

He consequently thought that God would have created everything instantaneously. That is why he came up with the theory that Creation should have been shorter than six earth days. He was comparing Scripture with what he saw as Scripture, not editing the Bible with Darwinism. There is a profound difference. His conclusion, however, was based on a wrong interpretation of the Latin, which doesn't do justice to the Greek original. The Greek says that God made all things together (*panta koinee*), or "the whole world". The New Revised Standard Version translates it that way, for instance. This history contains a warning for today's theologians: know your Greek! It might help you to avoid speculative theories that people take seriously because you are a well known church leader.

Faith and science

There is no conflict between faith and science on the data, or the facts. Sometimes faith and science clash on the level of interpretation and theorizing. We see this particularly in our time, now science in the post-Christian West has embraced worldview presuppositions that are incompatible with Christianity. Augustine's main aim in writing his Commentary on Genesis (*De Genesi ad litteram*) was to show that there needn't be any conflict between the Genesis account, even if this was to be taken literally, and science and philosophy. If one cannot come up with a scientific explanation that supports the Scriptures, one should still accept that God's Word is true and trust that we will find out later. Augustine takes this attitude, for instance, when he writes on the waters above the earth (Genesis 1:7).

The doctrine of Creation over the last 2,000 years

Early Church leaders like Origen, Augustine and Basil³ were young-earth creationists. This view was commonly held within the Church until the 19th century (including Aquinas, Bede,

the fourth Lateran council in AD 1215 and Pius X). The Church of all times and places embraced the traditional doctrine of Creation from the day of Pentecost until the Enlightenment. In the Roman Catholic Church this even continued until the Great War. But after the Enlightenment, darkness reigned. Miracles disappeared. Divinity became part of the humanities. Divine revelation was doubted or outright denied. Human religiosity was the new object. Theology became a science that explained the Bible as if there never was Divine intervention in history. Mythology, comparative religion and egalitarianism were the new keys of interpretation. There was no revelation, but a democratic process where earliest Christianity produced ideas about Jesus and decided what to think about God, creating a god after our likeness. The seeds were sown in 17th century philosophy and the political changes of the French revolution. The implications become fully visible in the 19th century. Especially from the early part of that century onward the natural sciences started to filter out God as a relevant factor. We observe a similar move in continental theology around the same time.

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Comparative cytogenetics and chromosomal rearrangements

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Creationists accept that creatures can change over time, but a clearer understanding of the types of changes involved is necessary for a robust creation model. In creation apologetic arguments, many genetic changes are assumed to be "accidents" and the degenerative nature of these changes are commonly pointed out. Biblically, degenerative changes are expected because of the Curse imposed on Creation after Adam and Eve sinned.¹ However, there is no biblical reason why all genetic changes must be "accidents" or even degenerative. After all, God is also portrayed in Scripture as a provider, so adaptive genetic changes are perfectly reasonable within the creation model.²

Related to this issue is a critical need for a reasonable estimate of genetic similarity between various kinds at Creation. For example, evolutionists often point to human-chimp similarities to support their model's assumption of common ancestry. Creationists commonly respond that similarity can be from a common designer and then list genetic differences between humans and chimps. Which of these differences are because God created humans and chimps differently and which are from changes that have been acquired since then? If we point to differences that can reasonably be attributed to changes since Creation, our arguments will be weak and misleading. A proper use of evidential arguments depends on a robust creation model which requires a more detailed understanding of genetic changes that have occurred during history.

Chromosomal rearrangements

Comparative cytogenetics has been important in establishing that many mammals have undergone significant

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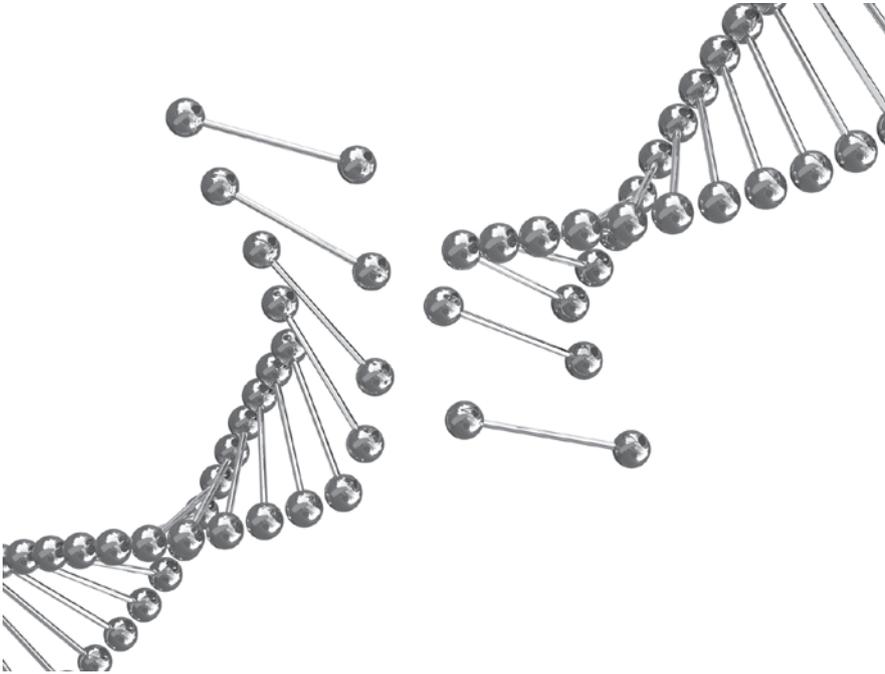


Figure 1. Chromosomal rearrangements involve the repair of double stranded breaks. They may be followed by changes in heterochromatin or centromeres, which suggest designed mechanisms are involved in the modifications. A better understanding of chromosomal rearrangements is necessary to developing both a more robust creation model and better reasoned apologetic arguments.

chromosomal rearrangements during their history. A diversity of karyotypes may occur within a genus³⁻⁵ or even a species.⁶⁻⁸ Given the considerable karyotypic diversity within some animal baramins (kinds), many of which were represented by only two animals on the Ark at the Flood, accounting for relatively rapid karyotype changes is a necessary part of the creation model.⁹ All rearrangements involve the repair of double stranded breaks. Additionally, many rearrangements are associated with alteration of heterochromatin, silencing of a centromere, and/or the formation of a new centromere.¹⁰ Because of the precision necessary to accomplish such changes while maintaining viability of the animal, it appears there are designed mechanisms in place to accomplish such rearrangements.

Creating comparative genome maps

Comparative genome maps based on chromosome painting are useful and have been performed using more than eighty eutherian species.

Yet chromosome painting has some significant limitations when comparing divergent species. There can be reduced hybridization efficiency of the probes from increased sequence divergence between these species (e.g. eutherians and marsupials). Comparative genome sequence analysis based on direct genome alignments has been used to overcome this problem. However, when evolutionists attempt to construct maps of a putative eutherian ancestor, the results are quite different between the two methods.

A new *in silico* method of comparison, called electronic chromosome painting (E-painting), has been developed to overcome limitations of the previously mentioned techniques and reduce the complexity of whole genome sequence alignments. First, orthologous (corresponding) genes are identified using various means such as reciprocal BLAST best-hit searches.¹¹ Comparative mapping of these orthologous genes allows for identification of regions with conserved gene order (syntenic segments). These can be used to

infer details about past chromosomal rearrangements. E-painting makes comparisons easier because it ignores intergenic regions. This also means the method cannot be applied to telomeric, centromeric, or non-genic portions of the genome.

A recent study using E-painting has revealed some interesting results.¹² The genomes of six different mammalian species (human, mouse, rat, dog, cow, opossum) and the chicken were compared. The mammalian genomes have been sequenced with a 7-fold or greater coverage. The chicken genome was included because previous studies had shown it remarkably similar to eutherians in genome organization. Altogether 526 evolutionary breakpoints (EBs) were identified and mapped with a resolution around 120 kb. There was a positive correlation between EB frequency and gene density. Unlike some previous studies, these EBs did not significantly correspond to well known breakpoints in cancer and other disease related rearrangements. Primate-specific rearrangements occurred preferentially in regions containing segmental duplications and copy number variants. The authors concluded that EBs were not random and show evidence of reuse. Their reconstruction of a putative ancestral eutherian genome based on this technique showed remarkable similarity to previous ones based on comparative chromosome painting.

Usefulness of comparisons across baramins

At this point some readers may be questioning the relevance of the above study. After all, the results are interpreted within an evolutionary framework where all life is considered to be related. Further, these results may make some people feel uncomfortable. If rearrangements do occur, and evolutionists can show how a chimp genome can be rearranged to fit the order found in a human, doesn't that lend credence to evolution?

First, chromosomal rearrangements themselves do not change one type

of animal into another. Carriers of balanced chromosomal rearrangements generally have a normal phenotype, although they may have reduced fertility.¹³ Additionally, intergenic regions, genes without orthologs, and the specific sequence of orthologous genes are not considered in these comparisons. One cannot turn a mouse into a man by simply aligning its genes in the same order as ours. Second, genomic comparisons, whether within or between baramins, can provide useful information on genomic structure. This information is essential for further building the creation model.

The identification of syntenic segments shows that genes commonly appear in a specific order. If there is an advantage to a specific order of genes, then chromosomal rearrangements may provide a mechanism for new gene associations that are advantageous in a different environment. Intrabaraminic E-painting investigations would be useful in investigating this idea further. It would also be interesting to note any overlap between EBs and breakpoints required by the creation model.

This study should also force creationists to address the issue of genome organization similarity between baramins at creation. Decades ago it was thought that karyotypes were fixed, at least at the species level. Historically, many creationists have assumed that God created different kinds with different karyotypes. In light of what is now known about rearrangements, this assumption needs to be reassessed. Understanding interbaraminic similarity at Creation will add robustness to the creation model and aid in interpreting interbaraminic investigations that exist in the literature.

Baranomes, VIGEs and chromosomal rearrangements

Peter Borger has suggested that God created baranomes, pluripotent uncommitted genomes, within created kinds.¹⁴ These genomes were designed to adapt rapidly, facilitated by the presence of variation inducing genetic elements (VIGEs). VIGEs include

repetitive sequences and various mobile elements.¹⁵ Interestingly, another recent study identified a significant enrichment of certain endogenous retrovirus (ERV) and long interspersed nucleotide (LINE1) elements in EBs in humans and marsupials.¹⁶ Studies of phylogenetic trajectory of orthologous chromosomes have shown many EBs are coincident with ancient centromere activity or the appearance of new centromeres.¹⁶ Thus the identified ERVs and LINE1s may be acting as VIGEs which play an important role in chromosomal rearrangements.

Conclusion

Creationists need a more complete understanding of the types of genomic changes that have occurred throughout history. This includes a more detailed understanding of chromosomal rearrangements. Identification of patterns of intrabaraminic chromosomal diversity should help clarify what types of rearrangements are consistent with the creation model. It may also help uncover underlying mechanisms for rearrangements and allow for reasonable inferences about the designed purpose of such rearrangements. This improved understanding of genomic structure and function may inform conjecture about interbaraminic similarities at Creation and aid in interpreting interbaraminic comparison that appear in secular literature. E-painting is a recently developed tool that can aid creation research in this area as genomic data continues to accumulate.

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