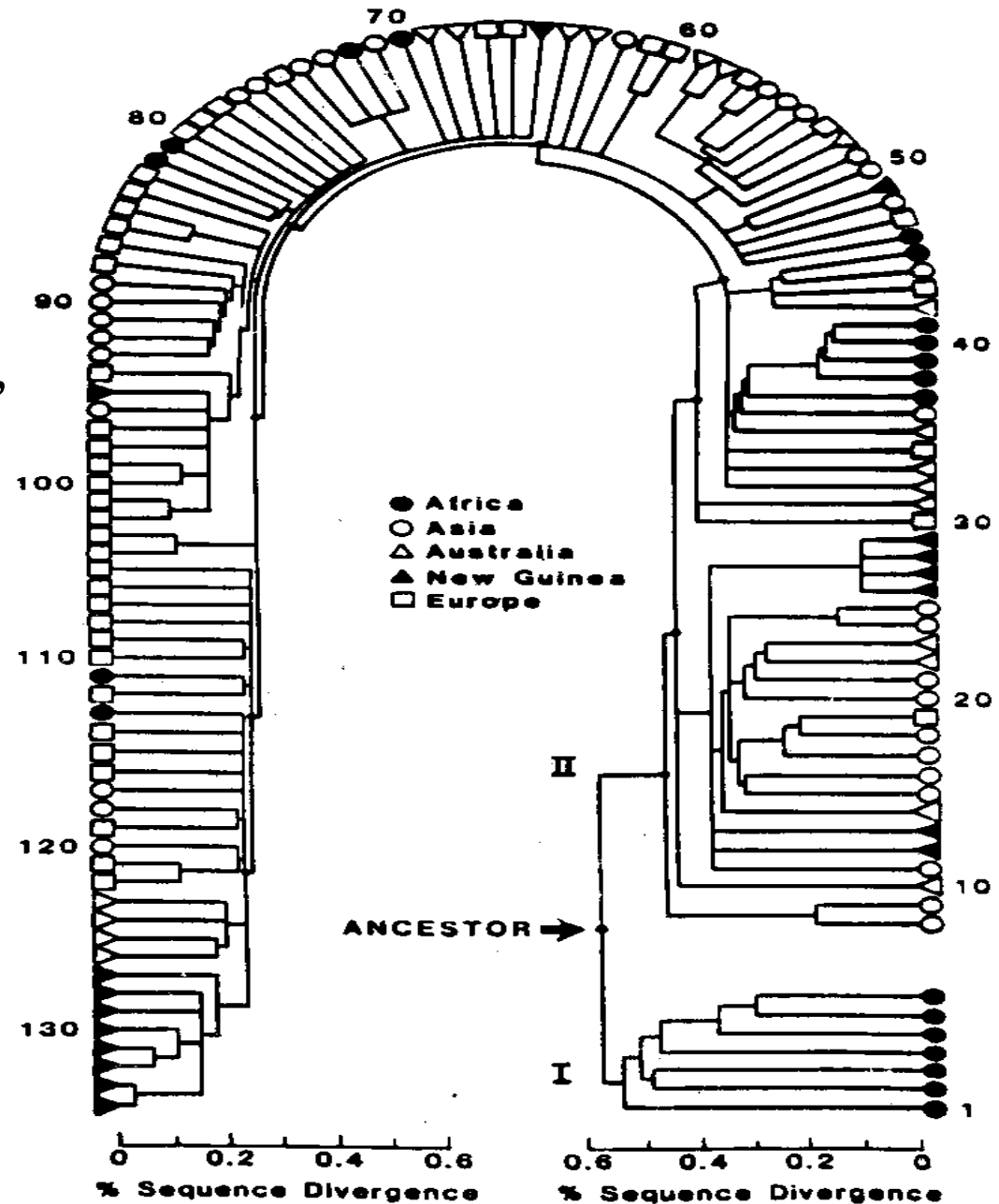
SYMBOLIC BEHAVIOR may not have originated in Europe, but its early record there is rich. Chauvet Cave, in the Ardèche region of France, contains the oldest cave paintings in the world. Its galleries showcase a menagerie of Ice Age creatures, including lions (*top left*), rendered in ochre 35,000 years ago. Ancient Europeans also had a love of music, as evidenced by this 32,000-year-old bone flute from Isturitz, France (*bottom left*). And they buried their dead with sometimes breathtaking ceremony, as seen above in this replica of a 28,000-year-old burial of two children and thousands of beads and other grave goods from Sungir, Russia.

Language Diversity: an early account

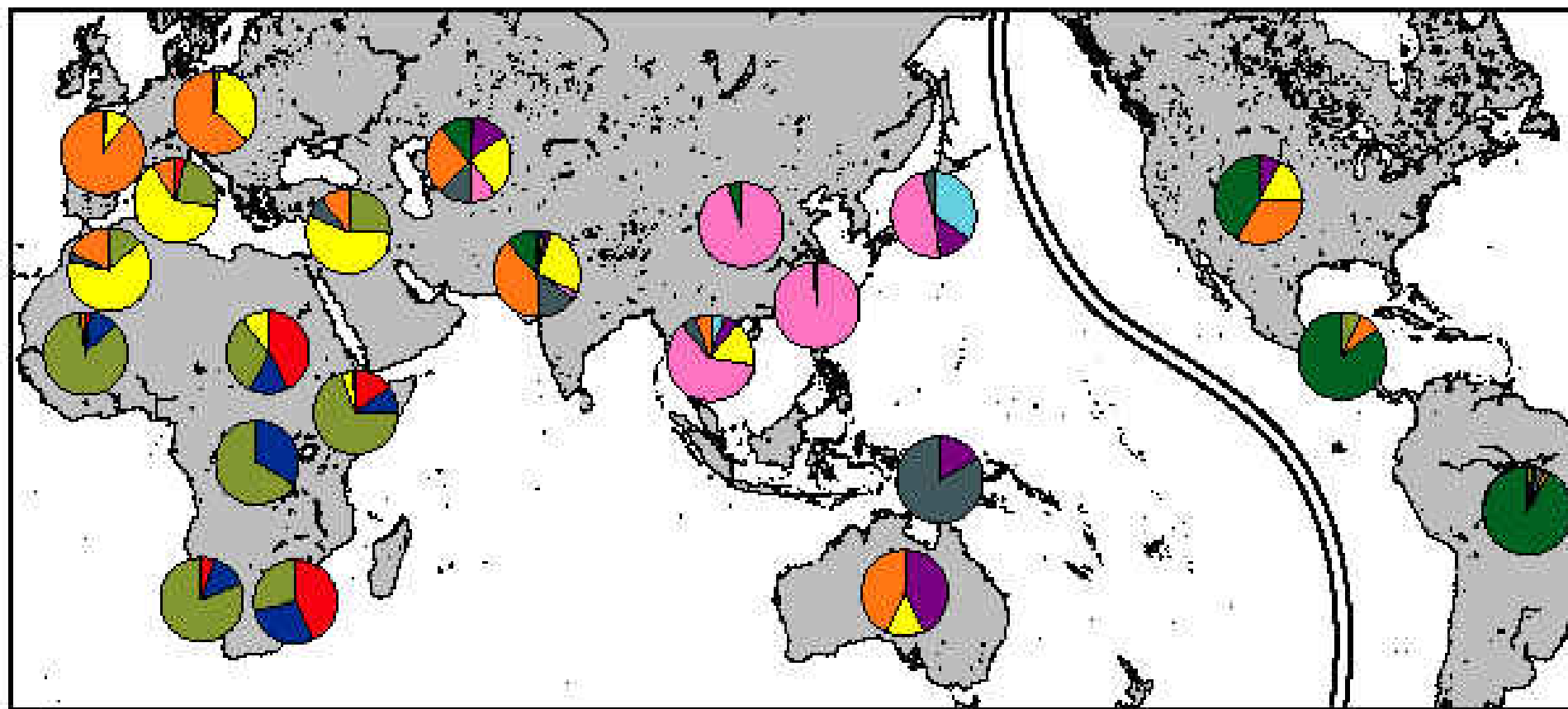
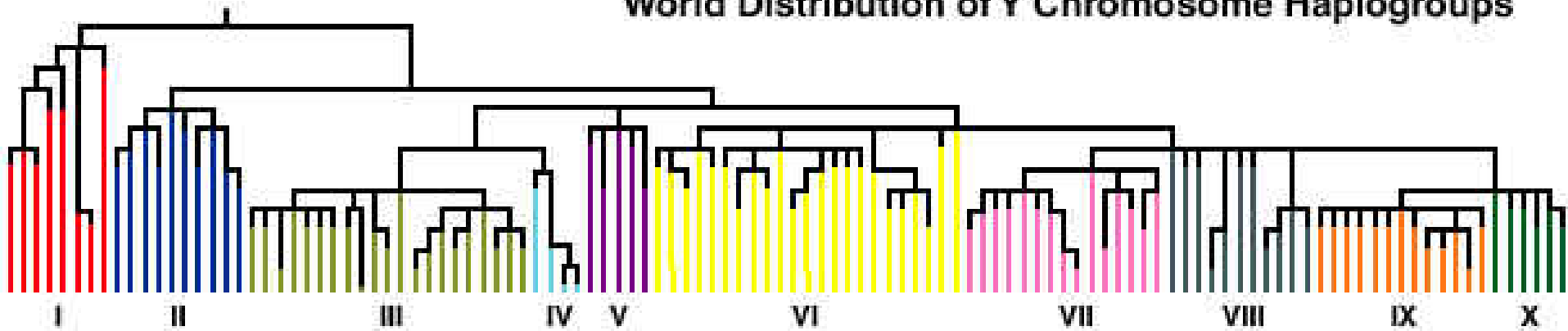


“Go to, let us go down, and there confound their language,
that they may not understand one another's speech” (Genesis 11:7)

Cann, R., M. Stoneking, and A. Wilson. (1987). Mitochondrial DNA and human evolution. Nature 325:31-36.



World Distribution of Y Chromosome Haplogroups

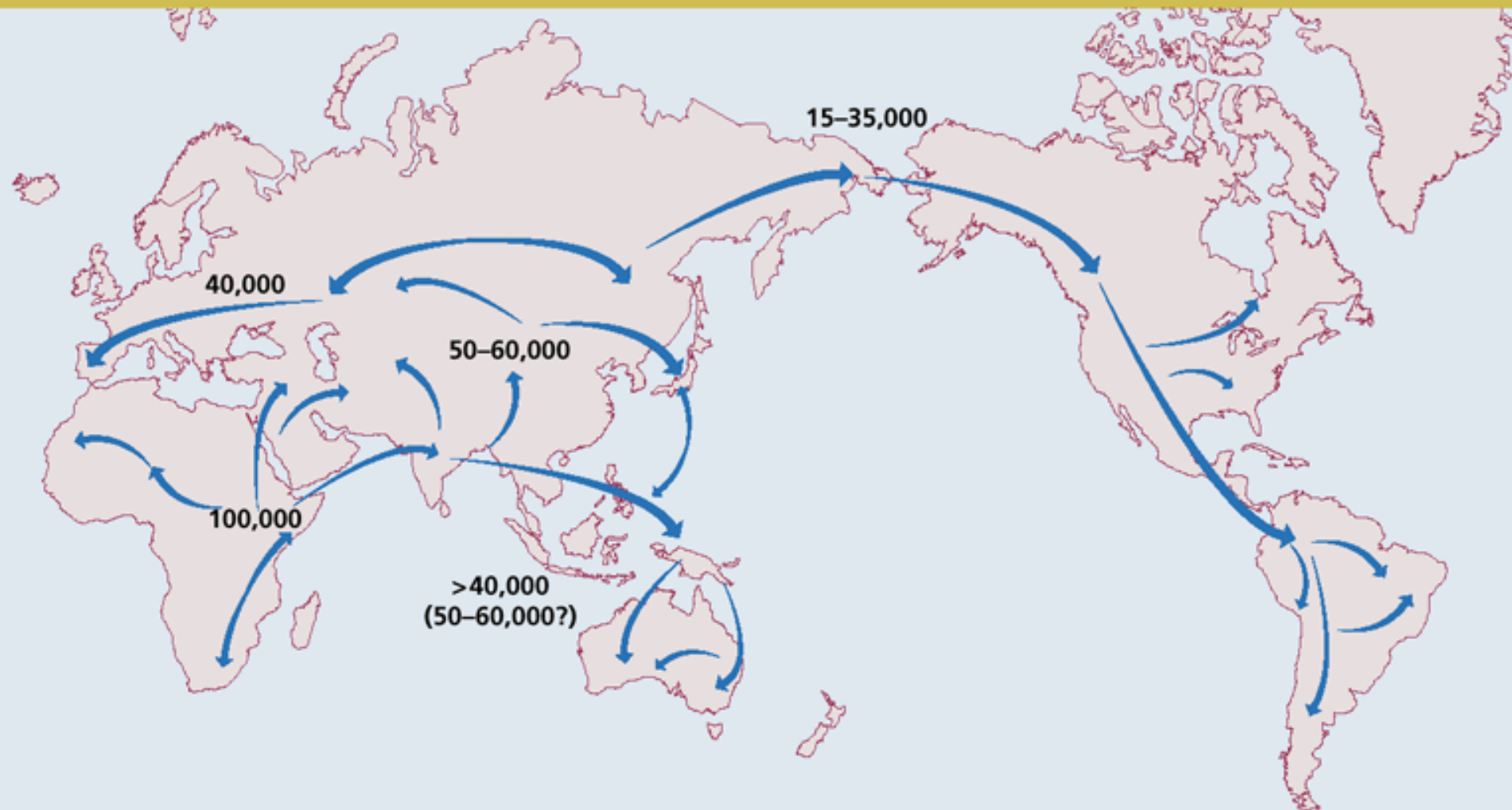


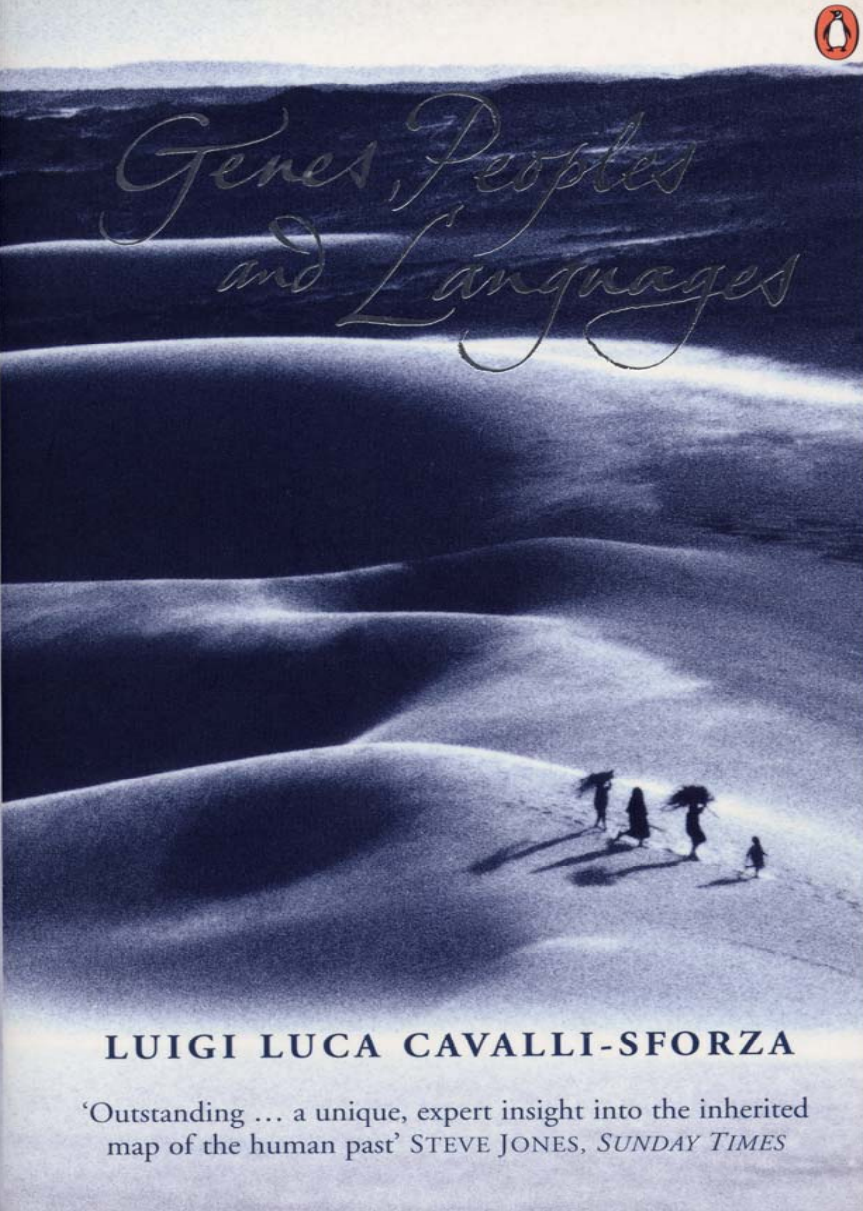
Personal communication from **Peter A. Underhill**, August 2000.

L.L.Cavalli-Sforza & M.W.Feldman.

The application of molecular
genetic approaches to the study of human evolution.

Nature Genetics Suppl. 33.266-75. March 2003.





Luigi Luca Cavalli-Sforza. 2000.
Genes, Peoples, and Languages.
New York: North Point Press.



2003. 卡瓦利斯福札著. 追蹤亞當夏娃. 台北遠流出版公司.