



What about Adam & Eve?

Alfred Driessen

Driessen.Alfred@gmail.com

Content



Introduction

What do we know about Adam & Eve

What do we know from science?

What does the Catholic Church tell us?

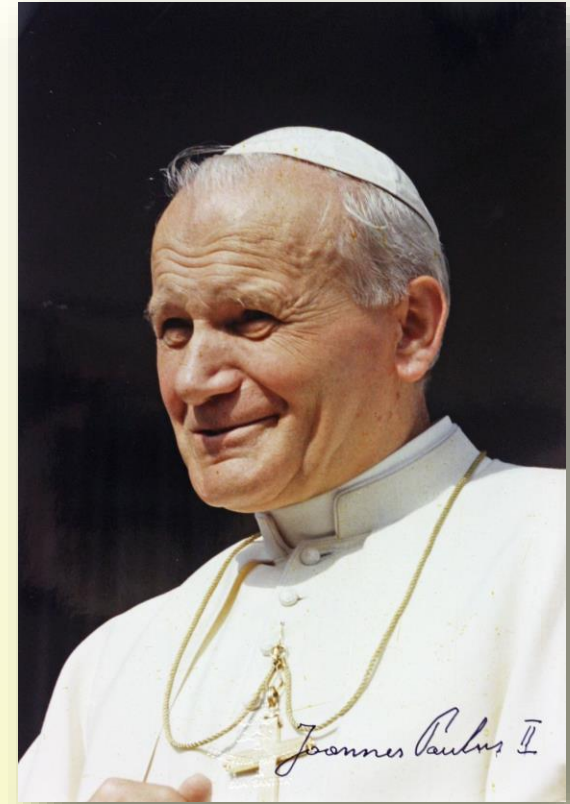
Conclusions

Truth cannot contradict the truth

John Paul II

Message to the Pontifical Academy of Sciences on Evolution (22-10-1996):

I am delighted with the first theme which you have chosen: the origin of life and evolution—an essential theme of lively interest to the Church, since Revelation contains some of its own teachings concerning the nature and origins of man. How should the conclusions reached by the diverse scientific disciplines be brought together with those contained in the message of Revelation? And if at first glance these views seem to clash with each other, where should we look for a solution? We know that the truth cannot contradict the truth. (Leo XIII, Providentissimus Deus).



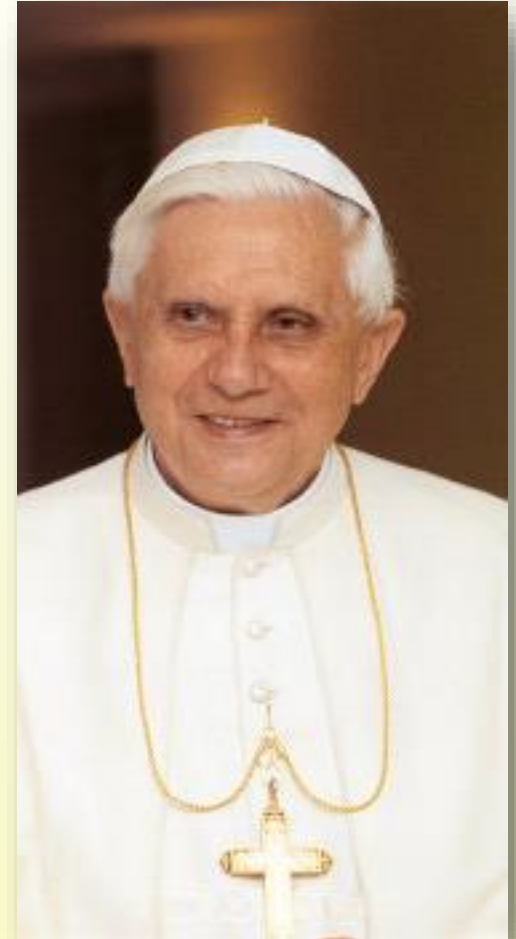
In the beginning was the logos (John, 1,1)

Benedict XVI

**Meeting with the representatives of Science,
Regensburg 12-9-2006)**

Modifying the first verse of the Book of Genesis, the first verse of the whole Bible, John began the prologue of his Gospel with the words: "In the beginning was the λόγος". This is the very word used by the emperor: God acts, σὺν λόγῳ, with logos. Logos means both reason and word - a reason which is creative and capable of self-communication, precisely as reason.

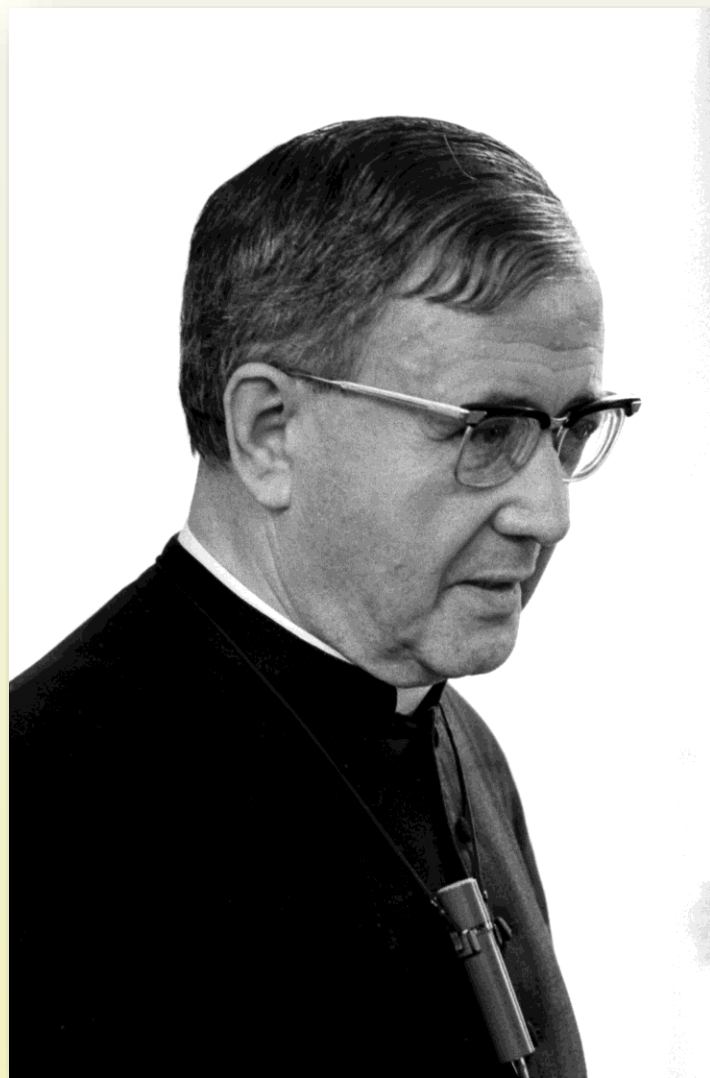
It is to this great logos, to this breadth of reason, that we invite our partners in the dialogue of cultures. To rediscover it constantly is the great task of the university.



Prologue by José Morales in: Pablo Blanco *Joseph Ratzinger, Vida y Teología* Rialp 2006

Reason and faith are united with an intrinsic reciprocal connection, i.e. both are related from within to each other. The relation between reason and faith is analogue to that between philosophy and theology, between nature and grace. This all proceeds and finds its justification in the two natures which exist in the incarnated Word: the divine and human nature which is assumed in the unique divine person of Jesus.





Friends of Gods (homily Human Virtues)

nr. 74 (...) because human virtues constitute the foundation for the supernatural virtues.

nr. 91 The human virtues are, I insist, the foundation for the supernatural ones. These in turn provide us with constant encouragement to behave as good human beings.

reason and faith

optimistic view on human capacity:

Theology is enriched by science (*intellego ut credam*)

Science is enriched by theology (*credo ut intellegam*)

some examples:

Galileo:

Theology is confirmed in the conviction that the Bible is not a science textbook

creation in 6 x 24 hours:

Never proposed by the Catholic Church.

Theology teaches that there is causality from outside time. Physics provides meanwhile evidence herefore.

Adam and Eve

Are all human beings descending from a single couple? See the following!



Content



Introduction

What do we know about Adam & Eve

What do we know from science?

What does the Catholic Church tell us?

Conclusions

The mystery of creation

Genesis, chapter 1, Jerusalem Bible

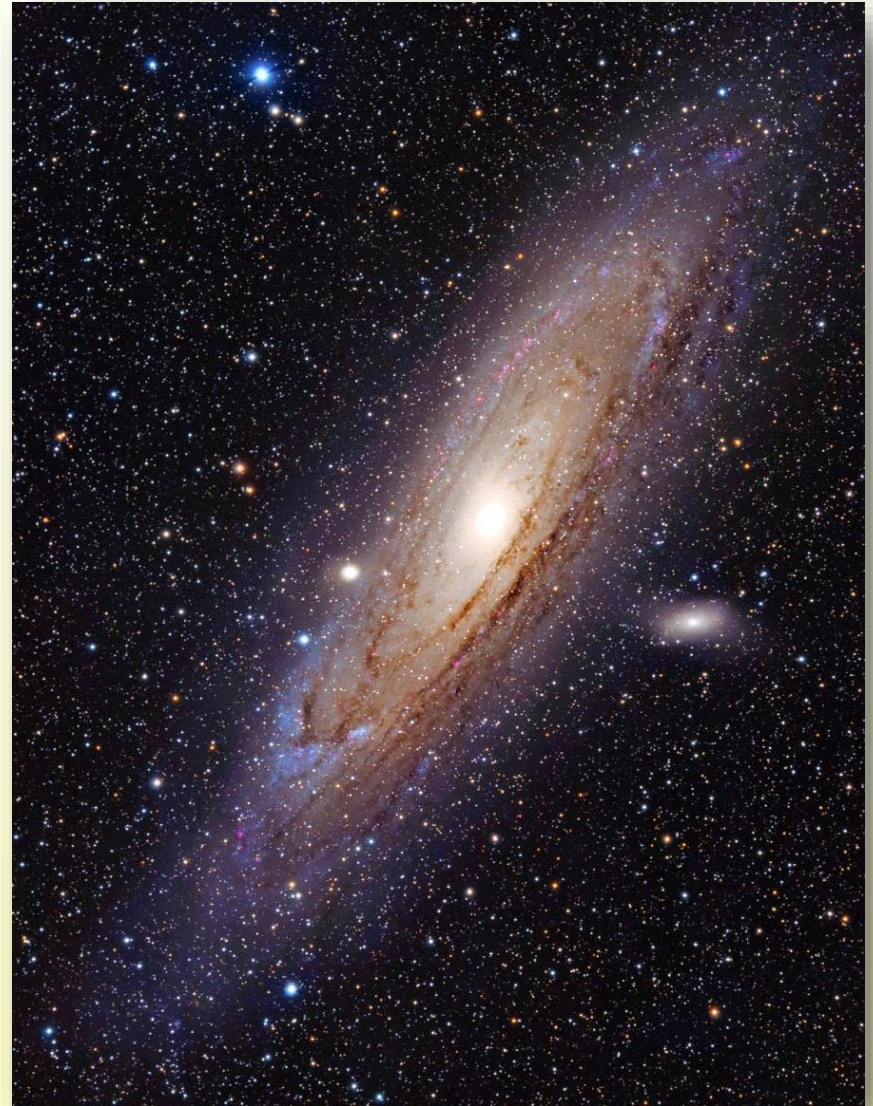
**1. In the beginning
God created heaven and
earth.**

with other words:

Heaven and earth have a beginning.

Heaven and earth are created.

**There is a creator: God who is
transcending (standing outside)
heaven and earth.**



creation of man I

Genesis, chapter 1, Jerusalem Bible
26. God said, 'Let us make man in our own image, in the likeness of ourselves, and let them be masters of the fish of the sea, the birds of heaven, the cattle, all the wild animals and all the creatures that creep along the ground'.

with other words:

Man is created directly by God.

Man is created as image of God.

Man has a preferential position in creation: he is master.



creation of man II

Genesis, chapter 2, Jerusalem Bible
7. Yahweh God shaped man from the soil of the ground and blew the breath of life into his nostrils, and man became a living being.

with other words:

Man is created in a two-step process:

- 1. materials aspect: soil of the ground or perhaps biological organism;**
- 2. breath of life: something different from the material world: soul.**

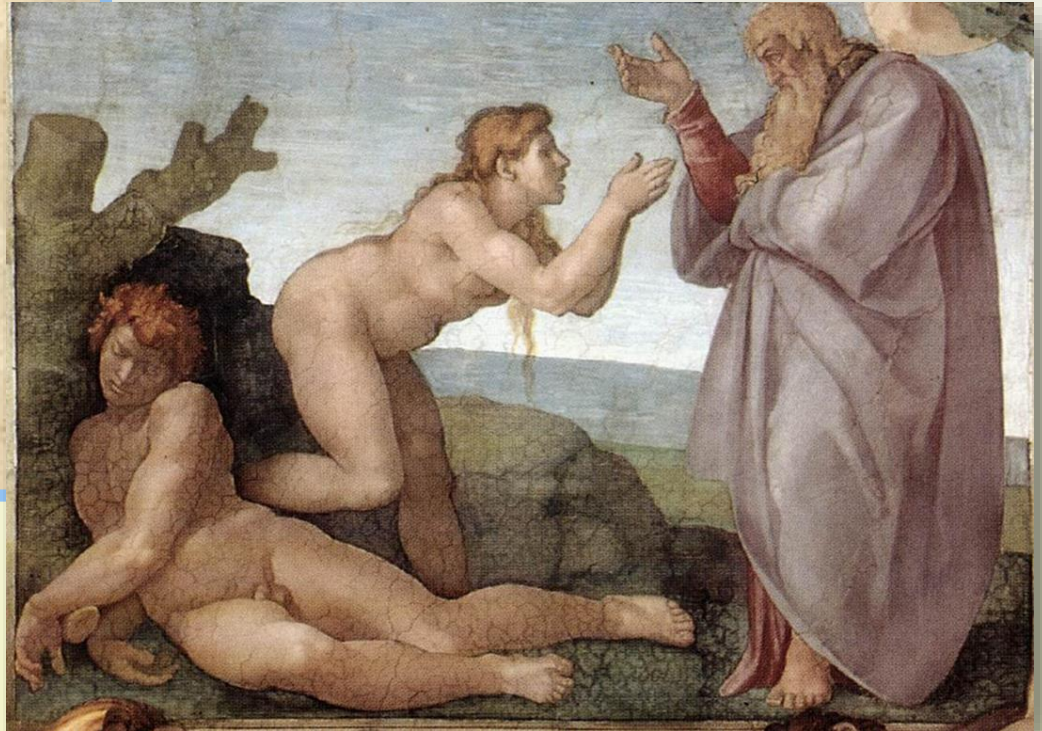


creation of man - woman: Adam - Eve

Genesis, chapter 1, Jerusalem Bible

26. God created man in the image of himself, in the image of God he created him, male and female he created them.

31. God saw all he had made, and indeed it was very good.



with other words:

Man and woman are created directly by God, they have equal dignity as image of God.

The creation is very good.

The first sin

Genesis, chapter 3, Jerusalem Bible
3 But of the fruit of the tree in the middle of the garden God said, "You must not eat it, nor touch it, under pain of death."

6 The woman saw that the tree was good to eat and pleasing to the eye, and that it was enticing for the wisdom that it could give. So she took some of its fruit and ate it. She also gave some to her husband who was with her, and he ate it.

with other words:

Man and woman in paradise did not respect the one and only command of God they had to obey.



The first sin

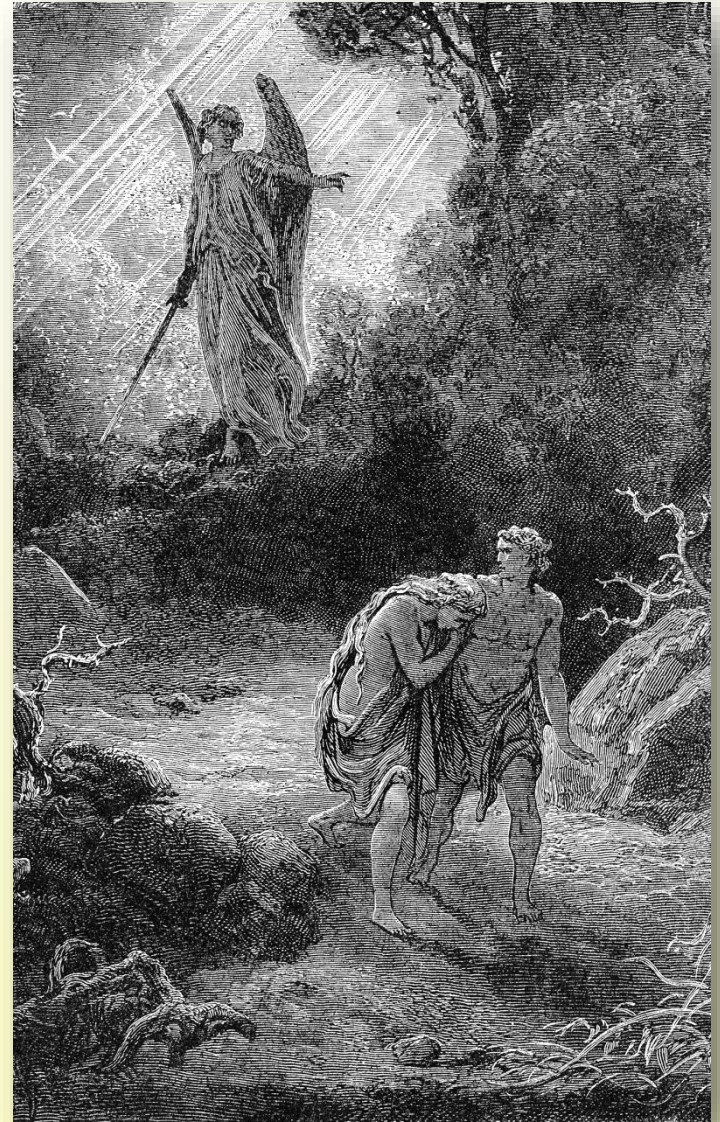
Genesis, chapter 3, Jerusalem Bible

23 So Yahweh God expelled him from the garden of Eden, to till the soil from which he had been taken.

24 He banished the man, and in front of the garden of Eden he posted the great winged creatures and the fiery flashing sword, to guard the way to the tree of life.

with other words:

Adam and Eve (and their descendant) were punished by expulsion from paradise and loss of friendship with God.



St. Paul: the consequence of first sin

St. Paul: Romans, chapter 5, Jerusalem Bible
12. Well then; it was through one man that sin came into the world, and through sin death, and thus death has spread through the whole human race because everyone has sinned.

14. Nonetheless death reigned over all from Adam to Moses, even over those whose sin was not the breaking of a commandment, as Adam's was.

with other words:

Consequences of sin have spread through the whole human race.

The consequences of sin are for all, even if the individual had not committed sin.



The justification by Jesus Christ

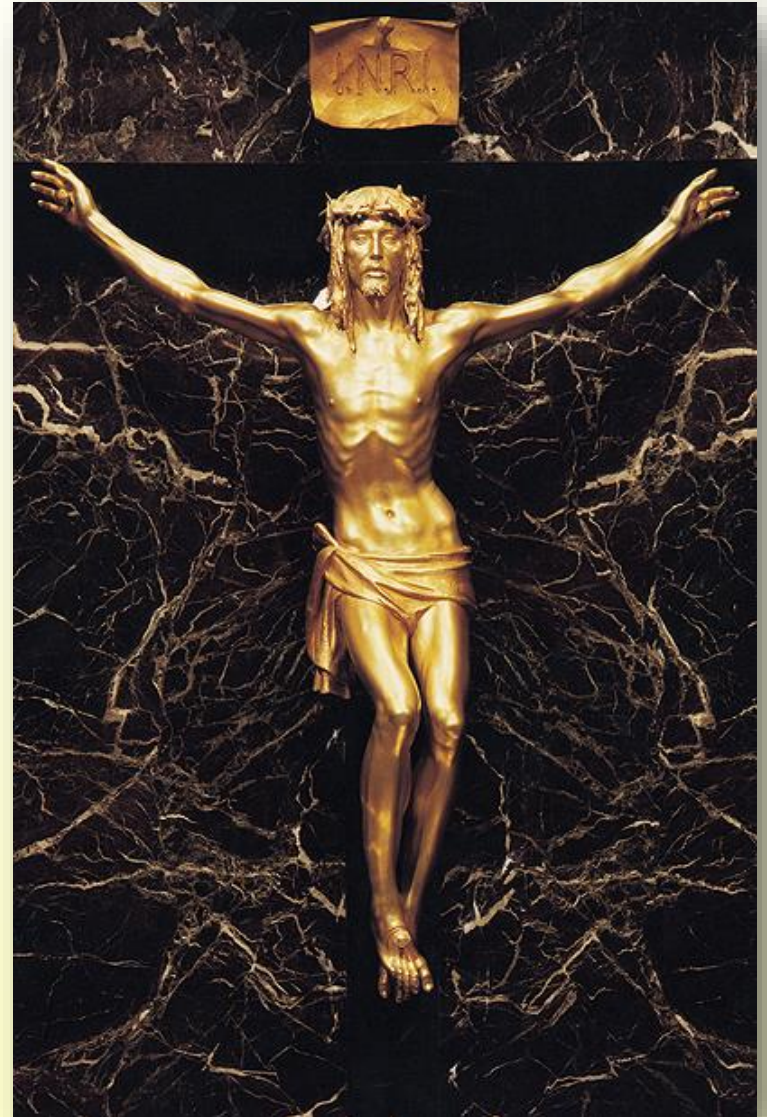
St. Paul: Romans, chapter 5,
Jerusalem Bible

18. One man's offence brought condemnation on all humanity; and one man's good act has brought justification and life to all humanity.

21. so that as sin's reign brought death, so grace was to rule through saving justice that leads to eternal life through Jesus Christ our Lord.

with other words:

The consequences of sin have been quitted for all by one single person: Jesus Christ, the new Adam.



Content



Introduction

What do we know about Adam & Eve

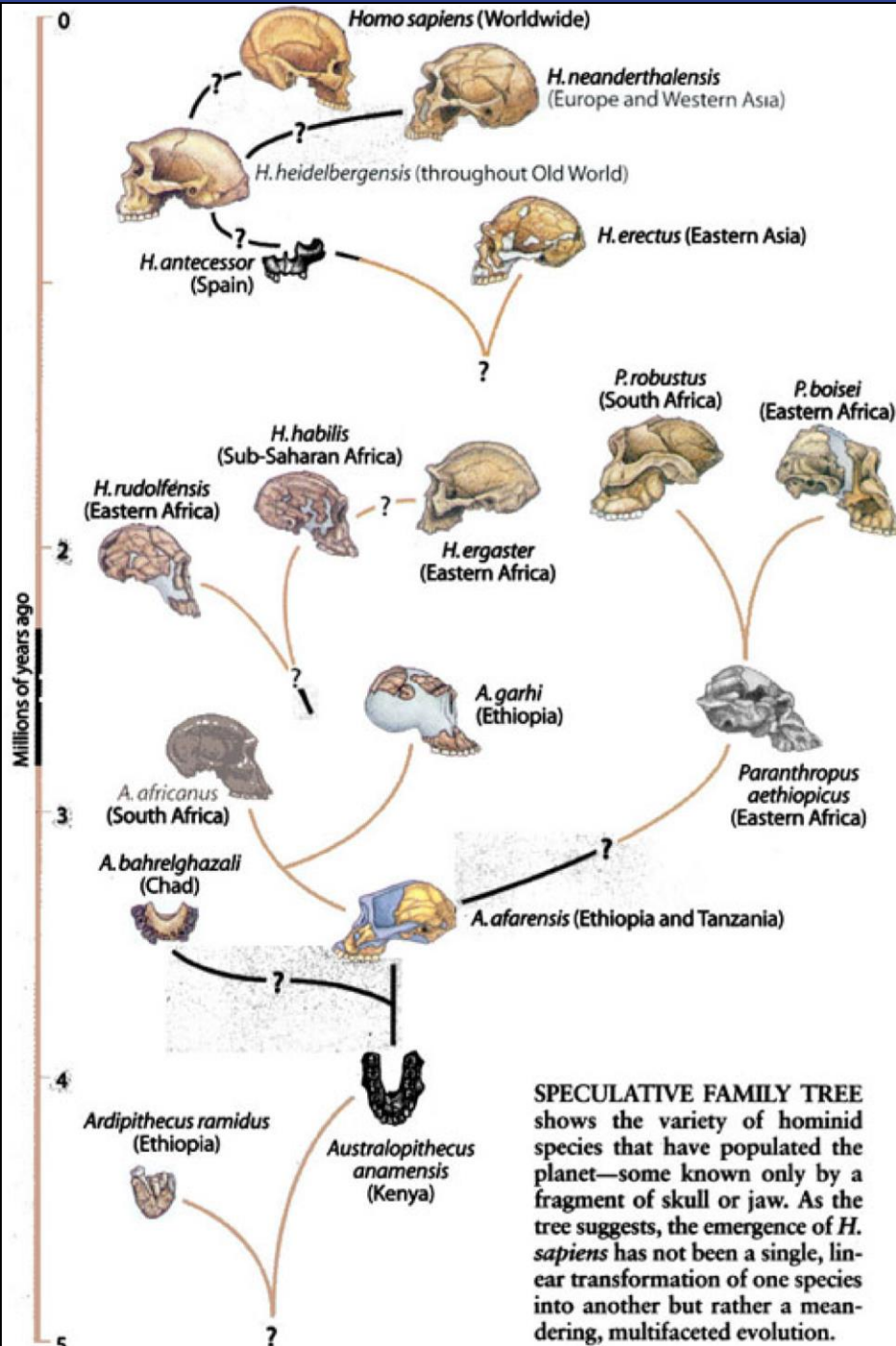
What do we know from science?

What does the Catholic Church tell us?

Conclusions

dating by fossils

Phylogeny of hominins according to Ian Tattersall (2000)

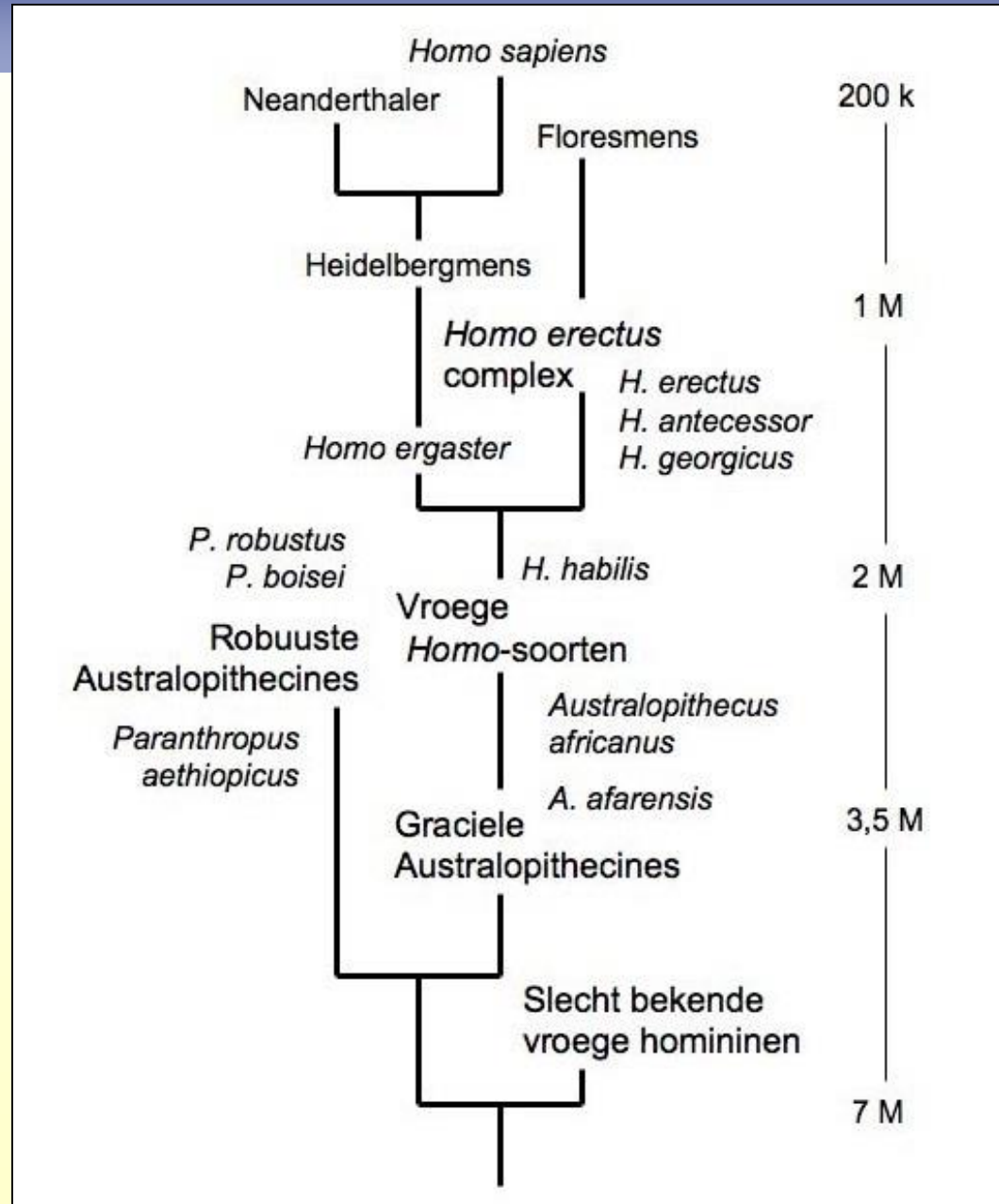


- origin 5 - 8 Millions of years
- in total 8 *Homo*-species and 14 non-*Homo*-species
- some lived simultaneously
- all extinct, besides *Homo sapiens*

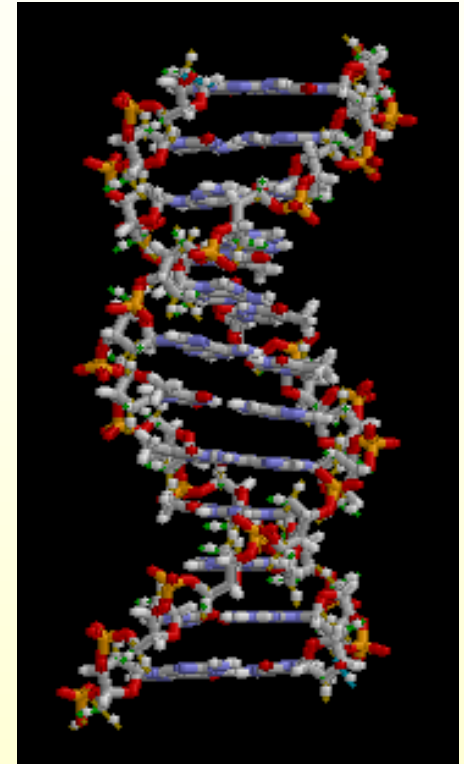
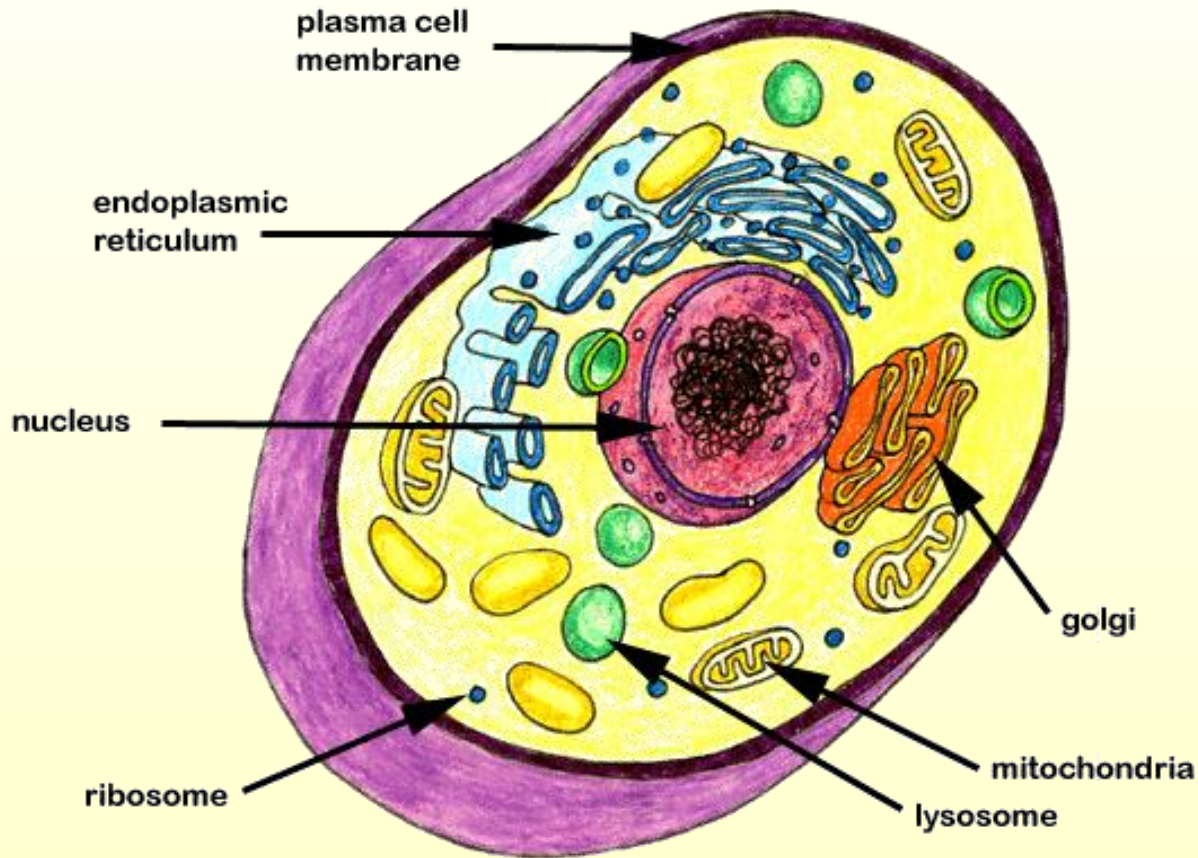
Homo sapiens: origin in Africa, \pm 200.000 ago

dating by fossils

- about 25 species!
- complex pattern
- dates in agreement with man-chimpansee divergence obtained by DNA

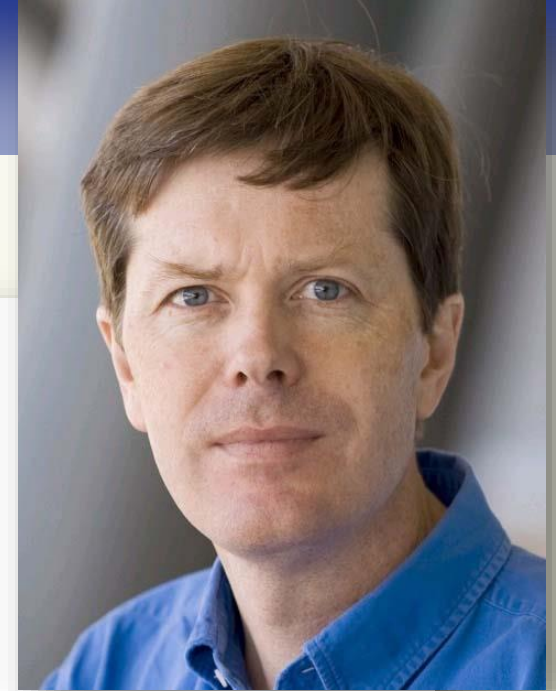


cross-section of a cell



**part of DNA in
the cell nucleus
or mitochondria**

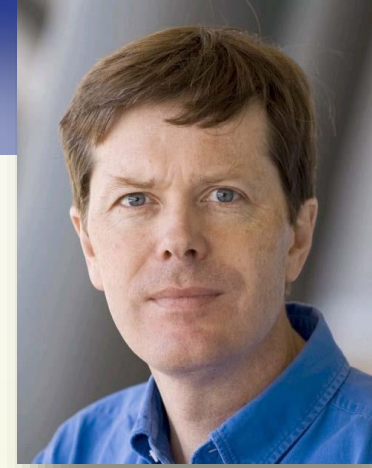




On the polygenic origin of humanity

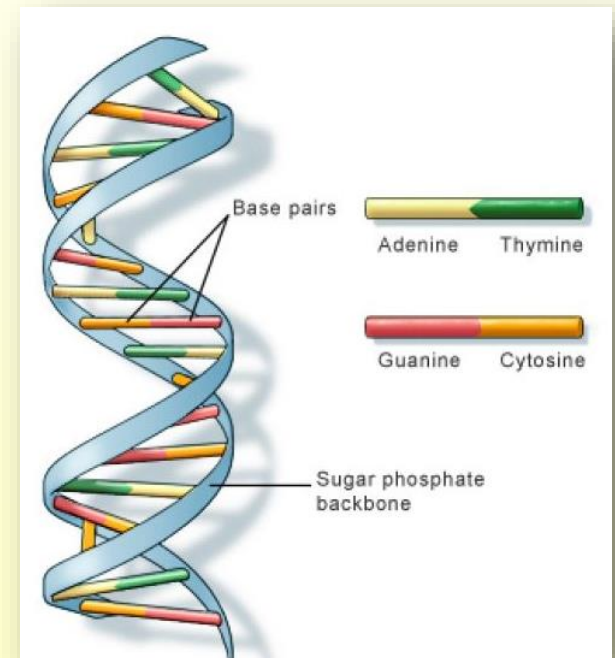
Richard Durbin
Wellcome Trust Sanger Institute
rd@sanger.ac.uk

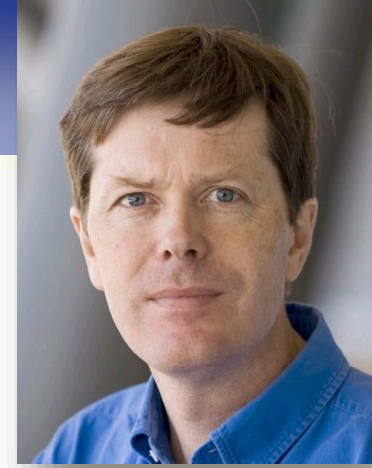
Richard Durbin, Introduction



“Can the polygenic origin of humanity be really considered a well-established scientific conclusion on the basis of today’s data?”

•Approach: Use genome sequences to consider the patterns of ancestry relating modern humans, and our living and extinct relatives.





The era of sequencing genomes

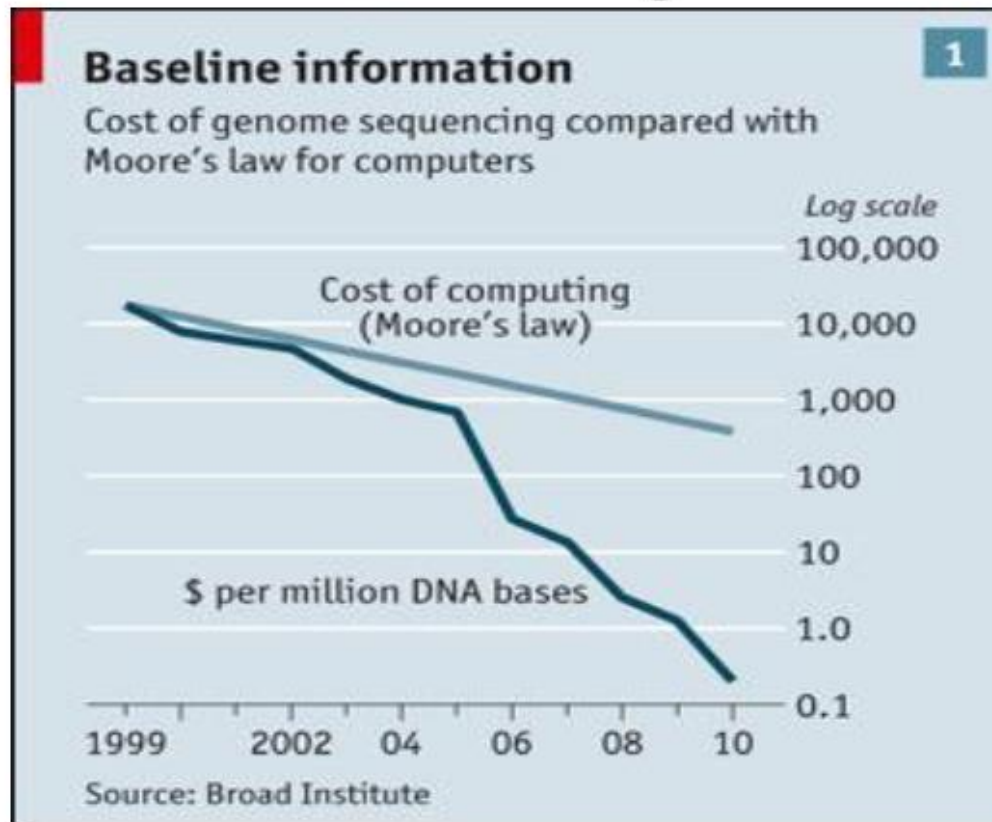
	Size (Mb)	Genes			Completion date
<i>H. influenzae</i>	2	1,700	1/1kb	Bacterium	1995
Yeast	13	6,000	1/2kb	Eukaryotic cell	1996
Nematode	100	18,000	1/6kb	Animal	1998
Human	3000	20,000	1/150kb	Mammal	2000/3
Chimpanzee, Orang-utan, Gorilla, Bonobo					2007-12
1000 Genomes Project: 179/1,094 humans					2010/12



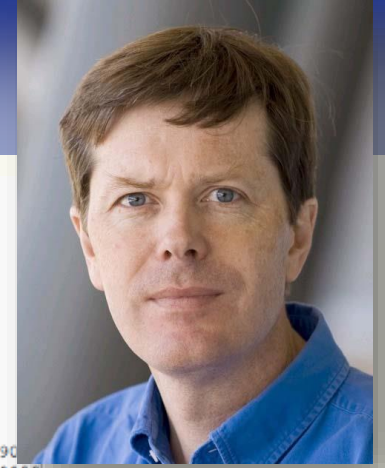
Richard Durbin



Between 2000 and 2010 DNA sequencing costs dropped by five orders of magnitude



We now sequence individual humans/animals for a few thousand dollars



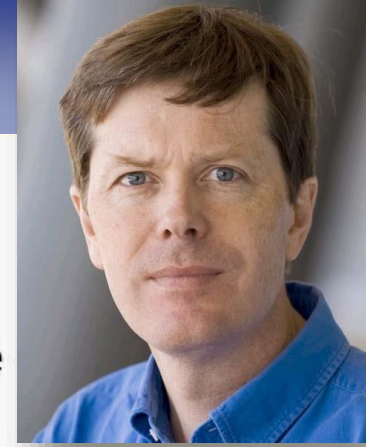
Human genomes differ at ~1/1000 sites

refNCBI36	8881	CCTCCGCCTCCAGGTTCAACTGATTCTTCTGCCTCAGCCCTCCCAAGTAGCTGGGATTACAGGGCAGCGCCACCACACCTGGCTAATTTTTTGTATTTTTTTAGTAGAGACGGGGTTTTFG	9000
Venter	8881	.....	9000
Watson	8881	.....	9000
refNCBI36	9001	CCACGTTGGCCAGGCTGGTCTTGAACCTCCTGACCTCAGGTGATCTGCCCGCCTTGGCCFCCCAAAGTGTGGGATTACAGGTGTGAGCTACCGCGCTTAGCCCAAGTATAGAGTTTTPTGT	9120
Venter	9001	.....	9120
Watson	9001	.....	9120
refNCBI36	9121	TGCCAAAACAAAACATATGAACATATGATAGCTCTAATAAAAAATGCTGTTCTTTGTFCTCATAATTCAGTAGCTGAACIATGCTCCATTTCATCTGTAAAAGAGAAATAATCTGTAC	9240
Venter	9121	.....	9240
Watson	9121	.....	9240
refNCBI36	9241	CTTCTTGAGTG	9360
Venter	9241	.....	9360
Watson	9241	.....	9360
refNCBI36	9361	ATACTTTTATTTTTTAAAGAAATGTAGGCAGTTGTGATTTTTTCCOCCCAACATTCATCAGAGAGCAGAAAAGGTGCTGCCAATTCAGACTTCCACATGAAAGATTTCACTATGCCAGG	9480
Venter	9361	.....	9480
Watson	9361	.....	9480
refNCBI36	9481	TGACCTGCCTAGAAAGCAGGTTAATAACCCCTGTTTCATGGGCTGTCCTTTCGCTTCACAATGAATGGTCTCCTTTTGCAATGAATTTTTGAAGTTTTGTTTTTATTCTATGPAATAA	9600
Venter	9481	.....	9600
Watson	9481	.....	9600
refNCBI36	9601	TTTGGCTACATGTAM	9720
Venter	9601	.....	9720
Watson	9601	.....	9720
refNCBI36	9721	ATCAATTAGGTCAAG	9840
Venter	9721	.....	9840
Watson	9721	.....	9840
refNCBI36	9841	TACAGTGTTTTACAACTTACTTGACCACAAAACCTTTTCTCGTGGTCTTGTGTTACTCAGAACTCAAATCTTTTGAATTTACAAATGAACAGAAACGACAGCAAATGGCTTATTCAA	9960
Venter	9841	.....	9960
Watson	9841	.....	9960
refNCBI36	9961	AGCAATATAGCAGTTTATTTAAAGAAGCTGGACTTGAAGTA	10000
Venter	9961	.....	10000
Watson	9961	.....	10000

3 billion bases per genome
So ~3 million differences per comparison



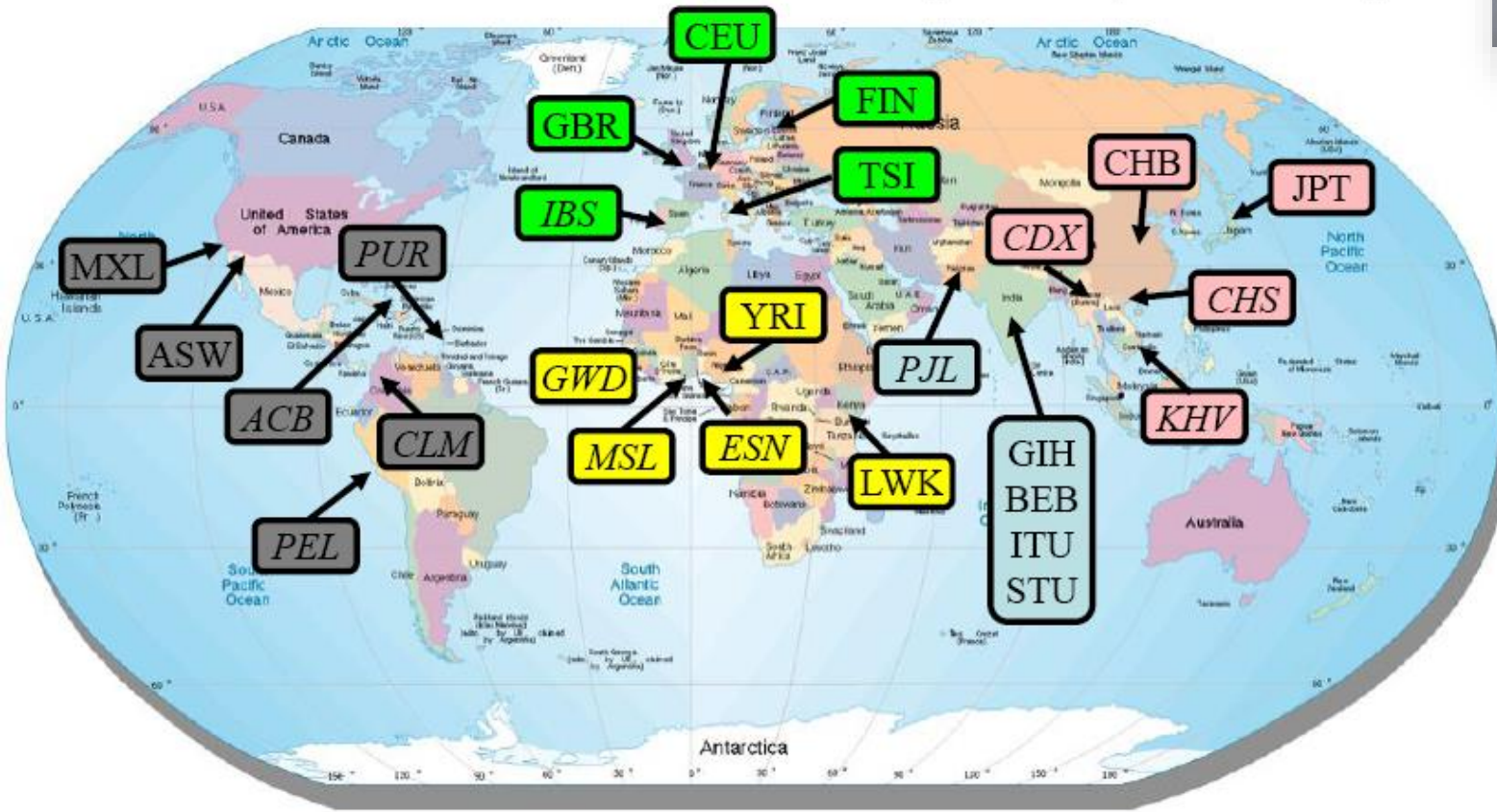
Richard Durbin



Pilot project 179 samples (Nature 2010)

Phase 1: 1,092 samples (Nature 2012)

Phase 3: >2,500 samples sequence complete



~100 per population: 4x Whole Genome Shotgun + Deep Exomes

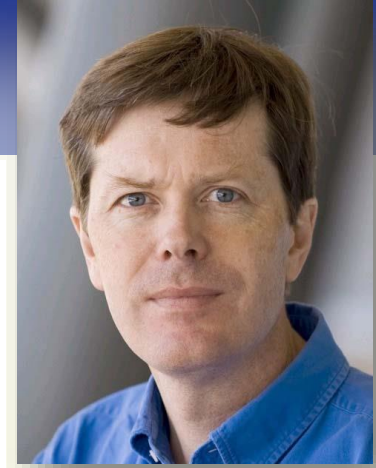




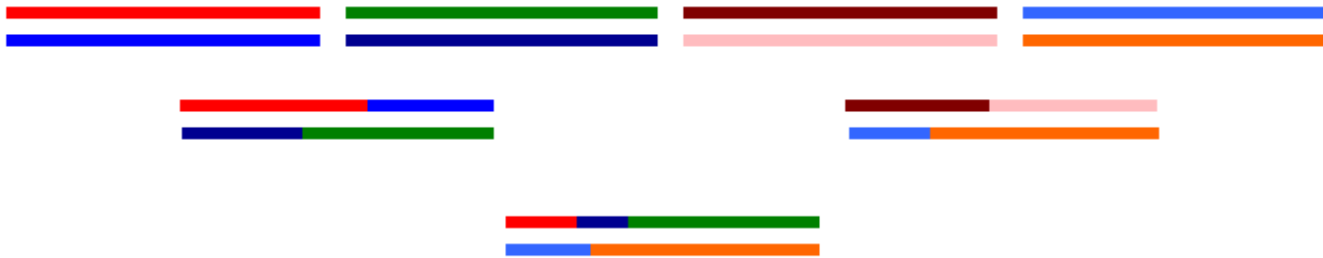
How are our genomes related?



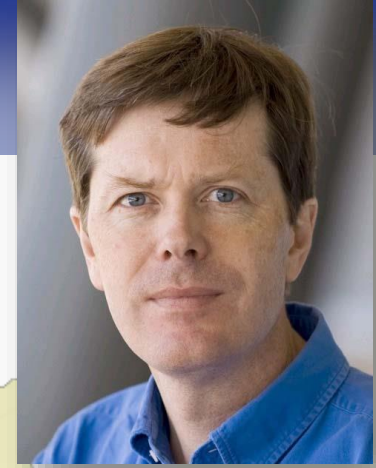
- We each inherit one copy of the genome from our father, and one from our mother
- These are each a mosaic of pieces from our grandfather and grandmother, by *recombination*



How are our genomes related?



- We each inherit one copy of the genome from our father, and one from our mother
- These are a mosaic of pieces from our grandfather and grandmother, by *recombination*
- One can follow the history of pieces back through the generations



Genome relationships in a population

Case study: Kuusamo

– Historical records

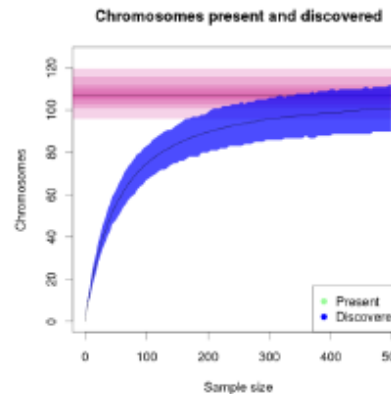
- Settled by 34 families in 1680s
- Very little immigration after initial settlement
- Current population ~20 000



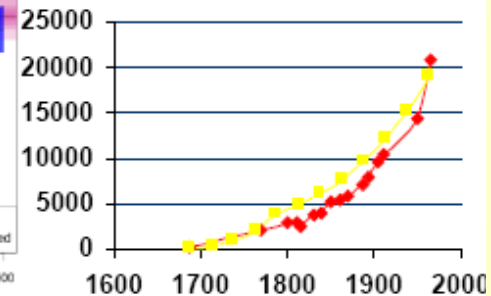
– Best fit model to genetic data

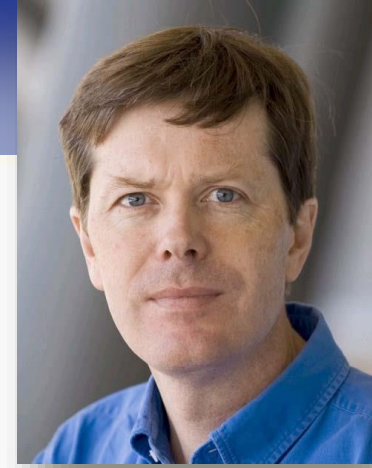
- 100 founders: 200 genomes
- Current population descends

from 95-120 of 200 founder copies at each place on the genome



Population Size





Minor aside: limits of inheritance

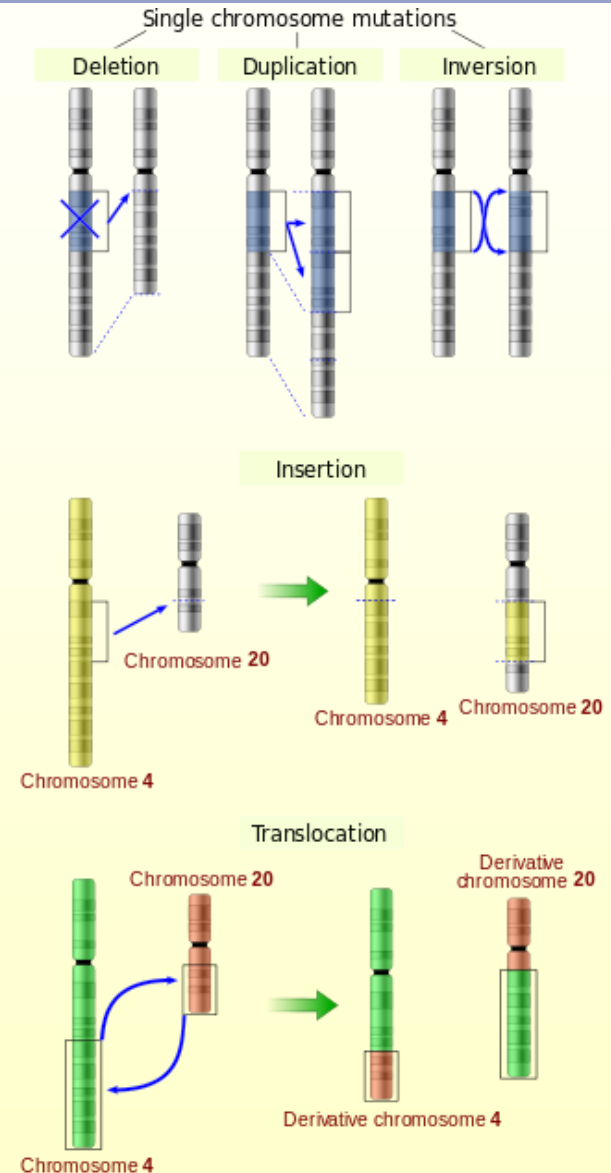
- There are around 60 recombinations per generation
 - So $60N$ pieces from N generations ago
- But there are 2^N ancestors N generations ago
- At 10 generations we inherit about 600 pieces from about 1000 ancestors
- Beyond 10 generations we inherit no DNA from most ancestors

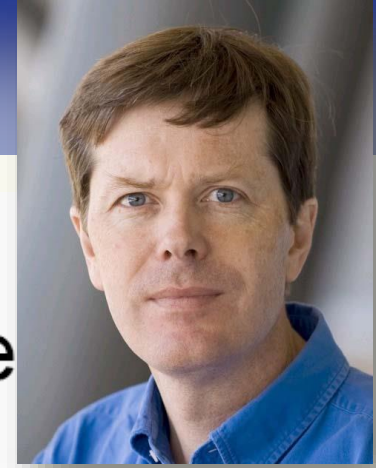
The molecular clock

The molecular clock (based on the molecular clock hypothesis) is a technique in molecular evolution that uses fossil constraints and rates of molecular change to deduce the time in history when two species diverged.

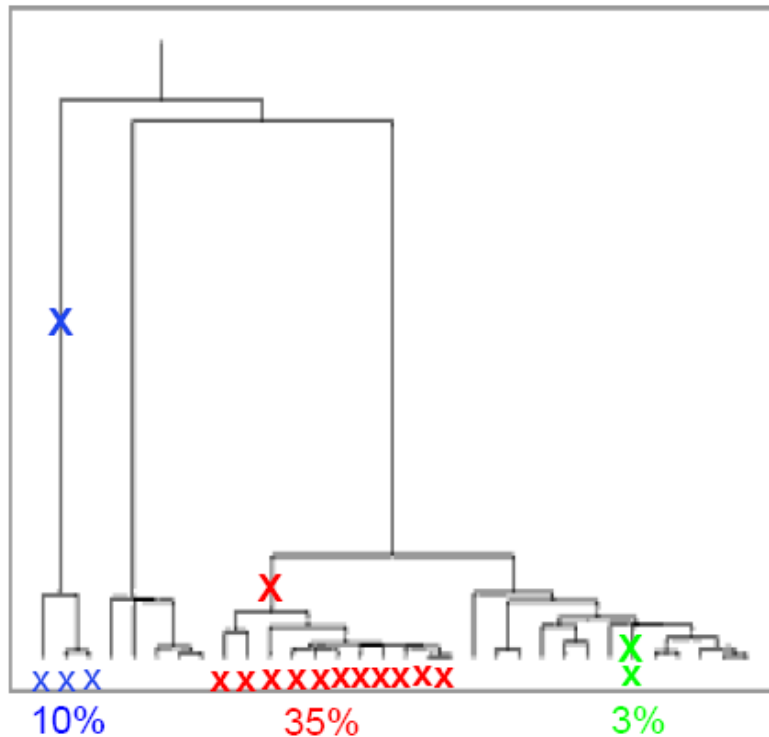
The molecular clock gives only a relative time as it is dependent on the mutation rate. It can be calibrated by the present experimentally obtained mutation rate.

Illustrations of five types of chromosomal mutations.





Going back further in time, At any one site we are related by a tree



- At each point in the genome we are descended from a common ancestor
- Mutations since the common ancestor give rise to genetic variants shared by the descendants, marking the piece of DNA that the mutation occurs on
- Each mutation makes a new *allele*, with an *allele frequency* in the population



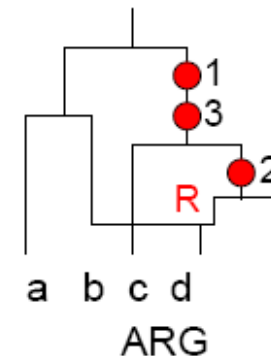
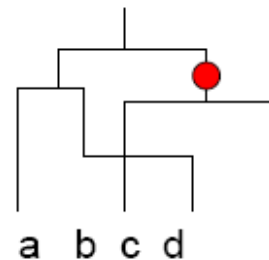
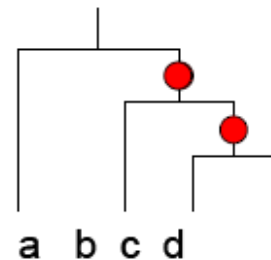


But the tree changes along the genome

- At each locus there is a tree
- Ancestral recombinations change the tree as you move along the genome
- The resulting *Ancestral Recombination Graph* describes the way that individual sequences in a sample are related

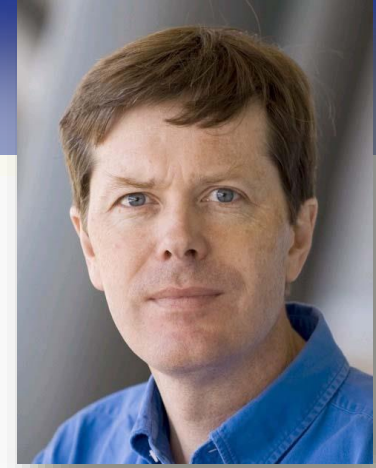
a ..C..G..A..
b ..T..G..C..
c ..T..A..A..
d ..T..A..C..

0 0 0
1 0 1
1 1 0
1 1 1



- The most recent common ancestor also changes, many times along the genome



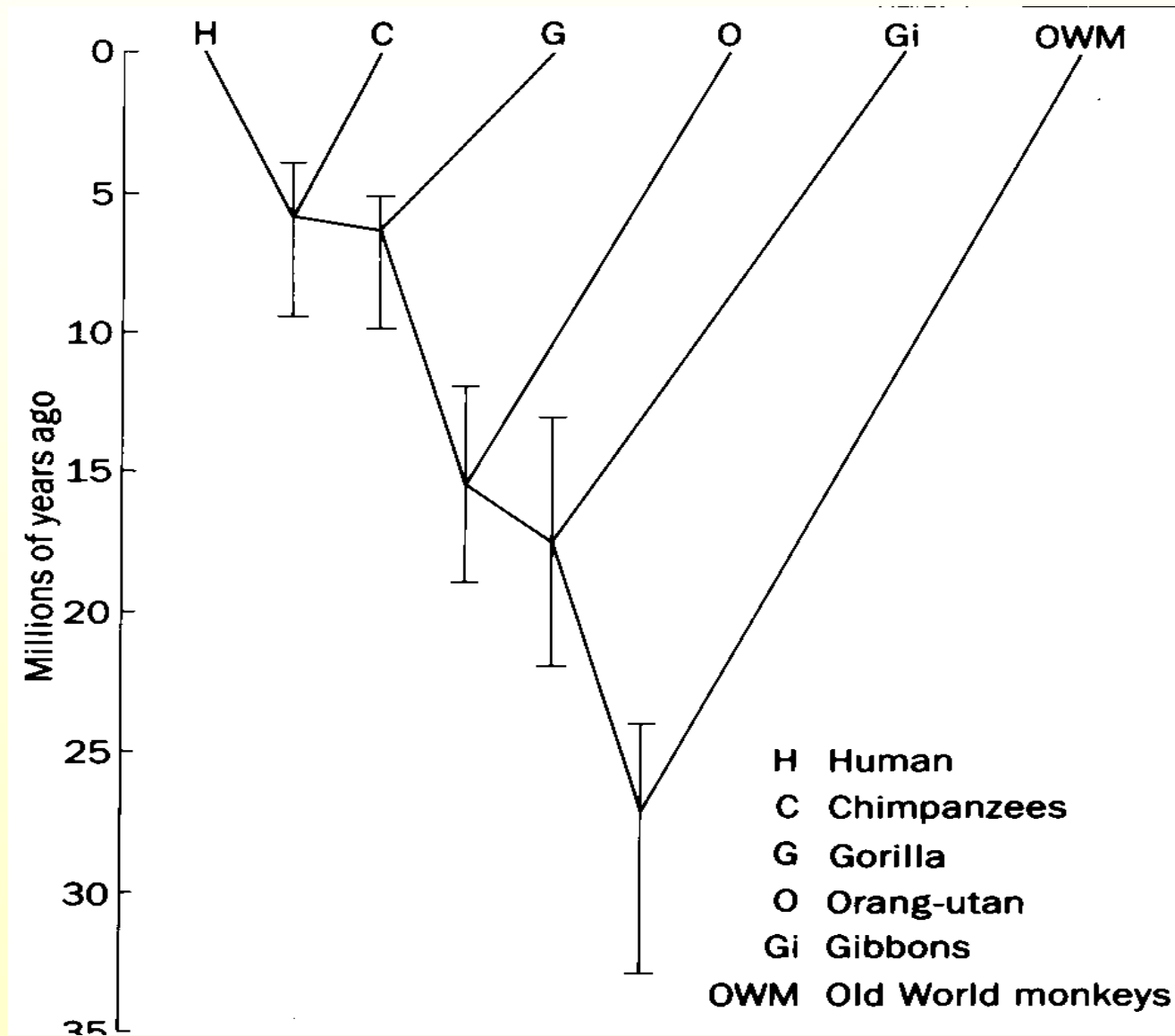


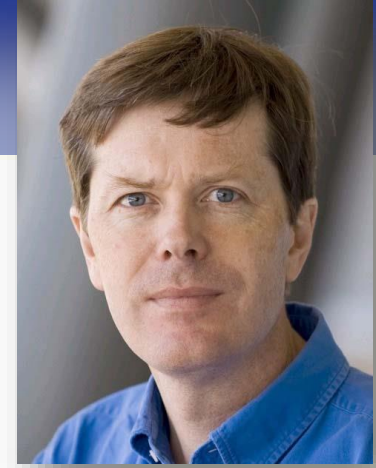
Special cases: Y and MT

- The Y chromosome (~1% genome) is inherited by men from their father, without recombination
- The *mitochondrial* chromosome (MT, ~0.001% genome) is inherited by each person from their mother, without recombination
- These each have their own tree, and (different) common ancestor, alongside the millions of different trees for the rest of the genome



Phylogeny of apes (via mitochondria genes)





Many crossbreeding homnins within the last million years

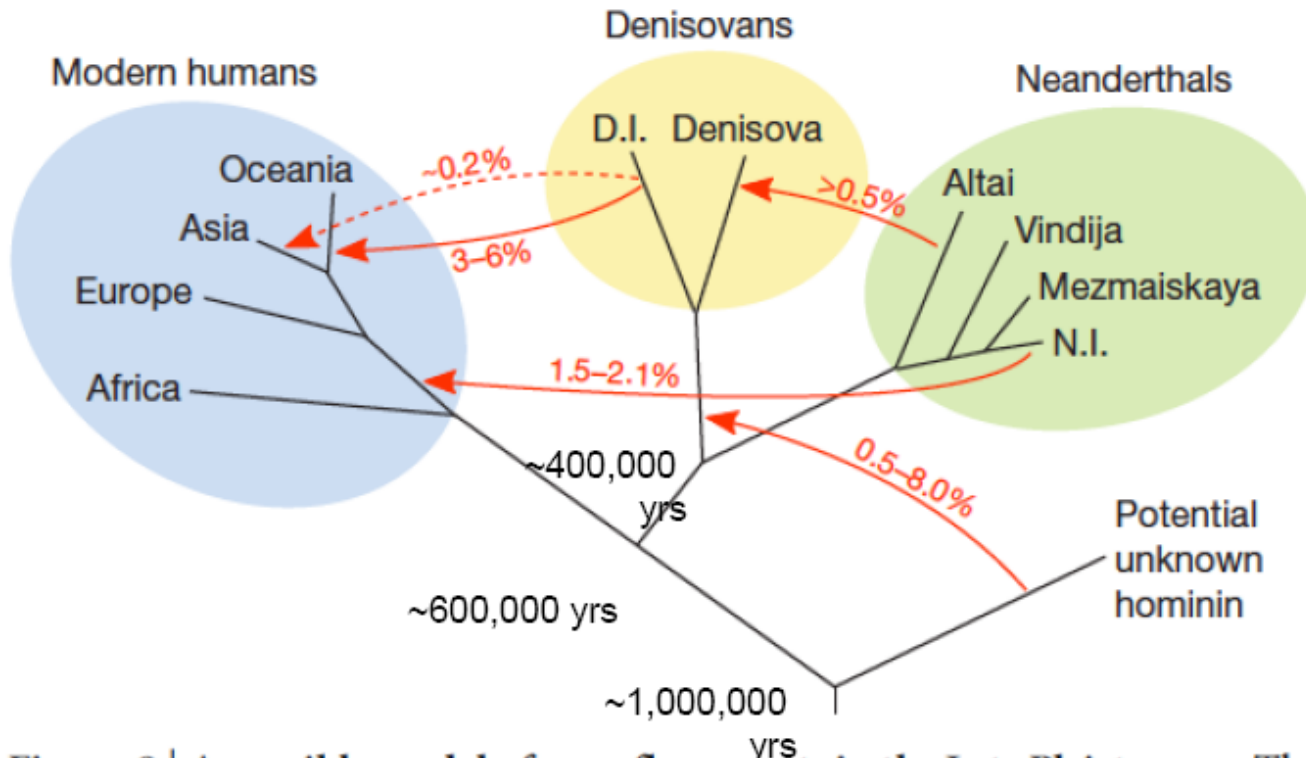
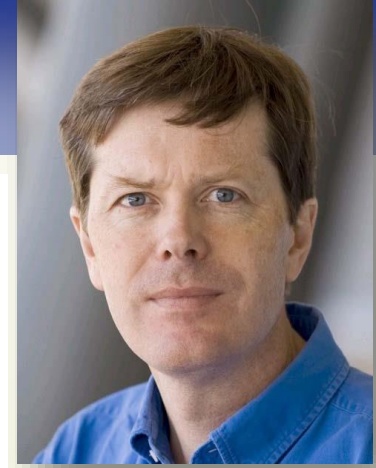


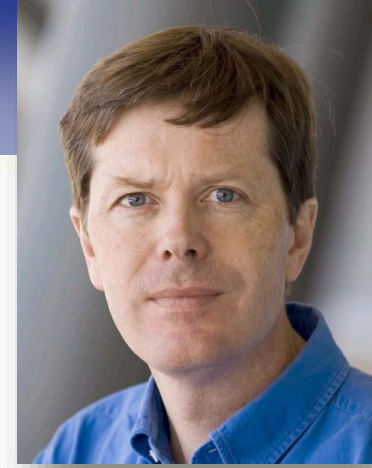
Figure 8 | A possible model of gene flow events in the Late Pleistocene. The direction and estimated magnitude of inferred gene flow events are shown.

“The complete genome sequence of a Neanderthal...”, Prufer et al., Nature 2013



Summary

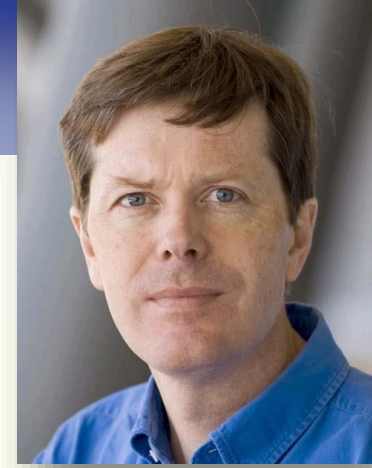
- At any one place in the genome, modern humans are related by a tree, with a most recent common ancestor (MRCA)
- But the tree, and MRCA, are different in different parts of the genome
 - Over 100,000 different MRCAs
- Most MRCAs predate the split from archaic extinct hominids such as Neanderthals
 - Some predate the split from chimpanzees and other apes



Conclusions and options

- Any attempt to separate all the DNA in humans from that in animals passes through many individuals
 - Only if we select a small fraction of the genome can we discuss a monogenic origin
- Modern humans have only been an isolated species for around 30,000 years
 - We need to consider the position of archaic hominins with whom we share multiple common ancestors, if not the extant apes





General points

- From the point of view of biology, some units represent true discrete objects, others useful descriptive concepts
 - True objects: nucleotides, mutations, individuals
 - Useful concepts: genes, species
- Compare to the relationship in geography between heights and contours as true physical measurements, and mountains as a useful concept

Content



Introduction

What do we know about Adam & Eve

What do we know from science?

What does the Catholic Church tell us?

Conclusions

Council of Trent

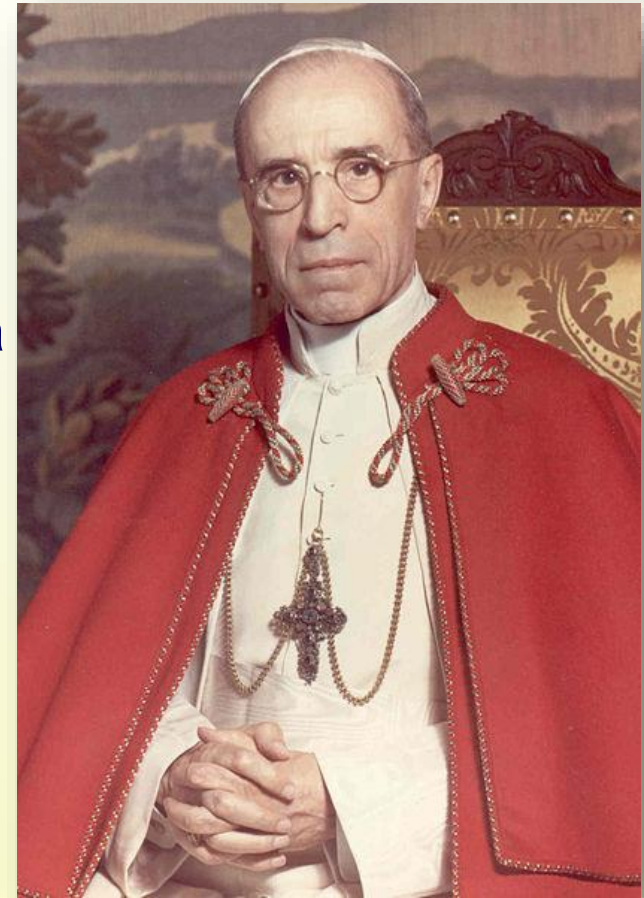
If any one asserts, that this sin of Adam, -which in its origin is one, and being transfused into all by propagation, not by imitation, is in each one as his own,- is taken away either by the powers of human nature, or by any other remedy than the merit of the one mediator, our Lord Jesus Christ, who hath reconciled us to God in his own blood, made unto us justice, sanctification, and redemption; [...] let him be anathema.

The Council of Trent, 5th Session, *Decree concerning Original Sin* (June 17, 1546).



Pius XII, Humanae generis (1950)

For the faithful cannot embrace that opinion which maintains that either after Adam there existed on this earth true men who did not take their origin through natural generation from him as from the first parent of all, or that Adam represents a certain number of first parents. Now it is in no way apparent how such an opinion can be reconciled with that which the sources of revealed truth and the documents of the Teaching Authority of the Church propose with regard to original sin, which proceeds from a sin actually committed by an individual Adam and which, through generation, is passed on to all and is in everyone as his own [Cfr. Rom., V, 12-19; Conc. Trid., sess, V, can. 1-4].



Pius XII, Humanae generis (1950)

For the faithful cannot embrace that opinion which maintains that either after Adam there existed on this earth true men who did not take their origin through natural generation from him as from the first parent of all, or that Adam represents a certain number of first parents. Now it is in no way apparent how such an opinion can be reconciled with that which the sources of revealed truth and the documents of the Teaching Authority of the Church propose with regard to original sin, which proceeds from a sin actually committed by an individual Adam and which, through generation, is passed on to all and is in everyone as his own [Cfr. Rom., V, 12-19; Conc. Trid., sess, V, can. 1-4].

**relevant part:
related to dogma
on original sin**



Pius XII, Humanae generis (1950)

For the faithful cannot embrace that opinion which maintains that either after Adam there existed on this earth true men who did not take their origin through natural generation from him as from the first parent of all, or that Adam represents a certain number of first parents. Now it is in no way apparent how such an opinion can be reconciled with that which the sources of revealed truth and the documents of the Teaching Authority of the Church propose with regard to original sin, which proceeds from a sin actually committed by an individual Adam and which, through generation, is passed on to all and is in everyone as his own [Cfr. Rom., V, 12-19; Conc. Trid., sess, V, can. 1-4].

**conditional part:
not related
directly to dogma**

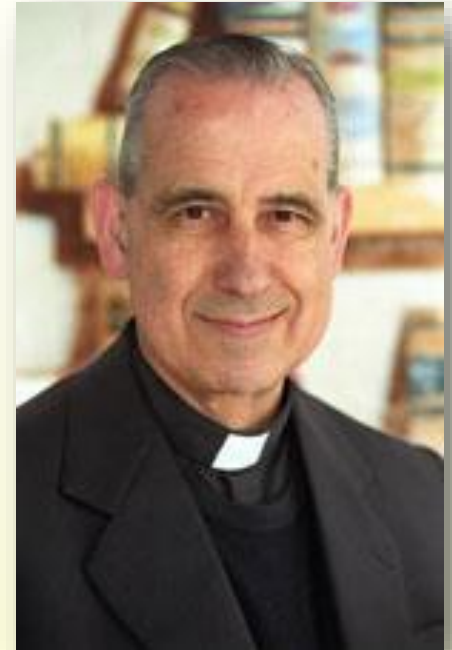


Pius XII, Humanae generis (1950)

comment of Mariano Artigas

Scripta theologica, 32 (2000/1) 243-267

It is plain from this text that the Magisterium of the Church does not intend to support the monogenism for itself, and in fact she does not have made of it the content of any explicit definition as a dogma of faith: Commonly it is accepted that Pius XII in the text just quoted intentionally avoided to close the door to future developments. The Church is interested in monogenism only as far as it is related to the sources of revelation, and the teaching of the original sin and redemption. In the last decades there have been several attempts on the part of some theologians to interpret the original sin and redemption in a way compatible with the polygenism. One cannot say that for now one has reached a really satisfactory explanation, but one can neither completely exclude that this will succeed once.



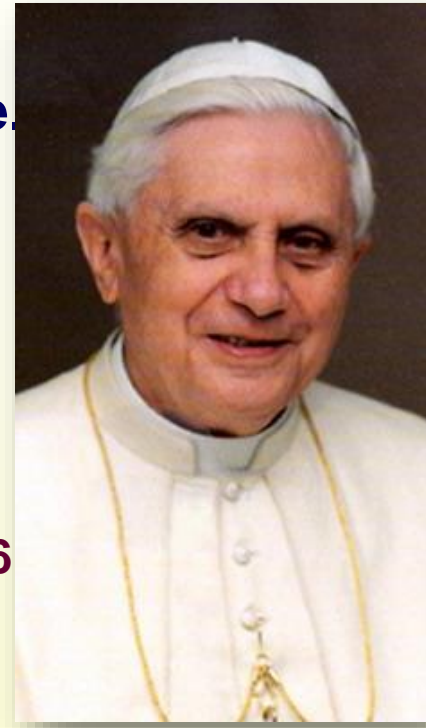
Compendium of the Catechism (2005)

Original sin, in which all human beings are born, is the state of deprivation of original holiness and justice. It is a sin “contracted” by us not “committed”; it is a state of birth and not a personal act. Because of the original unity of all human beings, it is transmitted to the descendants of Adam “not by imitation, but by propagation”. This transmission remains a mystery which we cannot fully understand.

Compendium of the Catechism of the Catholic Church, nr. 76

After the first sin the world was inundated with sin but God did not abandon man to the power of death.

Rather, he foretold in a mysterious way in the “Protoevangelium” (Genesis 3:15) that evil would be conquered and that man would be lifted up from his fall. This was the first proclamation of the Messiah and Redeemer. Therefore, the fall would be called in the future a “happy fault” because it “gained for us so great a Redeemer” (Liturgy of the Easter Vigil). **nr 78.**



Content



Introduction

What do we know about Adam & Eve

What do we know from science?

What does the Catholic Church tell us?

Conclusions

Conclusions I

- There is strong scientific evidence that any attempt to separate all the DNA in humans from that in animals passes through many individuals.**
- There is no dogma of faith in the Catholic Church that all men descend from two individual, historic persons called Adam and Eve.**
- It is dogma of faith: Original sin, in which all human beings are born, is the state of deprivation of original holiness and justice.**
- It remains an open question whether Adam & Eve were a single couple or group of persons.**



Conclusions II

- Science may provide new insight about the origin of man.**
- Theology may gain deeper insight in the fall of the first humans and the transmission of original sin by taking in account results of scientific research.**
- Both, theologians as well as scientist should cooperate to find the truth, each of them in their own field of competence.**
- The evidence for monogenism or alternatively polygenism should be elaborated in a joint effort of scientists and theologians.**



Acknowledgments

The author would like to thank

-- **Richard Durbin for allowing to reproduce his slides:** On the polygenic origin of humanity, Presentation at the conference „How did it all start?“, Netherhall House, January 3, 2014.



-- **Nico van Straalen for helpful discussions**

-- **Antoine Suarez: for introducing to the subject and providing a preprint of:** Can we give up the origin of humanity from a primal couple without giving up the teaching of original sin and atonement? May 2014





**This talk has been presented at
Conference Center Zonnewende, August 16, 2014**

