

Prepared Minds – From Medical Genetics to Medical Genomics

A “prepared mind” will help to harmonize “Genomic Medicine” with all clinical applications. Such prospect calls for a “**genetic point of view**” of life, health, disease and **family** factors (antecedent and prospective) reflecting medical, cultural and environmental issues. “Medical Genomics” is now a source of great wealth for many commercial initiatives and there is a growing tendency to refer to “patients” as “clients”, the implication being that the Professional code of Medical Ethics (for the most part Hippocratic in content) is being replaced by “caviat emptor” for “consumer be aware” pointing to Mercury, the protector of thieves.



Hippocrates 460-370 BC

Hippocratic Oath

I swear by Apollo, Aesculapius, Higeia and Panacea ... to share my goods (offer knowledge) ... to teach (advance medical knowledge) ... I will prescribe regimens for the good of my patients ... to my best judgment (competency and liife long learning) ... never do harm to anyone (deny care) ... to please no one will I prescribe a deadly drug nor give advice which may cause his death (assisted suicide) nor will I give a woman a pessary to induce abortion ... all that may come to my knowledge in the exercise of my profession ... I will keep secret and will never reveal (DNA genetic risks screening ...)



Fig. 396. — Les Grâces et Esculape, d'après un bas-relief antique.

Aesculapius (Esculapius) with **medical staff** (one serpent) shielding the three graces, Hygieia (Health), Panacea (therapy) and Medicina (media mediator) from mercenary Mercury with his staff with two snakes (perhaps for “double talk”) and a “client”. (more later about how Esculapius got “burned” for a mercenary act)

Prepared Minds
Knowledge sensitizes
Science systematizes
Philosophy seeks wisdom
Ethics guides toward “ends”.

Genetics emerged from “**Natural Philosophy**”(wisdom) and became “**Natural Sciences**” (knowledge). **Genetics** developed outside of the Medical domain. Only recently a “genetic point of view” (“**Medical Genomics**”) is being merged with Medical Sciences and Ethics, a work in progress.

Gene – Genome – Science – Probability

Medicine is the application of science and “arts” (skills, judgment, ethics)

In a manner of speaking, “**gene**” is a unit of information with the potential to be “materialized” into a “phenomenon” or **phenotype** (genetic **trait**). The “**genome**” is the total genetic complement of an **organism** – to develop, diverse components of the genome are “materialized” in a precise **chronology** (chronogenetics) and require specific environment conditions – the process (embryogenesis, growth, development, degeneration, regeneration, apoptosis ... is impacted by susceptibility, teratogens, mutagens, oncogens ... which impact the probability of outcomes (traits, phenotypes, intelligence, longevity ...). In simple terms, Genetics is the Science of “heredity” and Medical Genetics is focused on “health” and “disease”.

Science speaks of the “most” probable (probability)

Science is neither dogma nor religion (claims of the ultimate truth)

“It is a mistake to believe that a science consists in nothing but conclusively proved propositions, and it is unjust to demand that it should. It is a demand only made by those who feel a craving for authority in some form and a need to replace the religious catechism by something else, even if it be a scientific one. Science in its catechism has but few apodictic precepts; it consists mainly of statements which it has developed to varying degrees of probability. The capacity to be content with these approximations to certainty and the ability to carry on constructive work despite the lack of final confirmation are actually a mark of the scientific habit of mind.” (S. Freud)

NATURE – NURTURE

Inheritance + Environment = Variation

Genetics

Biologic variability

Human Genetics

Human variation (populations)

Medical Genetics

Individual variation, “health-disease”, reproduction ...

Medical Genomics (and Proteonomics), studies the totality of functions (organism) and interactions of the genotype (all hereditary elements) and proteins with the totality of environmental factors (past, present and prospective - teratogens, mutagens, oncogens, toxins, micronutrients, radiation ...) as they impact “health”, “disease” and risk of “disease”.

*“Great discoveries transcend the limits of the science
from which they emerge.”*

*“Nothing in Biology makes sense except in the light of Evolution”
(Theodosius Dobzhansky)*



Genetics Language to decipher life

Gene, allele, genome, gene flow, genomics ...

Multifactorial, epigenetics, imprinting ...

Chromosome, centromere, telomere ...

Locus ... linkage, map

Teratogen, mutagen, oncogen ...

Trait, phenotype, marker, “minor” anomalies ...

Dominant, recessive, co-dominant, X linked ...

“Birth Defect”, dysmorphology, syndromes ...

Screening, diagnosis, risk, carrier ...

“Genetic” “Counseling”, genomic prognosis

BIOLOGIC VARIABILITY and GENETICS

“IDEAS” - “WORDS” - “LABELS”

“BIRTH DEFECTS”

(Let no label or “word” replace realities - let none blind and close our minds)

With advances of the understanding of biologic variability, new words emerged to convey abstract “ideas” or generalizations about heredity – many of the early ideas were wrong and others had to “mutate” in the light of better understanding. The same is true for medical terms like “disease” which is under review.

“Disease” implies a decrease “fitness”, vital stability or “homeostasis” and “Healing” implies a restitution of wholesomeness or “norm” or “normality” which implies a return to a better or stable “homeostasis”.

Note that both achondroplasia (abnormal but not a lack of cartilage development) and a malformed thumb, are **“birth defects”**. The “ideas” inherent in “disease”, “disability”, “syndrome”, “genetic disorder” only partially fit the implications or the “natural history” of infants with achondroplasia (increased risk of fatal respiratory infections) and those with polydactyly (perhaps a rather clinically insignificant familial trait or a sign of an unrecognized malformation syndrome).

Birth Defect

(Nearly all of us have some)

Any “anomaly”, functional *(mental retardation is a premier example)* or structural *(including genes, chromosomes, enzymes, cells, tissues, organs ...)* noted at birth *(or in an embryo-fetus)* or later in life and caused by events preceding birth, whether inherited *(DNA-chromosomes-mitochondria)* or acquired *(DNA mutations and teratogens)*

Aristotelian views of heredity persisted until the 19th century



School of Athens – Plato and Aristotle (center)

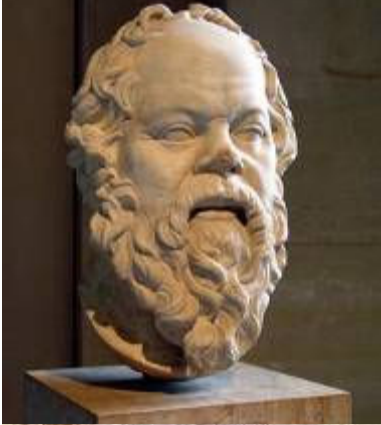
<http://www.consultsos.com/pandora/semen.htm>

Aristotle (384-322) is the founder of biology. He classified animals into **genera** subdivided into **species** ...

Like Epedocles, Aristotle proposed that **semen is a blood extract** which when mixed with less purified menstrual flow engenders the embryo. The mother supplied mostly the “matter” – in fact the oocyte is a very large cell (material and mother are related words). The father “enlivened” the matter with “spirit” – the spermato-zoid (from Zeus, Zoo, enZyme ... point to “life”) is a very small cell vibrant with energy. The fertilized oocyte undergoes divisions up to the stage of morula (mulberry like) without gain in size – once conjugation of the maternal-paternal DNA occurs, growth begins.

Blood line, pure blood, mixed blood ... reflect Aristotelian ideas.

Socrates c469-399 BC



Aristotle – Biology – Pangenesis - Humanities - Ethics

Inspired by his mentor Plato and the philosophy of Socrates (he advocated self-development with **ethics** at its core), Aristotle founded in Athens, the first “Lyceum”(c. 335 BC). To escape a possible death sentence for holding “subversive” views, Aristotle moved to Alexandria (named after his pupil Alexander the Great) where he produced most of his contributions.

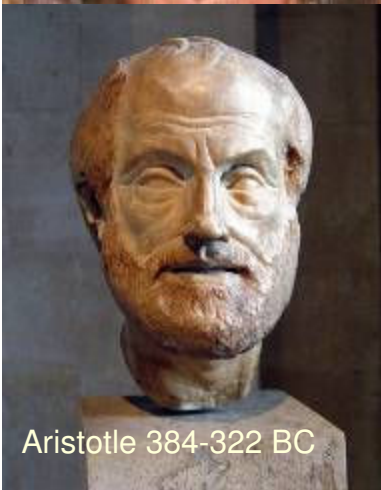
Among his extant works (most were lost) are: On Generation and Corruption, Memory, Sleep, Dreams, Longevity, on Youth - Old Age – Life and Death; Genesis of Animals and two pioneering works on Ethics, the Nichomachean and Eudemian Ethics.

Aristotle proposed that Natural Philosophy (modern Natural Sciences) study the phenomena of the natural world; that Metaphysics concerns knowledge of non-material phenomena; and that Ethics is concerned with the pursuit of the “highest good”.

At the time, the views on heredity reflected the hypothesis of Anaxagoras (c500-428 BC), who held that “all existed before” in infinitesimally small fragments that combined to form “matter” (as in maternity) and seeds (spermata). With variations, Hippocrates, Aristotle and Darwin accepted the view of “**pangenesis**” upholding that conception results from the “**blending**” of maternal with paternal factors.



Plato c427 – c347

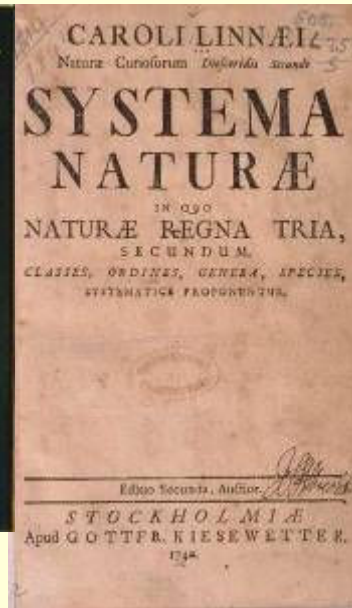


Aristotle 384-322 BC

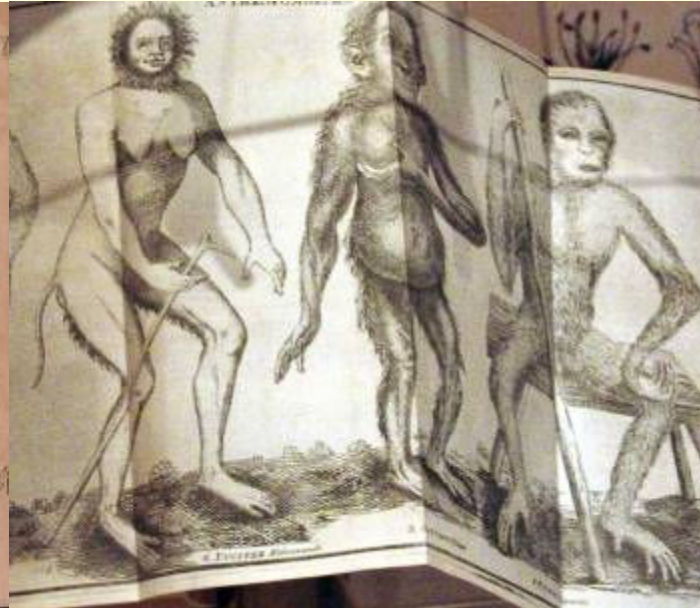
SCIENCE – SYSTEM - TAXONOMY



Carolus Linnaeus
(1707-1778)



Taxonomy



A “chain” of nature

Carl von Linee or Linnaeus, in 1735, offered a perspective on the **cohesion** or “**chain of nature**” and what could be viewed as a “modern” ecological thinking. Linee stressed that disturbing the balance (as per global warming) could have unforeseen consequences ... man is an “animal object among other animals” ... The Linnean Taxonomy remains in use.

More in: <http://consultsos.com/pandora/biopsy.htm>
<http://www.consultsos.com/pandora/conscien.htm>

Emerging Biometry – Prepared Minds



John **Dalton** (1766-1844) was “**color blind**” (in medical parlance referred to as “Daltonism”, so named in his “honor”). Dalton requested that his eyes be examined after his death (in 1995 studies showed he had an unusual form of **deuteroanopia** (see next).

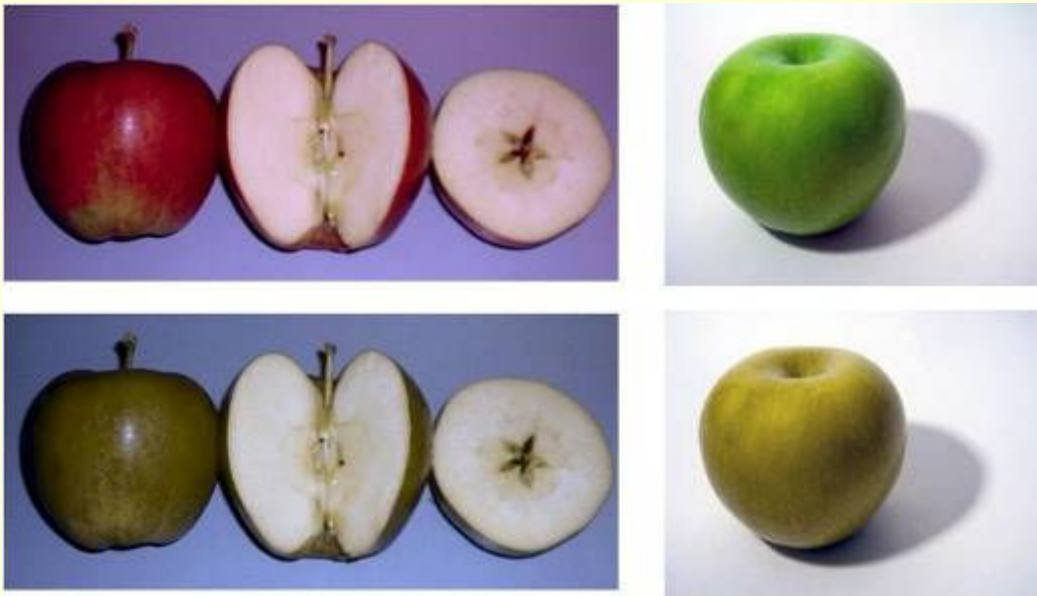
His mentor was John Gough, a blind philosopher. Dalton belonged to the Manchester Academy ...the members had a role in building the first railroad, advance textile technology, develop organic chemistry (textile dyes) ... designed the first electronic digital computer ...

Dalton was interested in meteorology and probability (as was Gregor Mendel) and was also interested in atomic theory (as was Mendeleyev who inspired Vernatsky and his pioneering views of the earth as being a “bio-sphere” threatened by the knowledge of mankind (“noosphere”).

Daltonism – Biometry – Epidemiology ... Genetics

(heterogeneity, sex ratio, prevalence ...)
 (“Color Blindness” is a misleading popular “label”)

Apples as seen by a trichromatic observer and the same apples as seen by a **deuteranope** (per Alex Wade)



DALTONISM

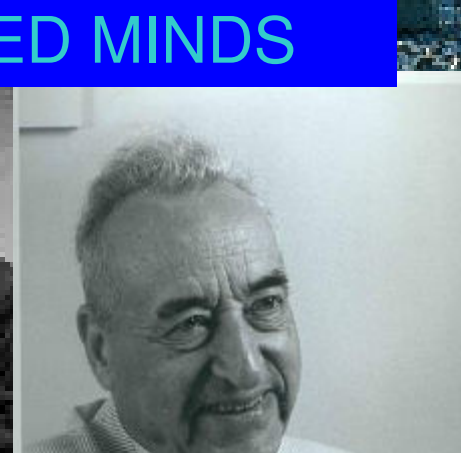
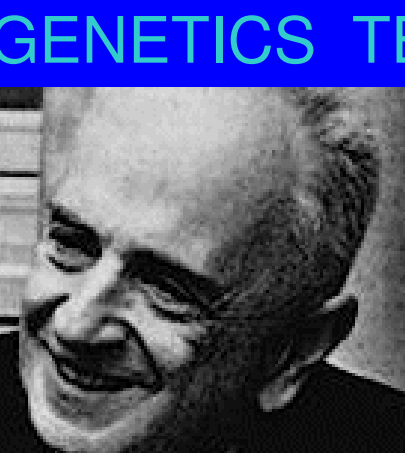
Prevalence in US	
Red-Green Males	7-10%
Women	<0.000001%
Monochromy	<0.0001%
Dichromacy Males	2.4%
Females	0.03%
Abnormal Trichromacy	
Males	6.3%
Females	0.4%
Deuteranomaly	
Males	5%
Females	0.4%

From <http://en.wikipedia.org/wiki/Image:GreenApple.png> and
http://en.wikipedia.org/wiki/Image:Braeburn_apples.jpg



Medicine – Teratology Mythology – History – Ethics (Prepared Minds)
COM 2007 W. Wroteleeki, M.D.
Installment 2- p13 of 13

GENETICS TERATOLOGY PREPARED MINDS



BIOMETRY GENE CHROMOSOME MUTAGEN TERATOGEN GENOMIC MEDICINE

