European Journal of Science and Theology, August 2014, Vol.10, No.4, 4-26

SYSTEMATIC ANALYSIS OF CREATIONIST CLAIMS SOURCE CRITICISM, CONTEXT, ARGUMENTATION AND EXPERIENTIAL THINKING

Petteri Nieminen[1,2*], Esko Ryökäs[2] and Anne-Mari Mustonen[1]

[1] *University of Eastern Finland, Faculty of Health Sciences, School of Medicine, Institute of Biomedicine/Anatomy, P.O. Box 1627, FI-70211, Kuopio, Finland*
[2] *University of Eastern Finland, Philosophical Faculty, School of Theology, P.O. Box 111, FI-80101, Joensuu, Finland*

(Received 14 December 2013, revised 3 April 2014)

Abstract

Creationist claims have been repeatedly analyzed for their scientific content but, despite of this, the same scientifically unsound re-interpretations of data from Natural sciences have persisted for decades. We have previously analyzed creationist claims for the presence of argumentative fallacies and experiential thinking and found these aspects to be potentially responsible for the persistence of the claims. In addition, fallacies and experiential thinking patterns, such as confirmation bias and attachment of moral labels to scientific issues, can be significant for the acceptance of creationist claims. Due to this, a systematic method of analyzing creationist claims including source criticism and assessment of experiential thinking, argumentation and the context of these aspects in creationist writings is presented. The examples reveal a high dependency of creationist writings on moral label attachment by demonization, *ad hominem* fallacies and confirmation bias. The proposed analytical method requires basic knowledge of philosophy of science and argumentation theory but is readily accessible to scientists, theologians and educators who participate in the debate between evolutionary theory proponents and creationists.

Keywords: confirmation bias, evolution, experiential thinking, fallacies, intelligent design

1. Introduction

The debate between creationists and proponents of evolutionary theory has been active and polarized since the 19th century [1]. The publication of widely-spread creationist writings in book format, such as by Morris in the early 1970's [2], and later by the proponents of the intelligent design (ID) theory, such as Davis and Kenyon [3] has intensified the controversy even further including debates on the introduction of creationist theories into the U.S. school curricula [4]. During the last decades, the Internet and related social media have proved

*E-mail: petteri.nieminen@uef.fi, tel.: +358-40-5083389

effective in the spread of creationist claims, for instance, in journals available as open-access publications (*e.g.*, Journal of Creation).

Briefly, creationism can be classified as young-earth creationism (YEC), old-earth creationism (OEC) and ID. All these forms are in opposition to particular widely-accepted theories of Natural sciences. YEC proponents do not accept the geological consensus about the age of the Earth and the Universe but, instead, hold to the literal interpretation of Genesis and estimate the Earth to be approximately 6000 years old [2, p. 80-95; 5]. OEC accepts the age of the Earth and the Universe but is in denial of a significant amount of biological data, *i.e.*, the validity of evolutionary theory on the transition of organisms into different forms by natural processes. ID is based on the argument from design and claims that an intelligent agent responsible for biodiversity could be witnessed under scientific testing [1, p. 33–41; 6–7]. It accepts the transition of organismal forms by various extents but requires the intervention of supernatural or other types of agencies at crucial points of evolution, especially regarding complex morphological and intracellular structures and abiogenesis [1, 4]. YEC and OEC proponents and some ID theorists claim that organisms appeared as individually 'created kinds', between which evolution would be impossible. The emergence of humans is regarded a process that could not have occurred by natural processes alone. Theistic evolution (TE) [1] is a concept that could be taken as 'borderline creationism'. TE proponents do not doubt the age of the Earth or the actual process of evolution. However, TE includes the (Christian) deity as an agent in the process but does not specify the actual type of possible intervention. TE proponents can, for instance, suggest that the deity has created the Universe in a way that enhances the emergence of complex life forms. TE is the doctrine adopted by major Christian denominations, such as the Roman Catholic Church [8], the Episcopal Church [9] and the Lutheran churches of northern Europe [Church of Sweden, *Is evolution compatible with Christian faith?*, in Swedish Uppsala, 2005, online at http://www.svenskakyrkan.se/default. aspx?id=679678, accessed 6 June 2013; Evangelical Church in Germany, *Evangelische Kirche zieht klare Trennlinie zu Kreationismus*, Hanover, 2008, online at http://www.ekd.de/EKD-Texte/ekdtext_94.html, accessed 15 May 2013; Evangelical Lutheran Church of Finland, *Evolution*, in Finnish, Helsinki, 2013, online at http://www.evl2.fi/sanasto/index/php/Evoluutio, accessed 6 June 2013]. The German Evangelical Church is especially adamant in opposing creationism and ID. "Creationism is… a perversion of faith in the Creator in a type of worldview, which ultimately leads to the dissociation of faith and reason" and ID is considered "a pseudoscience" [*Evangelische Kirche zieht klare Trennlinie zu Kreationismus*].

The different types of creationism disagree significantly regarding their position on Natural sciences. YEC regards the acceptance of Earth's age by OEC, ID and TE as contrary to Biblical teaching and does not accept the refusal of some ID theorists to identify the 'designer' as the Christian God [3, 10]. Despite of these controversies within creationism, YEC, OEC and ID all utilize the strategy of re-interpreting particular scientific data as evidence against

evolution or for creationism. From the scientific viewpoint, these claims have been rebutted in detail for decades [5, 11] but the claims persist.

Instead of concentrating once more only on the often refuted scientific content of creationist claims, we have recently analyzed also their context regarding argumentation and experiential thinking [P. Nieminen and A.-M. Mustonen, Evol. Educ. Outreach, (2014) manuscript in press; P. Nieminen, E. Ryökäs and A.-M. Mustonen, Int. J. Sci. Educ., (2014) manuscript in revision]. Briefly, we analyzed creationist texts for the presence of argumentative fallacies, such as appeals to authority and consequences, demonization (*ad hominem*), poisoning the well, equivocation, etc. [12]. Creationists often present their 'scientific' claims in the context of fallacious arguments, which is highly relevant, as fallacies can be regarded as tools to "generate false or unfounded beliefs" [13]. Experiential thinking, on the other hand, is an evolutionarily old process of decision-making that is beneficial for its rapidity but has deleterious effects as it can prevent the unbiased consideration of evidence and counter-evidence [14]. Aspects of experiential thinking include confirmation bias (accepting and emphasizing evidence for one's hypothesis and disregarding or dismissing zero or contradictory data), overemphasis on personal testimonials instead of evidence, labelling neutral data with moral significance and strong resistance to change. The persistence of the same creationist claims for decades despite of rigorous scientific rebuttals suggests that it is inadequate to analyze these claims solely based on evidence from Natural sciences. Also the presence of fallacies and signs of experiential thinking within the context of the claims should receive equal attention, as especially these aspects of the claims can contribute to their persistence and the failure to convey the opinion of the scientific community to creationists.

Because of this, we have constructed a scheme to analyze creationist claims in a systematic manner that includes analyses of fallacies and experiential thinking. The aim was to present a practical tool to assess creationist re-interpretation of scientific data. For proponents of evolutionary theory, it would also be recommended to avoid counter-fallacies and the reciprocal utilization of experiential thinking, *e.g.*, attaching moral significance to scientific data or creationist claims. The specific aim of the present paper is to present several examples of selected scientific claims of creationists in this manner in order to introduce our method as a novel option to discuss creationism without retorting to emotional or fallacious discourse and to assess comprehensively how the non-scientific content of creationist writings affects the general argumentative quality of the creationist case.

2. Method

For the present paper, we analyzed creationist texts representing claims from various disciplines and those appearing repeatedly over a long period of time. We selected the texts by the following criteria:

1. Oft-repeated claims that occur in several creationist disciplines (YEC, OEC, ID) in practically the same format and/or in several creationist books, journals or Internet sites.
2. We included claims representing several fields of sciences — Biology, Genetics, Cosmology and Palaeontology.
3. In addition to claims on Natural sciences, widely-cited arguments regarding demonization of evolutionary theory were also included, as scientists are often confronted by these claims.

Table 1. Sources of principal sample material.

Institution/Author	Format	Type	Source/Publisher
Answers in Genesis	• Online articles • Answers Research Journal	YEC	http://www.answersingenesis.org/
Creation Ministries International	• Creation Magazine • Journal of Creation	YEC	http://creation.com/
Creation Research Society	• Creation Matters • CRS Quarterly	YEC	http://www.creationresearch.org/index.html
Institute for Creation Research	Online articles	YEC	http://www.icr.org/
Intelligent Design and Evolution Awareness (IDEA) Center	Online articles	ID/OEC	http://www.ideacenter.org/
Intelligent Design Network	Online articles	ID	http://www.intelligentdesignnetwork.org/index.htm
UK Apologetics	Online articles	YEC	http://www.ukapologetics.net/
M.J. Behe	• Darwin's black box: The biochemical challenge to evolution • The edge of evolution: The search for the limits of Darwinism	ID	Free Press
P.E. Johnson	• Darwin on trial • Reason in the balance	ID/OEC	http://www.talebooks.com
T. Puolimatka (in Finnish)	• Faith, science and evolution • A test for openness in science discussion	ID/OEC	Uusi Tie Uusi Tie
P. Reinikainen (in Finnish)	• The forgotten Genesis • Darwin or intelligent design • Does God exist?	YEC	Uusi Tie Uusi Tie TV7
P. Davis and D.H. Kenyon	Of pandas and people: The central question of biological origins	ID	Haughton
H.M. Morris	• The remarkable birth of planet earth • Scientific creationism	YEC	Bethany Fellowship Master Books

The principal sources of material for analyses are depicted in Table 1. To assess the aspects of argumentation and experiential thinking (Table 2), the claims were analyzed as follows:

1. Original scientific sources (articles, books, *etc*.) were recognized and listed.
2. The creationist source of the claim was examined, assessed as original or as a re-interpretation of science and subjected to source criticism. If it derived from Natural sciences (journal articles, books, *etc*.) it was determined if the data were accurately depicted. Potential errors were recognized and briefly discussed.

3. The texts were analyzed for the potential presence of aspects of experiential thinking. These were recognized and classified.
4. The text including the claim was analyzed for the possible presence of argumentative fallacies. These were recognized and classified.
5. The context of the claim was analyzed to assess whether the scientific claim and its re-interpretation were presented in a context of fallacies and/or experiential thinking, as these could enhance the acceptance of the claim especially in an audience with pre-existing biases.
6. Finally, the findings were briefly summarized in table format.

While there are comprehensive online collections of creationist claims [11] and Internet sites where some argumentative fallacies are also recognized [RationalWiki, *101 evidences for a young age of the Earth and the universe (rebuttal)*, http://rationalwiki.org/wiki/101_evidences_for_a_young_age_of_the_Earth_and_the_universe, 2013, accessed 1 June 2013.], there is an absence of analyses that combine all the above-mentioned aspects, which are basically irrelevant for the science content. However, the significance of fallacies and experiential thinking on the reception of a claim by the audience can be highly relevant [13]. Due to this, we present here the results of our combined systematic analysis as a methodological tool to be utilized by the scientific community involved in the creationist–evolutionist debate.

3. Results and discussion

3.1. General remarks and a detailed analysis example

The main part of the results is presented as Tables 3–8 in a systematic form. Briefly, we analyzed claims that have occurred commonly and/or represent several scientific disciplines. In addition, most of the chosen claims have appeared in creationist writings for decades (*e.g.*, Cambrian explosion cannot be explained by evolutionary theory, association of evolution to atrocities) and/or remained influential despite of rigorous scientific rebuttals (flagella are irreducibly complex, harmful mutations accumulate due to 'genetic entropy'). Generally, we aimed to assess whether the claims concentrate on the actual scientific issues or if they are accompanied with non-rational aspects, *i.e.*, experiential thinking and argumentative fallacies. As revealed by the examples, all these claims did contain aspects of non-rational thinking patterns. We suggest that this should be assessed together with the analyses on the scientific content of a claim. In our brief examples, the scientific rebuttals were kept to the minimum, as scientists have responded to these parts of the claims in detail on several occasions (Tables 3–8) [*e.g.* 5, 11].

Table 2. Examples of argumentative fallacies and aspects of experiential thinking in creationist writings.

Fallacies [1, 12]	**Definition**	**Example(s) (Direct citations in *italics*)**	**Selected sources**
Ad hominem	Attacking an opponent's character instead of evidence.	Darwin portrayed, for example, as a racist, sadist, psychotic or plagiarist.	[2, 15, 16]
Circumstantial *ad hominem*	Instead of evidence, the opponent's past actions or motives are put under suspicion.	*"…most evolutionists… will freely admit that there are no 'missing links' although there have been several missing link hoaxes!"* Citations of scientists 'admitting' lack of evidence for evolution (= *tu quoque*).	[3; 3, p. 23; 17; 18]
Poisoning the well	Claiming that the opponent cannot help being opposed to an argument and, thus, anything the opponent argues can be discounted in advance.	Claims of the type: *"Evolutionists refuse to consider supernatural explanations".* Often stated with appeals to pity: *"The atheist or agnostic approaches are the only alternatives accepted in the discussion".*	[17, p. 42, 158; 19, 20]
Appeal to authority	The argument is supposedly right because an authority says it is right.	Historical and contemporary scientists listed as persons who believed in creation. Out-of-context citations of biologists 'doubting' evolution.	[17, p. 201–205, 239; 21]
Appeal to consequences and guilt by association	Instead of evidence, a theory is rejected based on its supposed consequences, linking the opponent's viewpoint to distasteful and evil phenomena.	"*If Darwinism is true, Hitler was our savior and we have crucified him". "Genocide… is merely a shocking name for the process of natural selection".* Evolutionary theory associated to abortions, sodomy, adultery and eugenics.	[2, p. 74; 17, p. 466–467; 19; 22; 23]
Equivocation	Misusing words in an ambiguous manner in a debate.	Evolutionary theory = Darwinism = social Darwinism. Thus, evolutionary theory is evil.	[22, 24]
Straw man	The opponent distorts the arguments and attacks the distortion.	*"According to evolutionists, a hydrogen atom formed by the big bang created the whole universe and life."* Emphasizing that 'chance' would have constructed complex organisms.	[17, p. 140–141, 168; 25]
False dilemma	The case is simplified into too few (2) choices and a choice made among this shortened menu.	*"There are only two alternatives: either the world receives its order from an outside source or the order is innate without any order given from the outside*."	[20]
Hasty generalization	Conclusions are based on limited evidence and/or some evidence is suppressed.	One problem with evolutionary theory causes the whole concept to collapse, *e.g.*, regarding radiometric dating methods. Differences in chimpanzee and human chromosome Y generalized to the whole genome.	[4, 26]
Appeal to fear and force	Instead of discussing evidence, the opponent is threatened with sanctions.	Disbelief in literal Genesis leads to '*grave consequences*'.	[5, 27]
Experiential thinking [14, 28–35]			
Testimonials	Using personal statements and testimonials instead of observations and evidence as proofs for one's theories.	*"…hundreds, perhaps thousands of scientists… have become creationists in recent years." "It is hard for me to believe that this… could be bridged by evolutionary mechanisms…"* Out-of-context citations of evolutionists admitting weaknesses in their theory.	[2, p. *iv*; 3, p. 23; 17; 19; 22; 24, p. 366–384]
Confirmation bias	Concentrating on data supporting one's hypothesis and ignoring contradictory or null information.	The Y chromosomal genes of chimpanzees and humans differ by 30%, therefore, all their genes differ by 30%. *"…can we not jettison every evolutionary story of chimp–human common ancestry…"*	[25, p. 23; 6]
Ignoring base rates	A single piece of data highlighted and a large bulk of information ignored.	Isolated erroneous results of radiometric dating highlighted and the vast majority of reliable results dismissed.	[26]
Attaching moral labels	Neutral issues (scientific theories) are given moral significance.	Discussing the allegedly evil consequences of evolutionary theory instead of its scientific validity. References to Nazism, abortions, euthanasia and immorality.	[2, p. 74; 19; 22; 23]

[1]Based on [G.N. Curtis, *Fallacy files*, http://www.fallacyfiles.org/aboutgnc.html, 2001, accessed 10 December 2012; B. Dowden, *Internet encyclopedia of philosophy: fallacies*, http://www.iep.utm.edu/ fallacy/, 2010, accessed 13 February 2013]

[2] [R.A. Brace, *The Bible and evolution. I was asked for, "information on evolution", my conclusion: surely evolution is the greatest 'act of faith' of all time!* http://www.ukapologetics.net/1evolutionfaith.htm, UK Apologetics, 2004, accessed 25 January 2013; *The utter failure of the 19th/20th century atheistic icons. Charles Darwin (1809–1882). It's time for the truth to be told…* http://www.ukapologetics.net/09/DARWIN.printer.htm, UK Apologetics, 2006, accessed 22 January 2013]

[3] [R.A. Brace, *The Bible and evolution. I was asked for, "information on evolution", my conclusion: surely evolution is the greatest 'act of faith' of all time!*]

[4] [R.W. Carter, *The chimpanzee Y chromosome is radically different from human*, http://creation.com/chimp-y-chromosome, Creation Ministries International, Eight Mile Plains, 2010, accessed 1 February 2013]

[5] [*The AiG statement of faith,* http://www.answersingenesis.org/about/faith, Answers in Genesis, Hebron (USA), 2012, accessed 30 March 2013]

[6] [R.W. Carter, *The chimpanzee Y chromosome is radically different from human*; B. Thomas, *Are humans as close to chickens as they are to chimps?* http://www.icr.org/article/humans-close-chickens-they-are-chimps/, Institute for Creation Research, Dallas, 2013, accessed 4 April 2013]

As an example of the process, we present next the detailed analysis on the creationist concept and discipline of 'baraminology' [36]. Basically, YEC proponents have accepted for decades that the animal 'kinds' that survived the alleged Biblical flood do not coincide with the biological species of modern taxonomy. 'Baraminology' as a discipline balances between finding a rational and plausible explanation to survival of animals in Noah's ark (there cannot have been too many species to accommodate) and the subsequent 'microevolutionary' diversification of these kinds ('baramins') after the flood. YEC scholars are, thus, attempting to establish the 'kinds' that were in the ark represented by a single male–female pair [37–39]. To start the analysis, we first examined the sample material including the creationist articles and possible scientific assessment of them. The most informative YEC sources were the freely available articles by Parker [37], Ham [38], Lightner [40, 41], Lightner et al. [39] and Sarfati [42]. In addition to standard literature searches regarding the claims, the scientific paper of Senter [43] with a detailed explanation of the YEC procedure of animal classification, was used to assess scientific plausibility of the concepts of 'kinds' and 'baraminology'.

To assess the concept, it is necessary to establish a supposed timeline for the creationist model. YEC authorities give the date for the creation as 4004 BCE and for the global flood as 2348 BCE [D. Wright, *Feedback: timeline for the Flood*, http://www.answersingenesis.org/articles/2012/03/09/feedback-timeline-for-the-flood, Answers in Genesis, Hebron (USA), 2012, Accessed 3 June 2013]. Thus, in 2348 BCE practically all terrestrial animal populations would have been decimated to one mating pair (except humans, with 8 persons surviving) and the diversification into modern species from these 'kinds' would have taken place during the 4362 years until present (2014 CE).

Table 3. Systematic analysis of the claim 'Humans differ from chimpanzees by 30%'. Direct citations in *italics*.

1. Source criticism

- Some original creationist papers[1] correctly cite that the reported difference is based on parts of Y chromosome and not the whole genome. Later texts [25, p. 9, 23, 87; 44] erroneously generalize this to apply the whole genome.

2. Original citation and scientific source

- [45]

3. Are aspects of experiential thinking present?

- Yes, as follows:
  - Testimonials: Citing evolutionary scientists as additional evidence for creation[2].
  - Confirmation bias: Emphasizing the findings of chromosome Y and dismissing other available data regarding the genome as a whole. Alleged differences between humans and chimpanzees are emphasized, while the actual number of fixed positively selected mutations existing between these species (154 genes when 2/3 of the genomes have been examined) [46] is ignored or dismissed.
  - Pseudodiagnostics: Erroneously cited data taken as pivotal evidence against evolution. "*This is evidence that humans and chimpanzees are very different… can we not jettison every evolutionary story of chimp–human common ancestry…?*"[1] "*Thus, one of the main pillars of evolution has once again collapsed by scientific research*" [25, p. 87].
  - Is base rate ignored? Yes, data regarding other parts of the genome not discussed and/or the "30%" data overemphasized.
  - Is there a tendency for broad generalization and stereotypical thinking? Yes, differences in one part of the genome = humans and chimpanzees are "*very different*"[1].
  - Is moral significance attached to the data? Yes, use of loaded language: "*a myth followed and taught blindly by evolutionists*"[3], "*Design was not considered as a possible answer (of course).*"

4. Are there argumentative fallacies?

- Yes, as follows:
  - Testimonials leading to appeals to authority and quote mining, such as out-of-context citations of scientists.
  - Moral issues leading to poisoning the well fallacy ("of course, design was not considered") and *ad hominem* (questioning the integrity of scientists: "*taught blindly*").
  - Confirmation bias leading to hasty generalizations ("*jettison… every evolutionary story of… common ancestry*").
  - Confirmation bias and pseudodiagnostics leading to equivocations and hasty generalizations (30% in chromosome Y = humans and chimpanzees are "*very different*"). Straw man argumentation can be interposed with appeals to ridicule: "*And just because a chimp has more chromosomes than a human does not mean that it evolved into a human, having simply lost or rearranged information in the DNA. For instance, a chicken has 78 chromosomes. And did you know that we share 60–75 percent DNA similarity with chickens? Now, does anyone allege that if you take away 32 chicken chromosomes that you'll get a human?*"[4]

5. Is the context such that the fallacies and aspects of experiential thinking can form a biased background for the audience to evaluate the actual 'scientific' claim?

- The scientific claim is presented in a fallacious context and the fallacies and the narrative related to experiential thinking appeal to emotions and can either create or enforce false beliefs. Specifically, the finding regarding chromosome Y is not considered on the background of other comparisons between the species and the other data (regarding most of the genome) are disregarded. The findings are considered to be "*very difficult for them* [evolutionists]"[1]. Evolutionary proponents are treated with *ad hominem* and poisoning the well fallacies.

6. Summary:

- The scientific part of the claim was originally presented correctly considering a part of chromosome Y only. Some later writings disregard this and present the difference of 30% representing the whole genome. The claim is used to disprove the common descent of humans and chimpanzees. This interpretation rests on experiential thinking patterns (testimonials, moralization, generalizations and ignoring negative or contradictory data and base rates). The claim is also accompanied with argumentative fallacies including *ad hominem*, poisoning the well and hasty generalizations. This context of experiential thinking and fallacies is important for the acceptance of the claim as the context creates and enforces false beliefs.

[1] [R.W. Carter, *The chimpanzee Y chromosome is radically different from human*]

[2] [R. Deem, *Human Y chromosome: "horrendously different" from nearest living "relative"*, http://www.godandscience.org/evolution/human_y_chromosome.html, 2010, accessed 15 May 2013]

[3] [CreationWiki, *Evolution myths*, http://creationwiki.org/Evolution_myths, 2013, accessed 10 December 2013]

[4] [***, *Reason 2: evolution*, http://www.answersingenesis.org/articles/2007/06/05/reason-two-evolution, Answers in Genesis, Hebron (USA), 2007, accessed 15 May 2013]

Table 4. Systematic analysis of the claim "Flagella could not have evolved naturally/flagella are irreducibly complex". Direct citations in *italics*.

1. Source criticism

- The claim originates from creationist (intelligent design) writings [47]. It has been repeated, *e.g.*, by Eirich[1], DeVowe [48], Sarfati and Matthews [49]. "*All the parts of a bacterial flagellum must have been present from the start in order to function at all.*"[1]

2. Original citation and scientific rebuttals

- No citation to an actual scientific paper, as the claim originates from creationists. However, the claim has been refuted in detail by, *e.g.*, Pallen and Matzke [50]. Basically, there are several types of functional bacterial and eukaryotic flagella and many genera lack several of the components considered pivotal by Behe [47]. However, the claim persists and is continuously presented as evidence against evolution.

3. Are aspects of experiential thinking present?

- Yes, as follows:
  - Testimonials: Emphasizing the credibility of creationist supporters: "*…a world expert on the flagellar motor*" [48], a scientist "*…says that belief in design has given him many research insights*" [49] and associating Biblical testimony to the claim "*motorized bacteria had an all-wise designer, Jesus Christ our Creator (John 1:3; Hebrews 1:2)*" [48]. There are appeals to unknown supporters: "*…polls show that the great majority of the public already is convinced of design*" [47, p. 272].
  - Confirmation bias: Data regarding the different types of flagella, the utilization of flagellar proteins in other functions and possible evolutionary paths are dismissed: "*Scientific American cites another difficult example of irreducible complexity—the rotary motors on bacterial flagellum, but it really has no answers*" [49]. These alternative hypotheses (evolution) are not thoroughly discussed.
  - Pseudodiagnostics: Erroneous claim taken as pivotal. Behe [47, 10th edn., p. 260] repeats the claim that flagella, blood clotting cascade, *etc.* are irreducibly complex as "*the removal of any one of the parts causes the system to effectively cease functioning*". Absence of parts of the flagellum does not cause loss of function [50], but this is ignored.
  - Is base rate ignored? Yes. The claim persists despite of available rebuttals against 'irreducible complexity'.
  - Is there a tendency for broad generalization and stereotypical thinking? Yes. The concept of irreducible complexity taken as definite falsification of evolution: "*…our confidence that Darwin's criterion of failure has been met skyrockets toward the maximum*" [47, p. 40]. Evolutionary theory is equivocated with "chance" with the assumption that it would be the explanation offered by biologists: "*Could such a motor that far exceeds man's inventions be the result of a cosmic accident billions of years ago?*" The claim that minute errors would cause the biological system to fail totally is also an example of hasty generalization. In fact, systems that would fail very easily would be evolutionarily hazardous and redundancy is to be expected. Thus, the data of Pallen and Matzke [50] fit well to evolutionary hypothesis.
  - Is moral significance attached to the data? Yes, scientific claims interposed with accusations, such as "*…he [Darwin] had an anti-theistic agenda*", "[scientist's name] *is hardly the epitome of reliability*", "*This is once more a lot of bluff by the atheist* [scientist's name]" [49].

4. Are there argumentative fallacies?

- Yes, as follows:
  - Testimonials leading to appeals to authority (Biblical authority and '*a world expert*') and to *ad populum* ('*great majority of the public*').
  - Moral issues leading to *ad hominem* ('*anti-theistic*') and questioning the integrity of a scientist ("*not reliable*", "*bluff*"). The rebuttals of scientists are dismissed as "*tactful silence*" or "*just-so stories*" [10, p. 267]
  - Confirmation bias leading to hasty generalizations and false dilemmas: Dismissal of scientific explanations taken as proof for creation: "*Every example of man-made electric motors proves to be primitively clumsy compared to the superior complexity and efficiency of the flagellum motor. The reasonable solution is that motorized bacteria had an all-wise designer.*" [48] In addition, there are appeals to incredulity ("*no answers*").
  - Generalization appears directly ("*failure… skyrockets towards the maximum*") and as straw man fallacies (evolution = chance/"*cosmic accident*").
  - Confirmation bias and pseudodiagnostics leading to generalizations, appeals to incredulity or ignorance ("*Could such a motor… be the result of a cosmic accident*") and appeals to ridicule ("*cosmic accident*", *"just-so stories*").

5. Is the context such that the fallacies and aspects of experiential thinking can form a biased background for the audience to evaluate the actual 'scientific' claim?

- Yes, the scientific claim is presented in a fallacious context including questioning the honesty or integrity of scientists. There is clear confirmation bias by disregarding the evidence against the concept of 'irreducible complexity' and alternative hypotheses are not considered.

6. Summary

- The claim ('irreducible complexity') has been repeatedly rebutted but the claim persists. The claim rests on experiential thinking patterns (testimonials, moralization, generalizations and ignoring negative data, alternative hypotheses and base rates). The claim is also accompanied with argumentative fallacies, such as *ad hominem, ad populum* and hasty generalizations. This context of experiential thinking and fallacies can enhance the acceptance of the claim as the context creates and enforces false beliefs.

[1] [D. Eirich, *The amazing cell: evidence for creation and against evolution*, http://answersingenesis.org/articles/2000/01/10/the-amazing-cell, Answers in Genesis, Hebron (USA), 2000, accessed 8 April 2013]

Table 5. Systematic analysis of the claim "All organisms degenerate due to 'genetic entropy'". Direct citations in *italics*.

1. Source criticism • The claim is of young-earth creationist origin in Sanford [51] and referred to, *e.g.*, by AiG[1], Williams [52], Reinikainen[2] [25]. Similar claim ('genetic load' lowers the viability of populations) originates from Morris [53].
2. Scientific references and rebuttals • Creationist authors often cite Crow [54] who speculated about the 1–2% reduction in fitness in human populations/generation due to modern society causing loss of natural selection, not due to accumulating mutations *per se*. This is erroneously cited in the claim. Several papers have investigated the possibility of mutations accumulating and perceive this to occur when selection is absent, but with selection, reductions in fitness do not occur[3] [55, 56].
3. Are aspects of experiential thinking present? • Yes, as follows: o Testimonials: Personal testimony for one's integrity: "*I am a sincere Orthodox Christian, I believe God will judge me in a very literal sense, and I consider lying is a very serious sin. I am distinguished in my field and I greatly value my integrity as an honest scientist.*"[3] While this statement can be both sincere and true, it is not relevant to the validity of the actual scientific claim. o Confirmation bias: Negative data are considered irrelevant: "*Beneficials happen, but generally they are loss-of-function mutations, and even then they are very rare!*"[3] The actual results estimating the proportion of beneficial mutations vary significantly [up to 13%; 57] and this should be recognized. Instead, creationists state that beneficial mutations occur in $1{:}10^6$ and cannot be fixed or that there are no beneficial mutations in humans [25, p. 34]. o Pseudodiagnostics: Erroneous data are taken as pivotal. The actual experiments showing that selection protects against reduced fitness are ignored[3] [55] and contradictory data on beneficial mutations dismissed [58, 59]. o Is base rate ignored? Yes, rarity of beneficial mutations is generalized to mean absence: "*Researchers cannot give even one example of a beneficial mutation in humans*" [25, p. 34]. The diversity of other organisms is not assessed: if genetic deterioration was uniform, rapidly reproducing species (prokaryotes, unicellular eukaryotes, rodents) would have to show reduced fitness compared to slowly-reproducing species, especially if all animal populations had decimated to N = 2 as required by the theory of global flood. o Is there a tendency for broad generalization and stereotypical thinking? Yes. Rarity of beneficial mutations is considered without selection. o Is moral significance attached to the data? Yes. Discussion in the rebuttals (also on the evolutionary side) is not restricted to the scientific issue but the integrity of both parties is questioned[3, 4].
4. Are there argumentative fallacies? • Yes, as follows: o Testimonials leading to appeals to authority and pity ("*I am a sincere orthodox Christian… I am distinguished in my field*"). There are also unreferenced personal testimonials appealing to ridicule: "*Mutations are responsible for diseases that kill; they do not change chimps into humans! Mutations aren't like science fiction where you get supernatural powers.*"[1] o Moral issues leading to *ad hominem* (questioning the integrity of the opposing scientists; also observed in scientific rebuttals). o Confirmation bias leading to hasty generalizations (genetic entropy reduces fitness and leads to human extinction) without actually considering observed evidence. o Confirmation bias and pseudodiagnostics leading to equivocations and straw men (beneficial mutations are rare = beneficial mutations are not selected = there are no beneficial mutations). "Human beings degenerate by 1–2% per generation" is a simplification of the speculative calculations by Crow [54].
5. Is the context such that the fallacies and aspects of experiential thinking can form a biased background for the audience to evaluate the actual 'scientific' claim? • Yes, the claim is presented in a fallacious context and the fallacies and the narrative related to experiential thinking appeal to emotions and can either create or enforce false beliefs. Especially the existing data that would support the notion of selection protecting against the accumulation of mutations in populations are dismissed or ignored.
6. Summary • Creationist authors cite the original paper [54] erroneously and the claim has been repeatedly rebutted. The claim rests on experiential thinking patterns (personal testimonials, moralization, confirmation bias, generalizations and ignoring negative or contradictory data and base rates) by ignoring a significant amount of contradictory data on beneficial mutations and the actual observations on selection counteracting the accumulation of mutations and the no loss of viability in natural or laboratory populations. The claim is also accompanied with argumentative fallacies including *ad hominem*, appeals to ridicule, hasty generalizations and equivocations. The concept 'genetic entropy' is also inconsistent with other creationist theories (see main text for 'baraminology').

[1] [http://www.answersingenesis.org/articles/2007/06/05/reason-two-evolution]

[2] [P. Reinikainen, *Evolution or creation*, in Finnish, http://www.pekkareinikainen.info/fi/index.php?option=com_content&task=view&id=25&Itemid=27, 2013, accessed 5 February 2013; *Lower than angels*, in Finnish, http://www.pekkareinikainen.info/

fi/index.php?option=com_content&task=view&id=24&Itemid=27, 2013, accessed 5 February 2013]

[3] [J. Sanford, *Critic ignores reality of genetic entropy*, http://creation.com/genetic-entropy, Creation Ministries International, Eight Mile Plains, 2013, accessed 1 June 2013]

[4] [S. Buchanan, *Assessing limits to evolution and natural selection: reviews of Michael Behe's "Edge of evolution" and John Sanford's "Genetic entropy"*, http://letterstocreationists.wordpress.com/stan-4/, 2010, accessed 10 February 2013]

Table 6. Systematic analysis of the claim 'An equation of creation has been discovered'. Direct citations in *italics*.

1. Source criticism

- The claim is of young-earth creationist origin[1] and not derived from Natural sciences, although it utilizes Historical sciences and Astronomy. Briefly, the claim states that $Hl_f \times \pi/\Omega = C_0$ or (hydrogen fine transition line×π)/0.0123456789 = speed of light. The Ω is claimed to derive from the mass ratio of Moon/Earth (approximately 1/81 = 0.012345679 and the '8' is added to represent "*all the characters of the base 10 number system*", as "*An omniscient Creator knows to use this number system to make us pay attention…*" The result is in "*Thom units*" given as a measurement unit of stone-age megalithic structures as '0.82945–0.82966 m'. Thus, the speed of light equals to 361437469.8 Thom units/s = 299794309.3 m/s (99% correct speed of light).

2 Scientific origins

- The claim refers to "*Thom units*" or "*megalithic yard*" as a unit of length [60]. The number of decimal places in the unit is astonishing considering the measurement accuracy of stone age tools. The uniformity of such a unit and its actual existence are controversial [61].

3. Are aspects of experiential thinking present?

- Yes, as follows:
  - Testimonials: The creationist author utilizes personal testimony: "*I am a scientist and as such I didn't at first believe it myself. But physics is physics and maths is maths, and you can't argue with it.*"[1] Additional evidence is derived from testimonials of other scientists allegedly supporting the result: "*… Thom… was an important figure in his time…",* "*brilliant extension and verification*", "*He was at the time an atheist... There is no longer room for atheism*".
  - Confirmation bias: The bias is very strong. The author inserts a figure in the 'mass ratio of Moon/Earth' to gain results compatible with the creationist hypothesis and claims to have knowledge about what "*an omniscient creator knows to use*". The ambiguity of "*Thom units*" is ignored. Base 10 figures are taken as the ones 'God would use", although binary numbers would have been more universal and number systems based on 60 and 20 more archaic.
  - Pseudodiagnostics: Erroneously cited data taken as pivotal. The equation is constructed not by observations but to get the desired result and taken to prove that "*…the Earth, Sun, and Moon must have been Created to accord with the Equation of Creation*".
  - Is base rate ignored? Yes. The actual calculations come out as follows: $Hl_f \times \pi$ = 4462.336272 MHz. Divided by Ω this yields a number that is off by 1000. The units on the opposite sides of the equation are MHz (frequency) and length/s (speed), which is nonsensical. This is ignored.
  - Is there a tendency for broad generalization and stereotypical thinking? Yes. The nonsensical equation is generalized as proof for creation and to claim knowledge of what 'God would have used'.
  - Is moral significance attached to the data? Yes. Potential criticism is dismissed: "*They* [the scientists] *are arguing about this equation and trying to tear it down already because they can't stand the implications — that there is a Creator, and the atheists and Godless are on the wrong side of science now*".[1]

4. Are there argumentative fallacies?

- Yes, as follows:
  - Testimonials leading to appeals to authority: '*important figure'*, '*brilliant extension*' and personal authority ("*I am a scientist…*").
  - Moral issues leading to poisoning the well fallacy and *ad hominem* ("*They… can't stand the implications*") and direct *ad hominem* (questioning the integrity of the scientist).
  - Confirmation bias (extra numbers added to Ω) leading to hasty generalizations ("*Created to accord with the Equation…*").
  - Confirmation bias and pseudodiagnostics leading to conceptual equivocations (MHz = length unit/s).
  - The construction *per se* is a form of the Texas sharpshooter fallacy (pieces of information with no relationship to one another are called out for their similarities, which is used for claiming the existence of a pattern[2]).

5. Is the context such that the fallacies and aspects of experiential thinking can form a biased background for the audience to evaluate the actual 'scientific' claim?

- Yes, the claim rests on confirmation bias and numerology, it is presented in a fallacious context and the fallacies and the narrative related to experiential thinking appeal to emotions and can either create or enforce false beliefs.

6. Summary

- The claim equates questionable measurement methods ("*Thom units*") and manipulated figures (1/81 changed into 0.0123456789 with the '8' added to yield the desired results). There is very strong confirmation bias, without which the claim would probably not survive.

[1] [D. Cumming, *The equation of creation*, http://www.ukapologetics.net/09/cumming2.html, 2009, accessed 3 April 2013]
[2] [http://www.fallacyfiles.org/aboutgnc.html, http://www.iep.utm.edu/fallacy/]

Table 7. Systematic analysis of the claim 'Evolutionary theory leads to various atrocities'. Direct citations in *italics*.

1. Source criticism

- The claim is extremely widespread and common. It includes association of evolutionary theory to Nazism[1] [2, 22], Stalinism [17, 24, 25], genocide [17], immorality [23] and mass murder [62].

2. Other sources

- The actual writings of the Nazi and Stalin do not clearly support the evolution association. Hitler claimed to work for the Christian God [63] and Stalin condemned Darwinism [64].

3. Are aspects of experiential thinking present?

- Yes, as follows:
  - Testimonials: Several emotional accounts including Holocaust survivors [17, p. 25]. In addition, testimonials of evolutionary theory allegedly accepting the destruction of the weak (poor, sick, *etc*.) as 'natural selection' [17, p. 477; 24, p. 182].
  - Confirmation bias: Other possible hypotheses for the causes of the Holocaust and totalitarianism are not discussed. The actual statements on religion and/or evolution by Hitler and Stalin are dismissed.
  - Pseudodiagnostics: Erroneous data are taken as pivotal. Evolutionary theory is connected to atrocities in texts that also aim to criticize the scientific validity of evolutionary theory. While it can certainly be useful to assess the complicated causes of totalitarianism, the validity of evolutionary theory is based on scientific evidence and not the fact that scientific claims can be misused to rationalize atrocities.
  - Is base rate ignored? Yes, other possible causes of atrocities are ignored or simply dismissed: "*We have often demonstrated that the occasional atrocities committed by professing Christians were completely contrary to the teachings of Christ, while the atrocities of 20th century Nazis and Communists were totally consistent with evolutionary teaching*".[1-Sarfati]
  - Is there a tendency for broad generalization and stereotypical thinking? Yes. Evolution is exclusively taken as the cause for atrocities and other hypotheses are ignored or dismissed.
  - Is moral significance attached to the data? Yes, the whole claim is not based on the actual validity of evolutionary theory but on its alleged moral consequences.

4. Are there argumentative fallacies?

- Yes, as follows:
  - Testimonials leading to appeals to pity and authority.
  - Moral issues leading to guilt by association and slippery slope arguments, appeals to consequences and *ad hominem* ('Darwin was a racist'). "*…if life is an accident* [Darwinist worldview]*… why not make human clones? Why not abort unwanted children? Why not euthanize the 'useless' aged?… Why not 'steal, kill, and destroy'?*" [19] "*Modern racism has always found its strongest and most vicious expression among doctrinaire evolutionists — men such as Karl Marx, Adolf Hitler…*" [2, p. 54–55] "*Genocide, of course, is merely a shocking name for the process of natural selection…*" [23]
  - Confirmation bias leading to hasty generalizations ("*Nazis and communists were totally consistent with evolutionary teaching…*").[1-Sarfati]
  - Confirmation bias and pseudodiagnostics leading to equivocations (Darwinism = social Darwinism) and straw men ("*The core idea of Darwinism is selection. The Nazis believed that they must direct the process of selection…*" [65], "*The mechanism of evolution is the destruction of the weak in the struggle for existence*" [25, p. 16], "*Darwin… felt some people were 'unfit' to survive...* "[2]).

5. Is the context such that the fallacies and aspects of experiential thinking can form a biased background for the audience to evaluate the actual 'scientific' claim?

- Yes, the claim is often presented in the same books and journals that deal with scientific data. The associations to atrocities can create a strongly biased background on the evaluation of the scientific parts of the discussion. The claim blurs effectively the difference between the actual scientific evidence and moral issues. The examples do not mention that the validity of evolutionary theory is not determined by its alleged moral implications.

6. Summary

- The claim has been repeatedly criticized and rebutted, but also the rebuttals are contributing to the fallacious discussion by not recognizing the irrelevance from the scientific point of view and not acknowledging the relevance of fallacies regarding the reception of the creationist theory presented in context. The discussion about the possibility of religion or science contributing to atrocities should be kept separate from the discussion about the evidence for a scientific theory. The association of evolutionary theory to atrocities [or, on the opposite side, blaming Christianity or other religions, *e.g.* ref. [3]] has great appeal and is presumably a strong creator of false beliefs for a biased audience. The claim rests on experiential thinking patterns (testimonials, moralization, generalizations and confirmation bias ignoring negative or contradictory data and base rates, such as other hypothetical causes for the Holocaust) and is totally fallacious when considering proof for evolution (*ad hominem*, guilt by association, slippery slope, *etc*.).

[1] [http://www.ukapologetics.net/1evolutionfaith.htm; http://www.ukapologetics.net/09/DARWIN.printer.htm; J. Sarfati, *Reinforcing the Darwin–Hitler connection and correcting misinformation about slavery and racism*, http://creation.com/the-charles-

darwin-adolf-hitler-connexion-correcting-misinformation-re-slavery-racism, Creation Ministries International, Eight Mile Plains, 2007, accessed 2 February 2013]

[2] [B. Hodge, *Finland school shootings: the sad evolution connection*, http://www.answersingenesis.org/articles/2007/11/08/finland-fruits-of-humanism, Answers in Genesis, Hebron (USA), 2007, accessed 2 February 2013]

[3] [M. Isaak, *Index to creationist claims. Claim CA006.1: Adolf Hitler exploited the racist ideas of Darwinism to justify genocide*, http://www.talkorigins.org/indexcc/CA/CA006_1.html, TalkOrigins Archive, Houston, 2008, accessed 15 December 2012]

Table 8. Systematic analysis of the claim 'The Cambrian explosion cannot be explained by evolutionary theory'. Direct citations in *italics*.

1. Source criticism

- The claim is presented in multiple formats often without references. The common form of the claim is as follows: All animal phyla appeared without ancestors or transitional forms in the Cambrian. This cannot be explained by evolutionary scientists and it is, thus, evidence for special separate creation. "*Representatives of every one of the animal phyla are found in 'Cambrian' rock*" [66], "*Representatives of all known animal phyla appear simultaneously and clearly separate*" [17, p. 230], "*At least 50, according to Stephen Jay Gould as many as 100 phyla, can be observed in Cambrian fossils*" [21, p. 17].

2. Original citations and scientific rebuttals

- The claim refers often to the ideas by Gould [67], who presented many Cambrian fossils as belonging to extinct phyla. This theory has been mostly disproven and plausible connections between the Precambrian and Cambrian fossils exist [68].
- The Cambrian animal phyla are not '*clearly separate*'. On the contrary, they offer transitional forms between the present phyla, for instance, in the case of annelids, brachiopods, molluscs, priapulids, *etc*. [68–72]. A significant issue in the claim is the assumption '*all animal phyla*', which is not observed in the fossil record. In fact, of the approximately 32 existing animal phyla, 20 entered the fossil record during later geological periods[1]. Furthermore, basic plant and fungal body plans (mosses, ferns, conifers, spermatophytes,) emerged after the Cambrian. Thus, the claim fails in source criticism.

3. Are aspects of experiential thinking present?

- Yes, as follows:
  - Testimonials: Citations of, *e.g.*, Darwin and Gould about alleged problems in the fossil record[2].
  - Confirmation bias: The claim repeatedly includes the concept of 'all animal phyla appearing simultaneously'. Actually, Precambrian fossils include cnidarians, probably arthropods, *etc*. In addition, 20 phyla have left fossil records only after the Cambrian and 12 appear in the Cambrian or earlier[1]. These data are dismissed or ignored as well as the data on the appearance of plant forms.
  - Pseudodiagnostics: Erroneously cited data taken as pivotal. The claim 'all phyla appear' is erroneous but it is taken as definite proof for separate creation [21, p. 17–18]. The outdated interpretation of Burgess Shale fossils by Gould [66] is cited as evidence for extinct phyla.
  - Is base rate ignored? Yes, the majority of phyla with no fossil record from the Cambrian are ignored.
  - Is there a tendency for broad generalization and stereotypical thinking? Yes. Phyla are equivocated as modern '*clearly separate*' life forms, although during the Cambrian, the phyla still had many similarities to one another. 'Animal phyla' are equivocated to all life forms.
  - Is moral significance attached to the data? Yes. In book format [17, 21, 73], the scientific claims are interposed with demonizing arguments about evolution associated to atrocities. Specifically, the integrity of scientists is questioned: "*…Scientists no longer even search for the missing links between invertebrate phyla*" [73, p. 142; compare to ref. 69–72]. General immorality is also implied: "*The false theories* [speciation and emergence of phyla] *have also caused widespread renouncement of faith in God*" [25, p. 29].

4. Are there argumentative fallacies?

- Yes, as follows:
  - Testimonials leading to appeals to authority, *i.e.*, citing Gould and outdated theories as proofs for creation.
  - Moral issues leading to *ad hominem* (questioning the integrity of scientists). "[the scientists'] *preference has been to demean the opposition and pompously declare evolutionary theory beyond any need of verification*" and accusing evolutionary proponents of 'arrogance'[2]. "*Will we ever live to see the day that evolutionists stop being so narrow-minded and arrogant…*" [74]. Also *tu quoque* arguments: "*Evolutionists themselves admit… that the explosive appearance of life in the Cambrian seems to support creation*" [73, p. 142].
  - Confirmation bias leading to hasty generalizations: "*This evidence practically crushes evolutionary theory*" [73, p. 142].
  - Pseudodiagnostics leading to hasty generalizations and straw men ('all phyla' and 'phyla are distinct').

5. Is the context such that the fallacies and aspects of experiential thinking can form a biased background for the audience to evaluate the actual 'scientific' claim?

- Yes, the scientific claim is presented in a fallacious context and the fallacies and the narrative related to experiential thinking appeal to emotions and can either create or enforce false beliefs. The concept of 'all phyla' shows especially strong confirmation bias and dismissal of data not supporting the creationist hypothesis.

6. Summary

- The claim has been repeatedly rebutted. It cites outdated hypotheses [67] and disregards data on phyla and plant forms that appeared after the Cambrian. The claim rests on experiential thinking patterns (testimonials, moralization, confirmation bias including ignoring negative or contradictory data and base rates). The claim is also accompanied with argumentative fallacies including demonizing *ad hominem*, hasty generalizations and equivocations.

[1] [***, *Metazoa: fossil record. Chart of first appearances of metazoans*, http://www.ucmp.berkeley.edu/phyla/metazoafr.html, University of California, Museum of Paleontology, Berkeley, 2013, accessed 14 February 2014]
[2] [D. Woetzel, *Evolutionists retreating from the arena of science*, http://www.creation.com/evolutionists-retreat-from-science, Creation Ministries International, Eight Mile Plains, 2009, accessed 23 May 2013]

YEC theorists have given some detailed data on these 'kinds' or 'baramins'. Their classification is based on interpreting the Bible mixed with data derived from Natural sciences. To determine a 'baramin', they first consider hybridization ("living things reproduce according to their kinds" [39]. YEC theorists admit that there is a scarcity of data concerning the possibility of hybridization between modern species and other methods must supplement it. Another determinant for animal classification in 'baraminology' is the 'cognitum', which is a 'perception-based concept'. Simply, the animals are classified into 'baramins' based on their distinctiveness by human senses. Statistical methods of taxon correlation ('statistical baraminology') [39, 43] are used to determine similarities between life forms by calculating the Pearson correlation coefficient based on morphological characters. This can be plotted to form a visual matrix [43]. This method has been recommended for extinct taxa with only the fossil record as data [39]. Comparative data on the protein or DNA sequences between life forms can be used but they are "not given as high priority as hybrid data or the cognitum". While the concept of 'baraminology' derives from YEC, also some sampled ID proponents refer to the 'created kinds' or 'kinds' as a more plausible concept than the evolutionary model by stating with no references that "there are no transitional changes from one kind into another in the fossil record" [17, p. 285–296]. To summarize, 'baraminology' proponents accept evolution 'within a created kind' but no change from one 'kind' to another. Of course, the latter has actually been observed, as the single-celled *Helacyton gartleri* is undisputedly of human origin [75].

Based on these concepts, creationists have published a list of 'mammalian ark kinds' that consists of 137 'baramins' [41]. These are mostly but not exclusively compatible with biological families. Regarding fossil specimens, Senter [43] applied the creationist taxon correlation analysis to yield 8 'dinosaur baramins' from fossil data. The number of 8 dinosaur 'baramins' could be considered to be compatible with the YEC concept of the global flood, as this could have provided sufficient space for them in Noah's ark. Scientifically, the subsequent diversification of the 137 mammalian 'baramins' into modern species and that of the 8 dinosaur 'baramins' into all known fossil forms is, however, not accounted for. Based on recent data, 5416 mammalian species have been classified [76], which would, according to YEC, derive from the 137 'baramins'. Thus, 5416 – 137 = 5279 new species should have been formed in 4362 years, 1.2 species/year. If we are not quite as generous with the timeframe (we have no scientific observations of new species constantly forming at least since the 1700's or 1800's), the number of novel species/year would have to be correspondingly higher. The 8 dinosaur 'baramins' calculated by Senter [43]

would have diversified into the approximately 1000 different dinosaur forms known at present from the fossil record [*List of dinosaurs*, http://en.wikipedia.org/wiki/List_of_dinosaurs, 2013, accessed 1 June 2013] (we acknowledge that some are synonyms of juvenile forms but also emphasize that not all dinosaur fossils have probably been unearthed at present). Within the dinosaur 'baramins', this diversification would have been even more rapid with species appearing at a very high rate/generation, as large animals would not have reproduced at the age of 1 year (compared to, *e.g.*, small rodents) and the subsequent dinosaur extinction would have forced the taxa to appear within a short timeframe after the alleged flood. If we generously assume that most dinosaur species would have become extinct in the YEC model by the year 0, 0.43 new species should have been formed each year. In addition, the genetic diversity of, for instance, the 'dog baramin' would have had to appear within a few thousand years [40]. Thus, from the scientific viewpoint the concept of 'baraminology' lacks explanatory power.

The second part of the analysis examines if the claims regarding 'baraminology' are presented in a context of experiential thinking. For this, the texts are analyzed for testimonials, confirmation bias, disregard of conflicting data, simplifications and moral issues. For testimonials and the use of personal experience instead of scientific observations, the concept of 'cognitum' is a clear example of a basic aspect of experiential thinking penetrating the whole method of 'baraminology'. As hybridization data between modern species are scarce and the DNA and protein data given less importance, the inclusion of species in 'baramins' is, thus, for a large part based on the personal opinion ('cognitum') of a creationist, which would make the procedure difficult to generalize or to be repeated. In addition, testimonials as direct quotes are used in the above-mentioned texts with frequent referrals to Biblical passages and their "reliable eyewitnesses" as "invaluable for establishing historical facts" [39]. Parker [37] cites Stephen J. Gould as a witness that species are distinct (and thus products of creation) and summons Linné as an authority on taxonomy of clearly distinct species based on "his conscious and explicit Biblical belief".

Confirmation bias and dismissal of contradictory information can also be observed in the sampled texts, for instance, in the habit of not harmonizing the concept of 'baraminology' to other aspects of Natural sciences or to other aspects of creationist theory. The compatibility of the number of 'animals kinds in the ark' and their subsequent diversification is rarely discussed with the context of feasibility regarding the genetic diversity and the rapidity of speciation required by the creationist model (see also ref. [43] for a more detailed discussion of the insurmountable problems with the YEC model). In the sample material, there are instances where the incompatibility in the genetic bottleneck during the alleged flood and the appearance of genetic diversity thereafter is disregarded. For instance, Sarfati [42] assesses the problem by stating that "the originally created kinds would have had much more heterozygosity than their modern... descendants". This does not take into account the decimation of all populations to 2 individuals by the global food,

which is one of the cornerstones of YEC theory. Lightner [40] recognizes the incompatibility ("significant diversity has arisen since the Flood") of the present karyotypic and allelic diversity with the available timeframe by using canids or the 'canid baramin' as an example. In this case, the data that do not support one's hypothesis are dismissed with an *ad hoc* explanation: "God… designed animals to be able to undergo genetic mutations which would enable them to adapt to a wide range of environmental challenges while minimizing risk". However, calculations based on the creationist concept of 'genetic entropy' suggest that all species would be doomed to extinction in the near future due to accumulating mutations [52]. According to this YEC model, a population of 10 human individuals would experience extinction after 110 generations or 2200 years. Such a rapid rate of deterioration would have been fatal also to all the other terrestrial species with an alleged population size of only 2 for the animal 'kinds' (8 for humans).

Several of the sampled texts also contain moral issues attached to the task of determining the 'baramins', as would be expected if the concept of 'baraminology' and its presentation were at least partly based on experiential thinking patterns [*e.g.*, 14]. For example, potential proponents of the alternative (evolutionary) hypothesis instead of 'kinds' are dismissed or disqualified as Bible-rejecting atheists displaying "willful denial of God's word" and "anti-Christian stand and pro-evolutionary propaganda" [38]. The same author also links the whole evolutionary worldview to immorality.

The third part of the analysis concentrated on argumentation and fallacies. All the sampled texts about 'baraminology' exhibited also fallacious arguments from the viewpoint of rational logic. *Ad hominem* — referring to the character of the opponent instead of evidence — was exemplified by emphasizing that scientific taxonomists are "driven by the secular worldview" and, thus, "interested in classifying life according to its supposed evolutionary history" [41]. The circumstantial *ad hominem* (appealing to past actions or opinions of the opponent instead of actual evidence) occurred when YEC writers used citations of biologists as testimonials for the creationist worldview. For example, Parker [37] cites Gould ("acrimonious anti-creationist") stating that "the existence of distinct species was quite consistent with creationist tenets…" Poisoning the well fallacy not only rejects the opponent's present arguments but also any arguments the opponent might put forth in the future. "Evolutionary indoctrination… stops most scientists from even considering that the drawings are of dinosaurs." [38] There are several appeals to consequences and guilt by association fallacies, when Ham [38] mentions that the unacceptance of the creation model would be undesirable: "…no absolute basis for morality… concepts of right and wrong are just a matter of opinion" and evolutionary teaching are a cause "why social problems abound today". False dilemmas — simplifying a complex issue into two alternatives — are exemplified by stating that "…there are only two ways of thinking: starting with the revelation from God… or starting with man's beliefs" [38]. In addition, Ham [38] claims that "If we accept the evolutionary teaching on dinosaurs, then… the Bible's account of

history is false. If the Bible is wrong in this area, then it is not the Word of God and we can ignore everything else it says…" (combining false dilemma with hasty generalization).

The fallacy of hasty generalization is also present when YEC writers accept the 'baraminological' models as fact despite of the above-mentioned genetic and timeframe restrictions and the scientific evidence for evolution. In addition, Sarfati [42] refers to the feasibility of the flood model by an example of "garden seeds could still sprout after 42 days' immersion in salt water" and generalizes this as evidence for plants surviving the alleged global flood. Appeals to authorities include the above-mentioned summoning of Linné and the quotes of evolutionary biologists (*e.g.*, Gould [37]). Finally, there is also an appeal to fear and force (*ad baculum*), when Ham [38] warns the readers as follows. "And what one believes concerning the book of Genesis… will affect how a person views himself or herself, fellow human beings, and what life is all about, including their need for salvation". Equivocation appeared when discussing the allegedly young age of dinosaur fossils. The not totally permineralized *Tyrannosaurus rex* fossil as reported by Schweitzer et al. [76] was conceptually equivocated to "unmineralized" with "blood cells and hemoglobin". Similarly, traces of heme compounds have become 'blood and blood vessels' and sulphurous odour has been re-interpreted as 'rotting [http://www.pekkareinikainen.info/fi/index.php?option=com_content&task=view&id=25&Itemid=27, http://www.pekkareinikainen.info/fi/index.php?option=com_content&task=view&id=24&Itemid=27].

Analyzing the links of the experiential thinking patterns and the above-mentioned fallacies, we observed a clear relationship. The use of testimonials was reflected in the appeals to authority and the *ad hominem* fallacies. The tendency for confirmation bias and the accompanying dismissal of contradictory data can be linked to hasty generalizations and equivocations. Regarding the attachment of moral significance, which is typical of experiential thinking, the appeals to consequences, demonization and the above-mentioned false dilemmas are an expected outcome.

Taken together, for a layman audience the claims about the 'created kinds' and 'baraminology' can at first glance appear sound and logical. However, the 4362-year timeframe after the alleged flood and the supposed rapid diversification of life forms face insurmountable problems regarding the possible genetic mechanisms that could have produced the diversity of species from the genetic pool of only two individuals per 'kind'. Another creationist concept ('genetic entropy', Table 5) would also be incompatible with the diversification, as the genetic pool of animals - according to the 'genetic entropy' theory -would not produce beneficial mutations or increase the information within the genome, which would be extremely low in diversity after the decimation of the species to one reproducing pair. The dismissal and/or hasty supernatural explanation of these discrepancies indicate that the creationist theory of 'baraminology' rests on experiential thinking instead of actual evidence. These experiential thinking patterns lead to argumentative fallacies, which are not relevant for the science

content but can be influential when the theory is presented to the (biased) public. It is important to assess these experiential thinking aspects and fallacies together with the scientific rebuttals to recognize their significance in the creation of flawed beliefs.

3.2. General analysis of creationist claims and the connection between experiential thinking and fallacies

The present analysis and our previous studies [Evol. Educ. Outreach, (2014), manuscript in press; Int. J. Sci. Educ., (2014), manuscript in revision] revealed a general pattern that emerges regarding the analyzed creationist claims. Creationist writers seem to process results derived from natural sciences through experiential thinking patterns: confirmation bias, disregard of negative or null data, associating science to moral issues and replacement of actual scientific observations with testimonials. Through this process, YEC and ID authors publish texts that transform these aspects of experiential thinking into argumentative fallacies. By relying on testimonials, the sampled creationists inevitably utilize appeals to authority and personal experience in contrast to scientific data. In addition to being appeals to authority, these testimonials can also be classified as appeals to ignorance, incredulity, fear or pity depending on the actual argument. Furthermore, from testimonials that cite scientists out-of-context as evidence for alleged problems in evolutionary theory, quote mining and *tu quoque* (circumstantial *ad hominem*) appear as fallacies. The association of moral issues to evolutionary data can be classified as *ad hominem*, guilt by association, appeal to consequences and slippery slope fallacies. Regarding confirmation bias, it causes cherry picking (fallacy of incomplete evidence), hasty generalizations, equivocations and straw man fallacies. Thus, the analysis reveals that there is a probable causative link between the experiential thinking utilized by creationists and the dependency on argumentative fallacies observed also in previous studies [Evol. Educ. Outreach, (2014), manuscript in press; Int. J. Sci. Educ., (2014), manuscript in revision]. These aspects of creationist texts have not usually been discussed in the scientific rebuttals regarding the context of creating false beliefs in the audience [*Creationist claims*, http://rationalwiki.org/wiki/Creationist_claims, 2013, accessed 1 June 2013].

Perhaps the most obvious case of experiential thinking and fallacies linked to creationist texts is the habit of associating evolutionary theory and its proponents to various atrocities. Typical of experiential thinking, this was often realized with testimonials in the sample material. While irrelevant when considering the actual evidence for or against evolutionary theory, creationist publications contain numerous passages that concentrate on the character assassination of Darwin [http://www.ukapologetics.net/1evolutionfaith.htm, http://www.ukapologetics.net/09/DARWIN.printer.htm] or discuss the links between evolutionary theory and the Holocaust [17, http://creation.com/the-charles-darwin-adolf-hitler-connexion-correcting-misinformation-re-slavery-racism]. Scientifically and rationally, it is of no significance regarding

evolutionary evidence, if the scientists developing the theory were 'good' or 'evil' or if the theory was used as rationalization for atrocities. Of course, the causes of totalitarianism can and should be investigated by their own right. From the point of view of the audience (especially if biased), the discussion about the association of evolution to genocide can be very powerful when persuading the audience to accept creationism. Due to this, scientists should recognize these fallacies and distinguish clearly when they are discussing the actual evolutionary theory and when participating in a debate that can be fruitful in historical and social sciences but does not actually concern evolution.

In addition to moral labelling, another clearly emerging pattern is the confirmation bias that leads the sampled creationists to dismiss or ignore data that are not in accordance with their biases or that are contradictory to other creationist theories, such as the incompatibility between 'baraminology' and 'genetic entropy'. Examples of this phenomenon also included the large amount of genetic data [46] that point to similarities in hominids and simians (Table 3), the scientific experiments that have shown the significant role of natural selection counteracting the potential accumulation of harmful mutations [78] and the actual observations of beneficial mutations [57; Table 5]. In this respect, creationists did not present the available source material that would have weakened their position, which seemed to be also the case for the claim on the Cambrian explosion. While the claim states that "all animal phyla enter the fossil record simultaneously", extant data do not support this claim [http://www.ucmp.berkeley.edu/phyla/metazoafr.html] (Table 8). On the contrary, the fossil record of most phyla does not extend back to the Cambrian. Obviously, this can be caused by an incomplete fossil record. However, as creationists demand more transitional fossils as evidence for evolution, it would not necessarily benefit the YEC/ID case to admit the scarcity of fossil remains.

The resistance to change — another aspect of experiential thinking — is clear in the ID theorists' lack of reaction to rebuttals on the concept of irreducible complexity (Table 4). Originally, Behe [47] claimed that the removal of any part from the flagellum, the complement system, the blood clotting cascade, etc. would cause the whole system to become nonfunctional. Many studies have thereafter shown that several prokaryotes contain fully functional flagella that do miss some of the components [50]. Similar findings are available for whales and the blood clotting system [79] and invertebrates regarding the complement system [80]. However, the original claim persists [10] and these examples are not assessed. In addition, the claim is accompanied by another testimonial: "[a microbiologist] declared, 'There are no detailed Darwinian accounts for the evolution of any fundamental biochemical or cellular system, only a variety of wishful speculations'" [47, p. 271].

Why analyze the fallacies and other aspects of creationist thinking that are not directly related to the scientific proof for or against evolutionary theory? One motivation is to assess the reasons why creationist claims remain attractive for a large part of the public — evolution is accepted only by 39.7% of population in the USA and by 26.0% in Turkey [Data360.org, *Belief in evolution - % of*

population, San Francisco, 2006, http://www.data360.org/dsg.aspx?Data_Set_Group_Id=507, accessed 17 February 2013]. Our analysis suggests that the appeal can be at least partly caused by the context, in which the claims are presented — associating evolutionary theory and its proponents to undesirable consequences (our analysis of fallacies). The claims can also appeal to the evolutionarily old and intuitive thinking patterns (our analysis of experiential thinking). Secondly, it is useful to have at least preliminary knowledge on these issues in order to be able to avoid the reciprocal use of fallacies and confirmation bias when assessing creationist writings and/or when presenting evolutionary theory in popularized form including rebuttals aimed at creationist theory. Our systematic approach was able to recognize both fallacies and aspects of experiential thinking in the selected examples in order to distinguish (un)intentional irrelevant rhetoric from the actual science. Based on our analysis and examples, we suggest that the recognition of these aspects can be of benefit to science educators and those participating in the creationist–evolutionist debate, including also those of the creationist conviction.

The proposed analytical model also provides additional support to the notion of creationism not being solid science [5]. The rebuttals defining creationism as pseudoscience gain systematic support if one considers and analyzes the fallacies and experiential thinking and not only the 'creationist evidence against evolution'. The analyzed creationist claims *are not* very scientific, as they rely heavily on unscientific and irrational thinking: testimonials, confirmation bias, ignoring negative and null data and attachment of moral significance to evolutionary theory. They *do* contain aspects of pseudoscience as they are often not based on evidence but testimonials, justified with fallacious scientifically irrelevant arguments and they show resistance to modification despite of huge amounts of data supporting other hypotheses. Analysis of fallacious arguments and experiential thinking patterns *does not prove that creationist claims would be false* — the probability of that is to be (and has been) assessed by scientific evidence. However, argumentation analysis and recognition of experiential thinking yield data on the strength of the creationist case. Regarding the analyzed examples the case has very meagre scientific support. Our method of systematic analysis and the presented examples could make the creationist–evolutionist debate more structured and help to discern the actual scientific content (evidence for evolution/creation) from the aspects irrelevant to the proof of a theory but relevant to the acceptance and persistence of the claims.

Acknowledgement

The authors wish to thank Professor emeritus Heikki Hyvärinen for critical comments on the manuscript.

References

[1] A.E. McGrath, *Science and religion: a new introduction*, 2nd edn., John Wiley & Sons, Chichester, 2010, 38-41.
[2] H.M. Morris, *The remarkable birth of planet earth*, Bethany Fellowship, Minneapolis, 1972.
[3] P. Davis and D.H. Kenyon, *Of pandas and people: the central question of biological origins*, 2nd edn., Haughton, Dallas, 1998.
[4] E.C. Scott, Annu. Rev. Anthropol., **26** (1997) 263.
[5] W. Young, *Fallacies of creationism*, Detselig Enterprises, Calgary, 1985.
[6] R.T. Pennock, Annu. Rev. Genomics Hum. Genet., **4** (2003) 143.
[7] K. Fitzhugh, Evol. Biol., **37** (2010) 68.
[8] John Paul II, *Message to the Pontifical Academy of Sciences: on evolution*, The Holy See, Vatican, 1996.
[9] The Committee on Science, Technology and Faith of the Executive Council, *A catechism of creation: an episcopal understanding*, Episcopal Church in the United States of America, Louisville, 2005.
[10] M.J. Behe, *The edge of evolution: the search for the limits of Darwinism*, Free Press, New York, 2007.
[11] M. Isaak (ed.), *Index to creationist claims*, TalkOrigins archive, Houston, 2006, online at http://www.talkorigins.org/indexcc/list.html, accessed 14 February 2013.
[12] F.H. van Eemeren and R. Grootendorst, *Argumentation, communication, and fallacies: a pragma-dialectical perspective*, Routledge, New York, 1992.
[13] R.J. Fogelin and T.J. Duggan, Argumentation, **1** (1987) 255.
[14] M. Lindeman, Scand. J. Psychol., **39** (1998) 257.
[15] J. Bergman, Impact, **367** (2004), online at http://www.icr.org/i/pdf/imp/imp-367.pdf.
[16] J. Bergman, Impact, **383** (2005), online at http://www.icr.org/i/pdf/imp/imp-383.pdf.
[17] T. Puolimatka, *Faith, science and evolution*, in Finnish, 2nd edn., Uusi Tie, Helsinki, 2009, 419-422.
[18] P.E. Johnson, *Darwin on trial*, TaleBooks, 1993, 44.
[19] W.S. Harris and J.H. Calvert, National Catholic Bioethics Quarterly, **Autumn** (2003) 531.
[20] M. Leisola, *Preface*, in K. Pälikkö, *From the beginning to the last days*, in Finnish, KP-art, Helsinki, 2012, 6–8.
[21] P. Reinikainen, *Does God exist?*, in Finnish, TV7, Helsinki, 2013, 146–149.
[22] J. Bergman, CEN Technical Journal, **13** (1999) 101.
[23] P.E. Johnson, *Reason in the balance: the case against naturalism in science, law & education*, InterVarsity Press, Downers Grove, 1995, 135, 144.
[24] T. Puolimatka, *A test for openness in science discussion*, in Finnish, Uusi Tie, Helsinki, 2010, 187–197.
[25] P. Reinikainen, *Darwin or intelligent design*, in Finnish, Uusi Tie, Helsinki, 2011, 17.
[26] K. Swenson, Creation, **23** (2001) 23.
[27] L. Weinberger, CEN Technical Journal, **19** (2005) 42.
[28] V. Denes-Raj and S. Epstein, J. Pers. Soc. Psychol., **66** (1994) 819.
[29] M.E. Doherty, C.R. Mynatt, R.D. Tweney and M.D. Schiavo, *Pseudodiagnosticity*, in *On scientific thinking*, R.D. Tweney, M.E. Doherty & C.R. Mynatt (eds.), Columbia University Press, New York, 1981, 158–169.

[30] S. Epstein, Am. Psychol., **49** (1994) 709.
[31] A. Hergovich, R. Schott and C. Burger, Curr. Psychol., **29** (2010) 188.
[32] M. Lindeman, Psychol. Health, **26** (2011) 371.
[33] R.S. Nickerson, Rev. Gen. Psychol., **2** (1998) 175.
[34] R. Pacini and S. Epstein, J. Pers. Soc. Psychol., **76** (1999) 972.
[35] S.J. Sherman and E. Corty, *Cognitive heuristics*, in *Handbook of social cognition volume 1*, R.S. Wyer Jr. & T.K. Srull (eds.), Lawrence Erlbaum Associates, Hillsdale, 1984, 186–268.
[36] W. Frair, CRS Quarterly, **37** (2000) 82.
[37] G. Parker, *Creation: Facts of Life*, New Leaf Press, Green Forest, 2006, online at http://www.answersingenesis.org/articles/cfl/species-kind, accessed 3 June 2013.
[38] K. Ham, *What really happened to the dinosaurs?*, in *The New Answers Book*, K. Ham (ed.), New Leaf Press, Green Forest, Arkansas, 2006, 167, online at http://www.answersingenesis.org/articles/nab/what-happened-to-the-dinosaurs, accessed 3 June 2013.
[39] J.K. Lightner, T. Hennigan, G. Purdom and B. Hodge, Answers Research Journal, **4** (2011) 195.
[40] J.K. Lightner, Journal of Creation, **23** (2009) 94.
[41] J.K. Lightner, Answers Research Journal, **5** (2012) 151.
[42] J. Sarfati, *Refuting Evolution*, Answers in Genesis, Brisbane, 1999, 31, online at http://creation.com/refuting-evolution-chapter-2-variation-and-natural-selection-versus-evolution, accessed 3 June 2013.
[43] P. Senter, J. Evol. Biol., **24** (2011) 2197.
[44] W. Brown, *In the beginning: compelling evidence for creation and the flood*, 8th edn., Center for Scientific Creation, Phoenix (AZ), 2008, 74, online at http://www.creationscience.com/onlinebook/LifeSciences37.html, accessed 3 May 2013.
[45] J.F. Hughes, H. Skaletsky, T. Pyntikova, T.A. Graves, S.K.M. van Daalen, P.J. Minx, R.S. Fulton, S.D. McGrath, D.P. Locke, C. Friedman, B.J. Trask, E.R. Mardis, W.C. Warren, S. Repping, S. Rozen, R.K. Wilson and D.C. Page, Nature, **463** (2010) 536.
[46] M.A. Bakewell, P. Shi and J. Zhang, Proc. Natl. Acad. Sci., **104** (2007) 7489.
[47] M.J. Behe, *Darwin's black box: the biochemical challenge to evolution*, 1st and 10th edns., Free Press, New York, 1996 and 2006.
[48] S. DeVowe, Creation, **27** (2004) 24.
[49] J. Sarfati and M. Matthews, *Refuting evolution 2*, New Leaf Press, Green Forest, 2011, 135, online at http://creation.com/refuting-evolution-2-chapter-10-argument-irreducible-complexity, accessed 22 May 2013.
[50] M.J. Pallen and N.J. Matzke, Nat. Rev. Microbiol., **4** (2006) 784.
[51] J. Sanford, *Genetic entropy & the mystery of the genome*, Feed My Sheep Foundation, New York, 2006.
[52] A. Williams, Journal of Creation, **22** (2008) 60.
[53] H.M. Morris, *Scientific creationism*, Master Books, Green Forest, 1974, 56-57.
[54] J.F. Crow, Proc. Natl. Acad. Sci., **94** (1997) 8380.
[55] D.H. Reed, Conserv. Biol., **19** (2005) 563.
[56] V. Ávila, D. Chavarrías, E. Sánchez, A. Manrique, C. López-Fanjul and A. García-Dorado, Genetics, **173** (2006) 267.
[57] D.W. Hall, R. Mahmoudizad, A.W. Hurd and S.B. Joseph, Genet. Res., **90** (2008) 229.

[58] S.A. Tishkoff, F.A. Reed, A. Ranciaro, B.F. Voight, C.C. Babbitt, J.S. Silverman, K. Powell, H.M. Mortensen, J.B. Hirbo, M. Osman, M. Ibrahim, S.A. Omar, G. Lema, T.B. Nyambo, J. Ghori, S. Bumpstead, J.K. Pritchard, G.A. Wray and P. Deloukas, Nature Genetics, **39** (2007) 31.
[59] B. Carlsson, E. Kindberg, J. Buesa, G.E. Rydell, M. Fos Lidón, R. Montava, R.A. Mallouh, A. Grahn, J. Rodríguez-Díaz, J. Bellido, A. Arnedo, G. Larson and L. Svensson, PLoS ONE, **4** (2009) e5993.
[60] A. Thom, J. R. Stat. Soc. Ser. A-Stat. Soc., **125** (1962) 243.
[61] D.H. Kelley and E.F. Milone, *Exploring ancient skies: a survey of ancient and cultural astronomy*, Springer, New York, 2011, 163.
[62] J. Bergman, Journal of Creation, **26** (2012) 48.
[63] A. Hitler, *Mein Kampf*, Zentralverlag der N.S.D.A.P. Frz Eher Nachf, Munich, 1936, 70.
[64] J. Stalin, *Анархизм или Социализм (Anarchism or socialism?)*, in *Сочинения (Collected works)*, vol. 1, Государственное Издательство Политической Литературы, Moscow, 1907, 307–308.
[65] R. Grigg, Creation, **28** (2005) 18.
[66] C. Wieland, Creation, **16** (1994) 38.
[67] S.J. Gould, *Wonderful life: the Burgess Shale and the nature of history*, W.W. Norton & co, New York, 1989.
[68] S. Conway Morris, *The crucible of creation: the Burgess Shale and the rise of animals*, Oxford University Press, Oxford, 1998.
[69] J. Liu, D. Shu, J. Han, Z. Zhang and X. Zhan, Acta Palaeontol. Pol., **51** (2006) 215.
[70] J. Liu, D. Shu, J. Han, Z. Zhang and X. Zhan, Gondwana Res., **14** (2008) 277.
[71] J. Paps, J. Baguñà and M. Riutort, Proc. Natl. Acad. Sci., **276** (2008) 1245.
[72] J. Paps, J. Baguñà and M. Riutort, Mol. Biol. Evol., **26** (2009) 2397.
[73] P. Reinikainen, *The forgotten Genesis*, in Finnish, Uusi Tie, Helsinki, 1991.
[74] J. Woodmorappe, Journal of Creation, **23** (2009) 39.
[75] B.P. Lucey, A. Walter, W.A. Nelson-Rees, M. Grover and G.M. Hutchins, Arch. Pathol. Lab. Med., **133** (2009) 1463.
[76] D.E. Wilson and D.M. Reeder, *Mammal species of the world: a taxonomic and geographic reference*, Vol. 1, 3rd edn., The Johns Hopkins University Press, Baltimore, 2005.
[77] M.H. Schweitzer, M. Marshall, K. Carron, D.S. Bohle, S.C. Busse, E.V. Arnold, D. Barnard, J.R. Horner and J.R. Starkey, Proc. Natl. Acad. Sci., **94** (1997) 6291.
[78] C.F. Baer, N. Phillips, D. Ostrow, A. Avalos, D. Blanton, A. Boggs, T. Keller, L. Levy and E. Mezerhane, Genetics, **174** (2006) 1387.
[79] A.J. Robinson, M. Kropatkin and P.M. Aggeler, Science, **166** (1969) 1420.
[80] M. Nonaka, K. Azumi, X. Ji, C. Namikawa-Yamada, M. Sasaki, H. Saiga, A.W. Dodds, H. Sekine, M.K. Homma, M. Masushita, Y. Endo and T. Fujita, J. Immunol., **162** (1999) 387.