

DISSERTATIONS IN EDUCATION, HUMANITIES, AND THEOLOGY

PETTERI NIEMINEN

A Unified Theory of Creationism

*– Argumentation, experiential thinking and
emerging doctrine*

PUBLICATIONS OF THE UNIVERSITY OF EASTERN FINLAND
Dissertations in Education, Humanities, and Theology



UNIVERSITY OF
EASTERN FINLAND

A Unified Theory of Creationism

*— Argumentation, experiential thinking and
emerging doctrine*

PETTERI NIEMINEN

*A Unified Theory of
Creationism*

— *Argumentation, experiential thinking and
emerging doctrine*

Publications of the University of Eastern Finland
Dissertations in Education, Humanities, and Theology

No 63

University of Eastern Finland
Joensuu
2015

Kopio Niini Oy

Helsinki, 2015

Sarjan vastaava toimittaja: Matti Kotiranta

ISBN: 978-952-61-1686-0 (nid.)

ISSNL: 1798-5625

ISSN: 1798-5625

ISBN: 978-952-61-1687-7 (PDF)

ISSN: 1798-5633 (PDF)

This one is for
Arwen,
with whom I share common descent.

Nieminen, Petteri

A Unified Theory of Creationism – Argumentation, experiential thinking and emerging doctrine

Joensuu: University of Eastern Finland, 2015

Publications of the University of Eastern Finland

Dissertations in Education, Humanities, and Theology No 63

ISBN: 978-952-61-1686-0 (nid.)

ISBN: 978-952-61-1687-7 (PDF)

ISSNL: 1798-5625

ISSN: 1798-5625

ISSN: 1798-5633 (PDF)

ABSTRACT

Creationism is a worldview based on the denial of biological evolution. Young-earth creationism (YEC) emphasizes the historical reading of Genesis and the young age of the earth, whereas old-earth creationism (OEC) and intelligent design (ID) accept the geological age of the planet but deny the possibility of life diversifying solely based on natural phenomena. At present, creationism is not accepted by several major Christian denominations, including the Roman Catholic Church, many protestant churches, especially in Europe, by Episcopalians or by Methodists. However, the position of, *e.g.*, the Russian Orthodox Church and Pentecostals regarding evolutionary theory is unclear. The present study analyzed texts in English and Finnish representing the major YEC and ID/OEC organizations and authors in book and article formats. Argumentation, thinking patterns and theological aspects of creationism were assessed in a systematic manner. In addition, in order to compare the argumentation of creationists with that of their evolutionary opponents, selected pro-evolutionary texts were also analyzed for argumentative fallacies and experiential thinking.

The studied creationists relied heavily on *ad hominem* arguments when attempting to disprove evolutionary theory. These included demonization of evolutionary scientists by character assassination, such as claiming them to be, for instance, mentally instable, plagiarist, cowardly or racist. The *tu quoque* fallacy appeared frequently when quoting evolutionary scientists allegedly confirming problems in evolutionary theory. The poisoning the well fallacy included statements that evolutionary proponents would refuse to consider supernatural explanations not based on science but on a worldview. Appeals to consequences and guilt by association appeared when evolutionary theory was associated with atrocities or deterioration of moral values. There were several appeals to authorities, presenting historical scientists as having been religious and quoting evolutionary scientists themselves as “admitting” that the creation model was correct. False dilemmas represented complex issues as a choice between only two alternatives, for example, by polarizing ethics into the creationist view of high morality and the naturalist worldview of “genocide as a part of natural selection”. Straw man arguments often appeared when creationists simplified evolutionary mechanisms to chance. Hasty generalizations included claims that the entire evolutionary theory would

collapse as a result of a single alleged problem with the theory. Equivocations identified Darwinism with social Darwinism and fossil ancestors of present life forms with their modern descendants. Evolutionary proponents also employed fallacies, most often *ad hominem*, *tu quoque*, appeals to authorities/consequences and guilt by association. From the viewpoint of proving or falsifying evolutionary theory, these fallacies would be irrelevant. However, they have become a major part of the creationist–evolutionist debate and the vicious circle of counter-fallacies should be broken by not only recognizing the fallacies but also by assessing their significance in the formation of false beliefs.

Aspects of experiential thinking heavily characterized the analyzed creationist writings. A large part of the texts consisted of various testimonials, quotes and opinions supporting creation and/or opposing evolution without presenting actual scientific evidence. In addition, metaphors and narratives, such as identifying the creationist–evolutionist debate as a battle between Christ and Satan and assessing evolutionary evidence as a court case, were employed instead of scientific data. Confirmation bias and lack of source criticism were observed in the disregard of data that would support alternative hypotheses. Falsely understood scientific data were taken to be pivotal to prove creationism, which is a form of pseudodiagnostics. Complex issues, such as the Cambrian explosion, were simplified into scientifically incorrect forms. The ethically neutral evolutionary theory was given moral significance by associating it with Nazism, Stalinism, abortions, euthanasia and alleged spread of sexual immorality. Evolutionary proponents used especially testimonials and moral associations.

If testimonials instead of actual evidence were presented, the result was fallacious and could be classified, *e.g.*, as *ad hominem*, appeals to authorities, quote mining, appeals to ignorance or *tu quoque*. Confirmation bias led to hasty generalizations and the attachment of moral issues to *ad hominem*, guilt by association, *ad consequentiam*, false dilemmas and *ad baculum* among others. The results indicated that in addition to assessing the scientific parts of creationist writings, it would also be useful to include experiential thinking and argumentation in the systematic analysis of these claims. There could also be a link between experiential thinking by creationists and their frequent utilization of fallacious argumentation. This can partly explain the persistence and spread of creationist claims despite rigorous scientific rebuttals.

Theologically, YEC proponents emphasized the inerrancy of Genesis as a historical narrative. Regarding revelation, YEC authors relied heavily on selected and re-interpreted scientific data to prove the accuracy of the Bible, which represented scientism. YEC proponents were also exclusive in ecclesiology and sometimes stated that it would be mutually incompatible to be a Christian and yet to believe in evolution. ID/OEC proponents were more diverse. Whereas some considered themselves as Christian, others refused to identify the “designer” as the Christian deity. YEC proponents criticized ID/OEC for problems in theodicy. In fact, the theodicy of ID/OEC authors was unsuccessful and concentrated mainly on compensating the evils of pain by referring to its usefulness as a warning signal, or dismissed theodicy altogether. The YEC theodicy relied on explanations based on original sin and eschatology. Both YEC and ID/OEC demonized evolutionary theory and its proponents heavily and sometimes identified evolution with Satan. They also started to utilize out-of-context cites without references

as slogans which could in the future form a basis for a new creationist canon. Although the theologies of both YEC and ID/OEC were based on Christian doctrine, the YEC scientism and reliance on scientific proof for the Bible and the ID/OEC agnosticism about the identity of the “designer” could suggest divergence from mainstream Christianity, with the potential of forming new denominations or emerging religions with their own canon supplementing the Bible.

Acknowledgements

From irritation to fascination to tentative cognizance—that is, how I could describe my acquaintance with creationism. At the onset of the project, my goal was to assess how good their case against evolution actually was. Of course, from the viewpoints of biology, astronomy and geology, that had been thoroughly analyzed and it was most unlikely that significant new contributions could be made by simply scrutinizing creationist claims scientifically. Thus; irritation entered *via* the creationist rhetoric mostly absent from science—accusations and innuendo about the evil nature of evolutionary theory itself as well as that of its proponents. While preparing my MTh thesis on the subject I felt obliged to answer these accusations in detail—repeating arguments that have been reiterated in numerous scientific rebuttals of creationism. Thus, on a small scale, I also entered the vicious circle of emotional debate without proper understanding of the reasons behind the failure of communication between creationists and scientists.

Gradually I became fascinated. What if the fallacious ballast instead of the oft-repeated scientific analysis were to be a principal goal of the project? This proved more fruitful and the number of side issues—arguments that had nothing to do with the actual scientific evidence for or against evolution or creationism—was utterly intriguing. This finally suggested a method to understand not only what the creationists have to say but also why. Cognizance made its entry with the concept of experiential thinking; there were testimonies instead of observations or experiments, confirmation bias instead of equally balanced consideration of facts, attachment of moral values to scientific results instead of careful deliberation of ethics. Patterns and connections began to emerge. When testimonials were used instead of evidence, the inevitable outcome was an appeal to authority; when contradictory data were ignored, one could not escape resorting to hasty generalizations; when moral issues were linked to science, the result was a text swarming with appeals to consequences, guilt by association fallacies and slippery slopes. How would this affect the theology of creationist proponents? I had to keep in mind that the religious conviction is a worldview that is (and should be allowed to be?) based on experiential thinking. It is enforced by testimonials. It is all about moral issues. Again, there was a connection: using the paradigm of faith to interpret scientific data, and using the requirement of absolute certainty to rewrite scientific results produced by statistical uncertainty. And when the uncertainties are borrowed to provide evidence for the absolutely certain faith of fundamentalism, new theologies emerge.

Those responsible for the present project are—first and foremost—Anne-Mari and Tommi. It was one of them (but no-one remembers which one), who had the idea that I should study theology due to my frequent singing of sacral music with our choir. Thus, we placed a bet that I would either be able to compete successfully in the entrance examination to the Faculty based only on absorbed knowledge from our choir concerts (Anne-Mari & Tommi) or that I would not (my bet). Tommi—as *the* body builder—also guarded the door, thus preventing my attempts to escape from the entrance examination. Obviously, I lost the bet but Tommi was the one with the most regret.

Anne-Mari supervised the project with her usual precision and Esko with his logical and careful manner. Tommi was the target of numerous theological monologues and he actually tolerated them better than expected. Jussi provided hilarious and intelligent feedback to my ideas. Dr. Maarten Boudry, Professor emeritus Heikki Hyvärinen and Docent Jukka Vuorinen are acknowledged for their critical comments on the manuscripts and Michael Bailey for the English-language proofreading. Of course, friends and family were involved as well as the School of Theology, especially Professor Antti Raunio, by providing the research opportunity and Professor Matti Kotiranta for preparing the printed version of this thesis. The project was supported financially by repeated collections of tithes, for which I thank Pekka, Thomas, Ossi, Otto, Kasper, Jussi and others. Finally, I am honored to have had the privilege of spending invaluable time with my precious with her physical exuberance and affection, our mutual trust and rewarding training sessions. This one is for you, Arwen.

Kuopio, February 2015

Petteri Nieminen

Table of contents

Abstract	vi
Acknowledgements	ix
1 Introduction	1
2 Review of the Literature	3
2.1 The evolution–creationism debate.....	3
2.1.1 History of the conflict between Christianity and science	3
2.1.2 Attitudes of the major Christian denominations to evolutionary theory	5
2.2 Modern evolutionary theory.....	10
2.2.1 The concept of evolution	10
2.2.2 Evidence for biological evolution and its potential falsification	14
2.2.3 Common misconceptions about evolutionary theory	16
2.3 The Creationist worldview	18
2.3.1 Young-earth creationism.....	18
2.3.2 Old-earth creationism and intelligent design.....	20
2.3.3 Rebuttals of creationism in natural sciences.....	21
2.3.4 Creationism and philosophy of science.....	22
2.3.5 Creationism and natural theology	26
2.3.6 Creationism and evolutionary theory in the court.....	27
2.4 Argumentation and fallacies.....	28
2.5 Experiential thinking.....	32
3 Aims of the Study	34
3.1 Aims	34
3.2 Hypotheses	34
4 Materials and Methods	36
4.1 Sampled texts.....	36
4.1.1 Creationist authors	36
4.1.2 Creationist organizations, journals and other texts	37
4.1.3 Sampled evolutionist texts	40
4.2 Analyses.....	40
4.2.1 Analysis of argumentation and fallacies (I–III).....	40
4.2.2 Analysis of experiential thinking and its connections to fallacies (II–III)	41
4.2.3 Constructing a method for systematic analysis of creationist claims (III)	42
4.2.4 Analysis of theological aspects of YEC and ID/OEC (IV).....	42
4.2.5 Statistical analyses (I–II).....	42
5 Results and Discussion	44
5.1 Argumentation	44
5.1.1 Fallacies in creationist texts (I).....	44

5.1.2 Fallacies in evolutionist texts (I).....	49
5.1.3 The significance of fallacies in the creationist–evolutionist debate (I, III–IV)	50
5.2 Experiential thinking and creationism	52
5.2.1 Aspects of experiential thinking in creationist texts (II–III).....	52
5.2.2 Linking experiential thinking and fallacies (I–III).....	56
5.2.3 Method for assessing creationist claims based on analyses of natural sciences, argumentation and experiential thinking patterns (III)	57
5.2.4 Why do creationists utilize experiential thinking (II–III)?.....	58
5.3 Creationist theology (IV).....	59
5.3.1 YEC doctrine	59
5.3.2 ID/OEC doctrine	62
5.3.3 Creationist canon?	63
5.3.4 Creationism and Christianity.....	64
5.3.5 Creationism and science.....	65
5.3.6 Aspects of Finnish creationism	67
5.3.7 Towards a unified theory of creationism?.....	68
5.4 Argumentation, experiential thinking and assessment of the present study	70
6 Conclusions	72
Literature	73

LIST OF TABLES

Table 1	12
Table 2	57

ABBREVIATIONS

AiG	Answers in Genesis
BCE.....	Before the common era
CE.....	Common era
CMI.....	Creation Ministries International
DNA	Deoxyribonucleic acid
IC.....	Irreducible complexity
ICR.....	Institute for Creation Research
ID.....	Intelligent design
NT	New Testament
OEC.....	Old-earth creationism
OT.....	Old Testament
RNA.....	Ribonucleic acid
TE	Theistic evolution
UKA	UK Apologetics
YEC.....	Young-earth creationism

List of original publications

This thesis is based on following original articles referred to by their Roman numerals:

- I Nieminen P, Mustonen A-M (2014): Argumentation and fallacies in creationist writings against evolutionary theory. *Evolution: Education and Outreach* 7, 11.
- II Nieminen P, Ryökäs E, Mustonen A-M (2015): Experiential thinking in creationism—a textual analysis. *PLoS ONE*, doi: 10.1371/journal.pone.0118314.
- III Nieminen P, Ryökäs E, Mustonen A-M (2014): Systematic analysis of creationist claims: source criticism, context, argumentation and experiential thinking. *European Journal of Science and Theology* 10, 4–26.
- IV Nieminen P, Mustonen A-M, Ryökäs E (2014): Theological implications of young earth creationism and intelligent design: emerging tendencies of scientism and agnosticism. *Theology and Science* 12, 260–284.

The articles are reprinted with the kind permission of Springer (I), Francis & Taylor (IV) and the Editor (Dr. Rusu) of the *European Journal of Science and Theology* (III). According to Creative Commons Attribution (CC BY) license, the authors retain ownership of the copyright of article II.

AUTHOR'S CONTRIBUTION

For all articles (I–IV), the candidate designed the study, collected and analyzed the sample material and prepared the first drafts of the manuscripts. The candidate conducted the statistical analyses for I–II and prepared the tables and figures for all publications and corresponded with the journal editors during the review processes.

— *Let's say hi to two books; one, the Bible, was written by Our Lord. The other, the Origin of Species was written by a cowardly drunk named Charles Darwin.*
— *This is slander. Darwin was one of the greatest minds of all time!*
— *Then, why is he making out with Satan?"*

~ *The Simpsons, Season 17, Episode 21, The Monkey Suit* ~

1 Introduction

Despite apparently serious contradictions between the worldviews of proponents of evolution and creationism, both emphasize the impartiality of scientific method to obtain and interpret evidence. Thus, in 1859, Charles Darwin—undoubtedly a proponent of evolutionary theory as proposed by him and Alfred Russel Wallace¹—wrote “A fair result can be obtained only by fully stating and balancing the facts and arguments on both sides of each question”². In a very similar manner, Tapio Puolimatka—in his religious opposition to evolutionary theory—remarked that “the comparison of different viewpoints and an open discussion between them is an integral part of the self-critical process of science”³. Both quotes contain a message that is crucial for the scientific method: to avoid one-sidedness, *i.e.*, confirmation bias⁴. Despite these conceptually quite similar statements regarding methods of unraveling the truth, there is obvious vehemence between religious and scientific worldviews.

According to Alister McGrath, the main issue causing religious opposition to scientific results derives from conceived contradictions between data from natural sciences and one’s interpretation of the Bible⁵. Although McGrath comments that it is an exaggeration to consider this as “warfare”⁶, the statements of individual scientists and religious authors do give an impression of reciprocal hostility. For example, Richard Dawkins, when defending naturalistic science, remarked that “It is absolutely safe to say that if you meet somebody who claims not to believe in evolution, that person is ignorant, stupid or insane (or wicked, but I’d rather not consider that)”⁷. The other side of the debate is no less hostile: “It is time to wake up. For 150 years people have been told fairytales and stories about their origins. The myth of evolution has destroyed the faith in the supremacy of God’s Word for millions of people”⁸.

¹ Wallace 1858.

² Darwin 1859, 2.

³ Puolimatka 2009, 111.

⁴ Nickerson 1998.

⁵ McGrath 2010, 12–25.

⁶ McGrath 2010, 9.

⁷ Dawkins 1989.

⁸ Reinikainen 2013c.

The above citations can be taken as examples of *i*) “conflict”, one of the models of interaction between science and religions proposed by McGrath⁹. This type of discourse is still common. According to a recent survey, 37% of Americans believe that “God created human beings in their present form” and 40% are in favor of “teaching creationism and intelligent design in schools”¹⁰. Although unconstitutional in the United States, this does actually take place¹¹. Other models include *ii*) “independence”—the assumption that science and religion deal with non-overlapping spheres of reality and have only little to say about one another. The model of *iii*) “dialogue”¹² is especially prevalent in the Catholic church, where science is seen as a tool to resist religious superstition and, on the other hand, religion could help science to avoid false absolutes¹³. The final model, *iv*) “integration”, attempts to avoid splitting the universe into spiritual and physical realities. The present thesis deals mainly with the model of conflict, its argumentation and characteristics of thinking in texts representing the conflict.

⁹ McGrath 2010, 45–50.

¹⁰ Hafiz 2013. These beliefs fit quite well within the views of young-earth creationism. For other countries, see Data360.org 2006.

¹¹ Moore 2000.

¹² See also Stephen J. Gould 1997 and his concept of “non-overlapping magisteria”. He emphasized that science and religion could be independent not only on a “diplomatic” level but also on moral and intellectual grounds. He suggested that if religion should not “dictate the nature of factual conclusions”, then science should not claim to hold any superior moral truth compared to that of spirituality.

¹³ John Paul II 1996; McGrath 2011, 47–48.

2 Review of the Literature

2.1 THE EVOLUTION–CREATIONISM DEBATE

2.1.1 History of the conflict between Christianity and science

The juxtaposition of religion and science did not begin with the publication of evolutionary theory by Darwin¹⁴ and Wallace¹⁵. During the formation of the church (first centuries CE), the conflict was recognized and addressed. Augustine of Hippo was very reserved about adapting scientific observations to Biblical writings¹⁶. Since the 17th century (regarding cosmology) and the 19th century (regarding evolution), the principal arguments between religion and science have concentrated on the interpretation of relatively few Old Testament (OT) passages¹⁷. In cosmology, the Copernican view of the solar system (the earth was no longer in the center of the universe) had an effect on the interpretation of the first chapter of Genesis by theologians. As a result, the literal interpretation—creation took place during a period of six 24-hour days—was gradually supplemented by an allegorical view of creation. Gradually, the model of accommodation also emerged. According to this model, revelation had been given to a certain time and culture and it was to be interpreted by taking into account its original audience. Jean Calvin assumed a pivotal role by emphasizing that the main theme of the Bible was its message about Christ: it was not a textbook on natural sciences.

In the 19th century, the emerging evolutionary theory (Table 1) again challenged the traditional Biblical worldview by suggesting that humans had developed gradually from other, more simple life forms. The specific points of conflict have been systematically discussed by McGrath. These issues derive from the latter half of the 19th century but they remain crucial issues of disagreement today¹⁸:

¹⁴ Darwin 1859.

¹⁵ Wallace 1858.

¹⁶ Augustine of Hippo ≈ 415, I, 19:39. *“Plerumque enim accidit ut aliquid de terra, de coelo, de caeteris mundi huius elementis, de motu et conversione vel etiam magnitudine et intervallis siderum, de certis defectibus solis ac lunae, de circuitibus annorum et temporum, de naturis animalium, fructicum, lapidum, atque huiusmodi caeteris, etiam non christianus ita noverit, ut certissima ratione vel experientia teneat. Turpe est autem nimis et perniciosum ac maxime cavendum, ut christianum de his rebus quasi secundum christianas Litteras loquentem, ita delirare audiat, ut, quemadmodum dicitur, toto coelo errare conspiciens, risum tenere vix possit. Et non tam molestum est, quod errans homo deridetur, sed quod auctores nostri ab eis qui foris sunt, talia sensisse creduntur, et cum magno eorum exitio de quorum salute satagimus, tamquam indocti reprehendantur atque respuuntur. Cum enim quemquam de numero Christianorum in ea re quam optime norunt, errare comprehenderit, et vanam sententiam suam de nostris Libris asserere; quo pacto illis Libris credituri sunt, de resurrectione mortuorum, et de spe vitae aeternae, regnoque coelorum, quando de his rebus quas iam experiri, vel indubitatis numeris percipere potuerunt, fallaciter putaverint esse conscriptos?”*

¹⁷ McGrath 2011, 20–21.

¹⁸ McGrath 2011, 37–41.

- The classical argument from design being a proof for the existence of God now had an alternative. This was answered at the time—and today—by proposing in a non-specific manner that evolution had been a tool for God in creation (theistic evolution, TE).
- Some protestant churches, especially in English-speaking countries, reacted to evolutionary theory by holding on to their literal interpretation of the Bible, particularly Genesis. This is still the stand of young-earth creationism (YEC). Others modified the Biblical concept of time (day, Hebrew “yom”) and interpreted one day of creation to be different from the timeframe of humans. Thus, the geological timeframe could be accommodated to the otherwise literal interpretation of Scripture. This is the strategy of present old-earth creationism (OEC) and many intelligent design (ID) proponents.
- Theological anthropology was the third crucial issue. Evolutionary theory challenged the concept of humans as the image of God. This is an issue that still is refuted by YEC, OEC and ID.

Creationism has been considered an American phenomenon, as its roots are in the fundamentalist movement that appeared in the United States in the late 1800s and early 1900s¹⁹. As *the Fundamentals*, the basic doctrine of fundamentalism was prepared, it included a response to evolutionary theory from the very beginning. Gradually the practice of judging science in relation to the Bible emerged with the literal interpretation of Genesis. Creationism became a reaction opposed to both evolution and Biblical scholarship, with major milestones during the Scopes trial²⁰ and renewed efforts in the 1960s–1970s when the Chicago Statement on Biblical Inerrancy²¹ was published by several conservative Christian denominations. At present, major creationist organizations are located in North America but creationism is far from being confined to the United States. Australia harbors major creationist organizations²² and during recent decades there has also been increased creationist activity in Europe²³. In Great Britain and Germany, creationism has been taught in a few schools, the Russian Orthodox Church and Ministry of Education have supported creationism and there is a “Creation Museum” in Sweden. Although creationism is not as widespread elsewhere as it is in the United States, the acceptance of evolutionary theory does not exceed 80% in any country. It has been suggested that due to the established national churches in many European countries, the meaning of religion has not been politicized as much as in North America. In addition, education and mass media are more controlled in Europe. Furthermore, the negative attitude of the Catholic Church towards creationism could be a contributory factor²⁴. The present study explores not only the widespread American creationism but also local Finnish creationism in this context: is it similar to the North American movement or more related to the European style creationism that does not disguise the beliefs as “scientific” (“creation science”). A timeline of the history of evolutionary and creationist thought is presented in Table 1.

¹⁹ Numbers 2006, 33–50.

²⁰ Moore 2000; Linder 2008; University of Minnesota Law Library 2013.

²¹ International Council on Biblical Inerrancy 1978.

²² Such as Creation Ministries International 2013.

²³ Blancke et al. 2013.

²⁴ Templeton Report 2009; Blancke et al. 2013.

2.1.2 Attitudes of the major Christian denominations to evolutionary theory

The Roman Catholic Church responded rapidly to the publication of *The origin of species* by Darwin. As early as in 1860, German bishops condemned the idea of evolution as “opposed to Scripture and to the Faith”²⁵. This took place in the Council of Cologne and provided the most explicit statement on evolution by the Catholic Church in the 1800s²⁶. By the turn of the century, however, the Vatican had *de facto* started to accommodate evolutionary theory into its doctrine. In 1894, some of the clergy in Vatican stated that the method of creation could be left to “human investigation” and that Genesis was “a tissue of metaphors”. The Holy Office initially condemned these views. This launched a vivid discussion, in which the view of Fr. Dominicelli became important. He pointed out that there was nothing in the Bible of “the manner in which animals and plants were made” and that “evolution is not contrary to tradition”. In fact, Augustine of Hippo had an idea of *rationes seminales*²⁷, which had similarities to modern evolutionary theory as noted also recently by McGrath²⁸.

Brian W. Harrison remarked that even the initial response of the Vatican to evolutionary theory was not one of straightforward condemnation²⁹. Human evolution was refuted but the concept of biological evolution *per se* in reference to other species was never unanimously condemned. Harrison goes as far as to suggest that it is not uncommon to hear a statement that “the Catholic Church ‘has never had a problem with evolution’”. Gradually, the model of accommodation emerged in the Catholic Church. In the 20th century, Pius XII noted in the encyclical *Humani generis* that there was not enough evidence to take a stand on evolution³⁰. By the end of the 20th century, this ambiguous opinion had changed dramatically, when John Paul II accepted evolutionary theory as “more than a hypothesis”. According to him, there was no conflict between evolutionary theory and doctrine if the most central issues of Christianity were not put aside. As a contradiction, he mentioned that the development of the human soul as a result of natural processes would be incompatible with faith³¹. Even more influential were the statements in *Communion and Stewardship*³². In this document, the geological age of the earth, the genetic relatedness of all organisms and the common descent of life forms were expressed in plain sentences in the indicative voice. Conflict was minimal, but the authors warned against

²⁵ Harrison 2001.

²⁶ Artigas et al. 2006. The Council concluded regarding evolutionary ideas as follows: “The first parents were created directly by God. Therefore, we declare as contrary to Sacred Scripture and to the faith the opinion of those who are not ashamed to assert that man, insofar as his body is concerned, came to be by a spontaneous change from imperfect nature to the most perfect and, in a continuous process, finally human.”

²⁷ “λόγοι σπερματικοί”; According to the concept, God created the world in “seed form” with potential for development and the observed development (\approx evolution) is the realization of these hidden potentials, McGrath 2010, 101–106.

²⁸ Or *rationes causales*; McGrath 2010, 101–106; Augustine of Hippo \approx 415, VI, 14.25. “*Quaeri autem merito potest, causales illae rationes, quas mundo indidit, cum primum simul omnia creavit, quomodo sint institutae: utrum ut, quemadmodum videmus cuncta nascentia vel fruticum vel animalium in suis conformationibus atque incrementis, sua pro diversitate generum diversa spatia peragerent temporum?*”

²⁹ Harrison 2001.

³⁰ Pius XII 1950.

³¹ John Paul II 1996.

³² International Theological Commission 2004.

using evolutionary theory as evidence for atheism. Recently, Benedict XVI expressed the accommodating view as follows³³:

I see in Germany, but also in the United States, a somewhat fierce debate raging between so-called “creationism” and evolutionism, presented as though they were mutually exclusive alternatives: those who believe in the Creator would not be able to conceive of evolution, and those who instead support evolution would have to exclude God. This antithesis is absurd because, on the one hand, there are so many scientific proofs in favour of evolution which appears to be a reality we can see and which enriches our knowledge of life and being as such.

During the 2009 *Science, Theology, and the Ontological Quest* congress organized by Pontifical Universities, catholic experts renounced ID by stating that “it’s not a scientific perspective, nor a theological or philosophical one”³⁴. In summary, the Catholic Church takes evolutionary theory as a well-proven scientific model on the development of life on the earth and totally accepts the geological age of our planet.

In stark contrast to the Catholic Church, many protestant denominations opposed and still oppose evolutionary theory vehemently. Especially in the USA, the reaction of fundamentalist Christians to modernization also includes refuting evolutionary theory³⁵. A central issue in the debate has been the inclusion of evolutionary theory into school curricula. In fact, until the 1950s evolutionary theory played only a minor role in science education in schools. However, the success of the Soviet Union in its space program alerted the U.S. Congress to the quality of science education. Thus, evolutionary theory entered school curricula in the 1960s, which coincided with the emergence of a new reaction opposing evolution: that of “scientific creationism”. In several court cases (such as in Arkansas and more recently in Kansas), the creationist side has lost in its attempts to either ban evolutionary theory from schools or to introduce YEC or ID in curricula. These attempts introduced the famous slogan “teach the controversy”³⁶, and the debate is ongoing. In addition to the USA, New Zealand kept evolutionary theory out of school curricula until 2010. In fact, in the 1993 curriculum, evolution could be mentioned only during the final, 13th school year. This changed abruptly in 2010, and at present evolutionary theory is an integral part of the science curriculum in New Zealand³⁷.

It must be emphasized that the negative outlook on evolution is far from being shared by all (US-based) protestant denominations. For instance, the Episcopal Church accepts evolution as “strongly supported”³⁸. The United Methodist Church agrees and states that “We

³³ Benedict XVI 2007.

³⁴ Templeton Report 2009.

³⁵ Scott 1997.

³⁶ The slogan was launched by ID proponents based on the claim that “...fairness and equal time requires educating students with a ‘critical analysis of evolution’”. While the idea has been condemned by the majority of biologists (as there is no actual controversy about evolution among them), Langen (2004) remarked that educating college students about the creationist–evolutionist debate would be helpful to understand the differences between the scientific method and other methods of acquiring data about nature.

³⁷ Campbell and Otrell-Cass 2011.

³⁸ Episcopal Church in the United States of America, the Committee on Science, Technology and Faith of the Executive Council 2005: “Biological evolution is a web of theories strongly supported by scientific observations and experiments. It fits in with what we know about the physical evolution of the universe, and has been confirmed by evidence gathered from the remains of extinct species and from the forms and

find that science's descriptions of cosmological, geological, and biological evolution are not in conflict with theology" ³⁹. The Seventh-day Adventists accept that there are divergent viewpoints among them on the interpretation of the first chapters of Genesis. This is, however, taken as a concern and the organization explicitly states that "We affirm the historic Seventh-day Adventist understanding of Genesis 1 that life on earth was created in six literal days and is of recent origin"⁴⁰. Among the Pentecostal movement there is also a wide range of views regarding evolution. However, there is also a tendency within the movement to accept these different views on the development of life⁴¹.

In Finland, scientists began to support evolutionary theory in the 1870s⁴². During the late 19th century, the educated part of the population became acquainted with evolutionary concepts and considered them to be contradictory to religion. Especially among the Swedish-speaking educated people, evolutionary theory gained support quickly. Archbishop Gustaf Johansson condemned the concept and remarked that it was "outside the Biblical faith" and considered it dangerous, leading to "apostasy and false misanthropy against the eternal rule of God"⁴³. Gradually, the accommodating strategy became prevalent. At present, the Evangelical Lutheran Church of Finland accepts the concept of evolution as a theory that is supported by strong evidence.

...although Darwin's theory on the mechanisms of evolution has been rectified, his idea on the development of species has not been scientifically questioned on a large scale... The Lutheran Church does not consider that evolutionary theory as a scientific model would be in contradiction with Faith in creation. Faith in creation is a holistic interpretation of the miracle of life and its appearance. Evolutionary theory is a scientific model on the development of species that is considered correct⁴⁴.

Although the organization of the Evangelical Lutheran Church of Finland is accommodating in its relation to evolutionary theory, influential revivalist movements in Finland have very variable views on evolution, including proponents of YEC and ID. Although there are (Lutheran or revivalist) movements that aim to promote creationism, the official information sites of the

environments of living species." The Episcopal view is generally shared by other churches of the Anglican denomination.

³⁹ United Methodist Church 2008.

⁴⁰ International Faith & Science Conferences 2002-2004 Organizing Committee 2004.

⁴¹ Badger and Tenneson 2010; Tenneson and Badger 2010: "In conclusion, we find conservative, Bible-believing, Pentecostal Christians (including Assemblies of God adherents) in all three theistic camps (YEC, OEC, EC [\approx TE]). With this in mind, we think our attitude needs to reflect the Reformation 'Peace Statement' (often erroneously attributed to St. Augustine): 'In essentials, unity. In nonessentials, liberty. In all things, love.'" The self-reported position of Pentecostal believers within the creationist - evolutionist debate in 2008 (N = 70) was as follows: OEC 38.6%, evolutionary creationism (\approx TE) 25.7% and YEC 24.3% (Badger and Tenneson 2010).

⁴² Murtorinne 1992, 299-340.

⁴³ Murtorinne 1992, 337.

⁴⁴ Evangelical Lutheran Church of Finland 2013: "Luterilainen kirkko ei katso evoluutioteorian luonnontieteellisenä selitysmallina olevan ristiriidassa luomisuskon kanssa. Luomisusko on kokonaisvaltainen uskonnollinen tulkinta elämän ihmeestä ja sen synnystä. Evoluutioteoria on totena pidetty luonnontieteellinen selitysmalli lajien kehittämisestä."

organizations are relatively cautious in their comments on evolution. For instance, The Lutheran Evangelical Association of Finland has a position that could be regarded as being located between ID and TE:

When did humans become living souls? Apparently the Bible does not contradict the clear results of plant and animal breeding that testify in favor of evolutionary theory. But the Bible is opposed to the assumption by proponents of evolutionary theory that the road to humans would have been similar to other beings⁴⁵.

A more accommodating view of the same revivalist organization states that “as Christians we cannot place boundaries to scientists regarding what and how they do their research. But nor do we accept to take any directions from them to our faith and teaching”⁴⁶. This fits the model of independence of science and religion⁴⁷. In stark contrast to this, particular independent Lutheran denominations in Finland are strong proponents of YEC. The Union of Independent Evangelical Lutheran Congregations in Finland (Suomen evankelisluterilainen seurakuntaliitto) considers modern scientific cosmology and evolutionary theory to be “the work of the Devil”⁴⁸. This view (YEC) is shared by the Confessional Lutheran Church of Finland⁴⁹ and by a conservative spin-off organization of the Evangelical Lutheran Church of Finland, the Luther Foundation in Finland⁵⁰.

Other Lutheran Churches of Central and Northern Europe share the view of the Finnish Church of accommodation of evolutionary theory to Christian doctrine with an outlook that basically represents TE and does not state in detail how the divinity would have participated in the process of emergence and diversification of life. Examples of this are the Swedish and German Lutheran Churches. The statements on evolutionary theory by the Swedish Church are rather similar to those of the Finnish Church⁵¹. In the Evangelical Lutheran Church of Iceland, the clergy has even taken up the specific question of theological anthropology and the descent of humans from primates: “... reason and faith are not opposites but two aspects of human nature that both merit to flourish and prosper... The Church welcomes the thriving of free thinking... Humans and apes have a common ancestor considered

⁴⁵ Anon 2011.

⁴⁶ Kiviranta 2011.

⁴⁷ McGrath 2011, 45–50.

⁴⁸ Salo 2012.

⁴⁹ Särelä 2012: “It is emphasized that God created everything ‘according to its kind’... Satan has attacked and still attacks against this word of God in indiscriminant frenzy... Although there is a particular order in creation, it does not occur from one species into another in an evolutionary manner.”

⁵⁰ Hardt 2002. The text is a translation of the Swedish original (1980) and published in the series “Morning Star” (Aamutähti). According to the Foundation, the series aims to “...serve in the propagation of the Gospel and to serve all confessional Lutherans in the restoration of our church” (“... palvelemaan evankeliumin levittämisessä, sekä kaikkien tunnustuskirkollisten luterilaisten palvelemisessä kirkkomme jälleenrakennustyössä”). The position is not quite as exclusively creationist as Särelä (2012) but refers to the six-day creation and Noah’s flood as more likely compared to evolutionary theory.

⁵¹ Church of Sweden 2005; Öjermo 2008: “Intelligent design är verkligen en icke-fråga för de flesta som tillhör Svenska kyrkan. De skapelseberättelser som finns i Bibeln (det finns flera stycken!) är myter som lovprisar Gud som skaparen. Hur skapelseverket gått till sysslar astronomer och andra att reda ut. Att tro på Gud och veta med vetenskapliga mått mätt är inget motsatspar.”

by many to have lived about 15 million years ago⁵². Acceptance of evolution can be said to be perhaps the fullest in Germany, where the Evangelical Church is strictly opposed to creationism, which it takes to be “a perversion of science” and ID a form of “pseudoscience”⁵³.

The (Russian) Orthodox Church is divided in its approach to evolutionary theory. Those of the compatibilist approach more or less accept evolutionary theory as a well-proven scientific fact⁵⁴. “Should modern science be able to prove without the shadow of a doubt that man evolved from amoeba, reptiles, animal life into what he is today, Orthodox theology would be able to make the transitional acceptance far more readily than Western theology...” In a similar manner, the Orthodox Church in America considers evolution to be a valid scientific theory while maintaining that humans are the outcome of divine creation⁵⁵. However, within the (Russian) Orthodox Church there are also many of the dualist notion, who see that science and faith can be incompatible. Evolutionary theory is considered to be heretical, pseudoscientific and something that a person who considers herself to be an orthodox should not accept⁵⁶.

Taken together, most Christian denominations have an accommodating view on evolutionary theory (TE). Some major churches have also practically condemned creationism (mostly YEC and ID) as pseudoscientific; examples of these are the Roman Catholic Church and the German Evangelical Church. Opposition to evolutionary theory is probably the strongest in certain protestant denominations but the Russian Orthodox Church is also divided regarding this issue.

Within the major denominations, there are also (revivalist) movements and organizations that deny the general acceptance of evolution by their respective churches and

⁵² Skúli Sigurður Ólafsson (The Evangelical Church of Iceland) 2005: “Í þeirri kirkjudeild sem Þjóðkirkjan íslenska tilheyrir hefur löngum verið litið svo á að skynsemi og trú séu ekki andstæður heldur tveir þættir í mannlegu eðli sem þurfa hvor tveggja að njóta sín og blómstra... Þess vegna hefur kirkjan ekki kosið að berjast gegn frangangi vísindanna, öðru nær. Kirkjan fagnar því þegar frjáls hugsun fær að dafna... Menn eru víst ekki komnir af öpum í þeim skilningi að núlifandi apar séu forfeður mannsins. Menn og apar eiga sér hins vegar sameiginlegan forföður sem talinn er hafa verið uppi fyrir um 15 milljónum ára.”

⁵³ Evangelical Church in Germany 2008: “Der Kreationismus ist vielmehr eine Verkehrung des Glaubens an den Schöpfer in eine Form der Welterklärung, die letztlich dazu führt, dass das Bündnis von Glaube und Vernunft aufgekündigt wird.” “Das aus dem Kreationismus entwickelte Konzept eines ‘Intelligenten Design’, wonach die Welt das Produkt eines intelligenten Weltentwerfers sei, wird in dem EKD-Text als pseudowissenschaftlich bewertet. Vor den Prüfkriterien strenger Wissenschaft hätten solche Hypothesen keinen Bestand.”

⁵⁴ Kuraev 2001; Nicozisin 2013.

⁵⁵ Orthodox Church in America 2014.

⁵⁶ Sysoyev 2009: “Понятно, что никто из тех, хоть формально считает себя православным не может согласиться с теорией эволюции в ее атеистической форме. Но почему-то некоторые, замороженные наукообразной мифологией считают, что эволюция - это факт, и потому пытаются механическим образом совместить ее с христианством.” “Но что безусловно является ересью, так это учение о том, что смерть не через человека, что тление не от Адама, что Адам создан не из праха земного, что он не является конкретной личностью, что первородного греха никогда не происходило, что мир многократно исчезал и восстанавливался, что мир вечен. Все эти учения полностью исключают Жертву Христову.”

have adopted the YEC or ID worldview. The present study concentrated on the writings of these organizations and authors promoting YEC and ID/OEC. TE is not discussed in detail⁵⁷.

Regarding other major religions, the reception of evolution in the Islamic community has been mixed. Evolutionary theory is taught in school biology curricula in major Muslim countries, such as Egypt, Iran, Morocco, Pakistan, Turkey and Tunisia⁵⁸. However, human evolution is only rarely included. It has been suggested that the Quran is ambiguous when it comes to the creation of life, including the creation of life from water and clay. At present, Islamic creationism is emerging in Europe in a form that could mostly represent OEC⁵⁹, whereas YEC is virtually absent⁶⁰. The emergence of Muslim creationism is suggested to be a response to western secularization: evolutionary theory is considered a prime reason for this and is associated with racism and eugenics⁶¹. However, the Islamic community is no less uniform in its reaction to evolutionary theory than the Christian one.

2.2 MODERN EVOLUTIONARY THEORY

2.2.1 The concept of evolution

Biological evolution is a change in the hereditary material in a population during the course of time⁶². As a result of evolution, the proportions of particular genes in a population change. Genes can change, disappear or be multiplied into several copies. Eventually, this can have effects on the individuals of the population by modifications in their appearance or other characteristics. The general timeline of the development of evolutionary theory can be seen in Table 1. The core of the original evolutionary theory by Darwin can be summarized as follows⁶³:

- Species change.
- Natural selection is a principal factor in the change.
- All present species have common descent.

⁵⁷ Whereas TE uses arguments from natural sciences in support of its arguments (*e.g.*, McGrath 2010 and the “fine-tuning” argument), it differs from YEC and ID in that it does not dismiss scientific results or their interpretation but generally accepts them as reliable. This is very different from YEC which, for example, claims that all radiometric dating is flawed (Reinikainen 1991). ID, on the other hand, twists complex phenomena, such as genetic differences between taxa, by dismissing crucial parts of the data (Davis and Kenyon 1993). As the present study concentrated on the conflict model (McGrath 2011), TE was thus excluded, although it would certainly offer an interesting study target in its own right.

⁵⁸ Hameed 2014.

⁵⁹ Yahya 2006. The author is a Turkish Islamic OEC proponent, who argues against evolution mainly by presenting pictorial material of life forms that are relatively similar in fossil form compared to modern forms and takes this as proof that no evolution has occurred. Yahya also frequently uses the straw man argument by claiming that evolutionary theory would predict chimeric forms, such as animals with components from, *e.g.*, bears and whales or reptiles and squirrels.

⁶⁰ Hameed 2014.

⁶¹ Blancke et al. 2013; Hameed 2014.

⁶² Purves et al. 2004, 443–463. A population consists of individuals of the same biological species living in a particular geographic area at the same time.

⁶³ *E.g.*, Mayr 2003; Purves et al. 2004. Although selection is of importance, migration and chance can also cause changes in allele frequencies.

- The number of species (*i.e.*, biodiversity) has increased over time.
- The changes have been gradual.

More specifically, evolution requires genetic variation within the population. This is expressed in the Hardy–Weinberg principle as follows: allele and genotype frequencies in a population remain constant from one generation to another in the absence of evolutionary influences. This means that evolution is a (permanent) deviation from the Hardy–Weinberg equilibrium⁶⁴. This also means that the adaptation of an individual to the environment is not evolution: evolution takes place in a population.

The forces that permanently change the allele frequencies, *i.e.*, the Hardy–Weinberg equilibrium, are the forces that cause and maintain biological evolution. *Mutations* provide the genetic variation that is a prerequisite for evolution. It has been estimated that all humans have at least six new mutations. While this may seem scanty, the human species as a whole would thus carry approximately 42 billion new mutations that would not have been present in the previous generation⁶⁵.

Gene flow is the transfer of genetic material between populations. For the most part, populations of the same species are not totally isolated from each other; both individual organisms (especially animals) and/or their gametes (animals, plants and fungi) or seeds (plants) can migrate. This can provide a population with new alleles and change the allele frequencies. As the Hardy–Weinberg balance requires a closed population, genetic flow is a significant factor in evolution⁶⁶.

Genetic drift is targeted especially at small populations. If the number of individual organisms in a population decreases drastically, the population experiences the bottleneck effect. As a result, the population can lose a large part of its genetic variation⁶⁷. A similar phenomenon occurs during the founder effect, when a small part of a large population becomes isolated and, thus, represents the founders of a new population with low genetic variability⁶⁸.

⁶⁴ Purves et al. 2004, 463–470. The Hardy–Weinberg equation can be expressed as follows: with two alleles (\approx forms of the same gene on homologous chromosomes; p and q) $p^2+2pq+q^2=1$, when $p+q=1$. The requirements are as follows: the population is diploid, only sexual reproduction is present, mating is random, generations do not overlap, the population is infinitely large in size, the allele frequencies are equal in both sexes, there is no migration, there is no mutation and there is no selection. Thus, in the real world, there are indeed many factors that cause deviations from the Hardy–Weinberg equilibrium.

⁶⁵ Purves et al. 2004, 463–470.

⁶⁶ Purves et al. 2004, 468.

⁶⁷ The bottleneck effect has potential ramifications in creationist theory, especially YEC. According to YEC, all terrestrial animal populations were decimated to two individuals during the global flood (except humans with eight individuals), which would have caused a tremendous bottleneck effect.

⁶⁸ Purves et al. 2004, 468–469.

Table 1. Timeline on the history of evolutionary theory and creationism.

Year	Evolutionary concepts	Creationist concepts
≈ 580 BCE	Anaximander of Miletus: Animals appeared first in water; humans are children of a different type of animal.	
≈ 400–300 BCE	Epicurus: Many species derived from Gaia but only the most successful have survived.	Plato and Aristotle: Species (also geological, etc.) are fixed, essentialism.
≈ 59 BCE	Lucretius (<i>De rerum natura</i> ¹): Propagated the epicurean view of nature. "Nature is free from the jurisdiction of gods."	
≈ 415 CE	Augustine of Hippo: <i>Rationes seminales</i> , animals were not created perfect but in a state of potentiality.	
1377	Ibn Khaldun: Humans developed from a world of monkeys and species have become more numerous ² .	Medieval Christianity: Perfect universe with a fixed hierarchy of beings from lower to higher (humans). No species could move within this hierarchy.
17–18 th century	Maupertuis: Reproduction entails modifications which can accumulate, producing new races and species. Cuvier: Fossils represent forms that have become extinct.	Newton and Descartes: Nature (universe) as a perfect machine.
18 th century	Linné and the classification of life forms nomenclature. The system has been applied by both evolutionary and creationist proponents.	according to the (modern) scientific
1802		Paley: Natural theology and design argument with the influential watchmaker analogy.
1809	Lamarck: <i>Philosophie Zoologique</i> . Transmutation of species, inheritance of acquired characteristics.	
1830–1833	Lyell: Principles of geology. Earth has existed for millions of years.	Lyell was also a believer in the immutability of living species.
1844	Chambers: Vestiges of the natural history of creation. Fossil record as evidence for transmutations and progressive ascent to humanity.	Continuation of design argument and condemnation of especially the possible descent of humans from other species.
1859	Theory of evolution and natural selection by Darwin and Wallace.	
1900–1910	Mendel: Laws of inheritance.	Principles of inerrancy in the Bible established (fundamentalism).
1920s		Scopes trial in Tennessee in 1925: Prohibition to teach evolution.
1950s	Watson and Crick: Discovery of DNA and its significance in heredity.	Lysenkoism in the Soviet Union, inheritance of acquired characteristics considered suitable for the Stalinist view on anthropology.
1960s–70s	Debates on gradualism vs. punctuated equilibrium.	Scientific creationism, Chicago Statement on Biblical Inerrancy.
1990s	Several important transitional fossil chains discovered (e.g., dinosaur–bird-transition, whale fossils, Burgess Shale and origin of Cambrian phyla).	Intelligent design movement and re-appearance of the design argument by Paley.
21 st century	Comparison of DNA sequences to data derived from morphology and the fossil record allowing the design of more accurate phylogenetic trees. Testing hypotheses based on, e.g., fossils with methods of molecular biology. Epigenetics.	Continuing advocacy of both young-earth creationism and intelligent design. Creationist museums and universities in the United States.

Selected references: Kirk et al. 1983; Johnston 1999; Bowler 2003; Larson 2004; McGrath 2010.

¹Lucretius 59 (Liber II, verses 1090–1092): "Quae bene cognita si teneas, natura videtur libera continuo, dominis privata superbis, ipsa sua per se sponte omnia dis agere expers (Which well perceived if thou hold Then Nature, delivered from every haughty lord, And forthwith free, is seen to do all things Herself and through herself of own accord, Rid of all gods)". <http://www.thelatinlibrary.com/lucretius.html>.

²Ibn Khaldun *Muqaddimah* (1377), Chapter I:6.

Sexual selection changes the Hardy–Weinberg equilibrium by violating the rule of random mating⁶⁹. In addition to increasing the number of homozygotes in a population, sexual reproduction also provides, similar to mutations, increased genetic variability by recombination⁷⁰. Sexual selection can produce impressive and flamboyant biological structures, such as the peacock’s tail.

For instance, genetic drift and bottlenecks can reduce the amount of genetic variability in a population⁷¹. One crucial factor in the maintenance of variability is sexual reproduction with recombination and the subsequent production of new genetic combinations. As a result, even siblings can be genetically quite very different. This increases the probability that at least one of the offspring of a mated pair would be adapted to its environment well enough to be able to reproduce itself⁷².

The above-mentioned phenomena produce changes in the genes and allele frequencies of populations. *Natural selection* is ultimately the force that leads to adaptation. Due to genetic variability, there is also character variation. Based on this, the population contains individuals that are better adapted to the prevailing environment (also including other organisms in the ecosystem). These individuals can produce more offspring and, thus, their alleles can become more common⁷³. The result is increased adaptation of the population to its biotic and abiotic environment⁷⁴.

Natural selection acts on characters of the individuals in a population⁷⁵. This results in variation of these characters in several possible manners. *Stabilizing selection* occurs when the individuals representing extremes regarding a character or a combination of them in the population have the least offspring. Thus, average individuals are favored. *Directional selection* favors individuals that represent characters diverging from the average of a population in a certain direction. In *disruptive selection* individuals with average characteristics have the least offspring. This type of selection is assumed to be rare.

Speciation occurs when one species splits into two daughter species that continue as distinct lineages or when a single population becomes a new species without splitting. The pivotal phase in speciation is the separation of a single gene pool into two or more isolated ones. In these newly-isolated gene pools, the above-mentioned phenomena can change allele frequencies. Directional or disruptive selection can cause the characteristics of the now isolated populations to become increasingly different from one another. Eventually, the genetic difference between the daughter populations can become so extensive that they can no longer exchange genes even if they were to come together. At this point, two new species have

⁶⁹ Purves et al. 2004, 469–470. Obviously, mating is not random in the animal kingdom, as different types of mating rituals make it a non-random event. In the plant kingdom, self-fertilization is an important factor causing non-random mating.

⁷⁰ Mayr 2003, 165–168. Recombination or crossing-over signifies the exchange of genetic material between maternal and paternal chromosomes during the formation of gametes.

⁷¹ This aspect is also crucial for the YEC case. YEC claims that new genetic material cannot be formed and/or that mutations eventually accumulate and make populations unviable.

⁷² Purves et al. 2004, 476.

⁷³ Purves et al. 2004, 470–472.

⁷⁴ Purves et al. 2004, 470.

⁷⁵ Purves et al. 2004, 470.

formed⁷⁶. *Allopatric speciation* occurs when the daughter populations are geographically isolated, such as when a small population is accidentally stranded on an island. *Sympatric speciation that occurs without geographical isolation* generally occurs in plants due to the multiplication of their chromosome number (polyploidy)⁷⁷. The formation of two species from a common ancestral population is not a process that would have a clear dividing point in time. On the contrary, many species can form hybrids, especially in geographical zones that contain populations of both daughter species.

2.2.2 Evidence for biological evolution and its potential falsification

As one of the main concepts of evolution is the diversification of life forms into novel species, observations of new species emerging provide strong evidence for biological evolution. In the plant kingdom, multiplication of the chromosome number (polyploidy⁷⁸) has produced several new species that are in reproductive isolation from their ancestors⁷⁹. In fact, this type of speciation is also accepted by YEC and ID but they claim that the above-mentioned speciation events are all “within kind” and that no transition “between kinds” has been observed⁸⁰. However, an example of a single-celled life form evolving from a multicellular species (“between kinds” also according to YEC doctrine) is available. *Helacyton gartleri* is an amoeboid life form that has spread without conscious effort to many cell culture laboratories around the world⁸¹. It derives from human cancer, has a chromosome number divergent from that of its ancestral species and reproduces by cell division.

Evidence for selection has been obtained from laboratory experiments at, for example, the Michigan State University. Since 1988, scientists have followed an initially genetically homogenous *Escherichia coli* strain that was divided into 12 populations and subjected to various environments and challenges. The bacteria have been reared for >50,000 generations and the researchers have observed them to be able to utilize novel food sources and to experience morphological changes (increase in size)⁸². The researchers have estimated that of hundreds of millions of mutations that have taken place, 10–12 have become fixed/population. Other notable laboratory experiments include a study on the evolution of multicellularity in yeast⁸³. By choosing the cells most prone to forming aggregates for a few hundred generations, the unicellular yeast culture began to exhibit signs of multicellularity, including reproduction by budding instead of cell division and spontaneous death of the cells at the point of separation.

⁷⁶ Purves et al. 2004, 481–487.

⁷⁷ Purves et al. 2004, 486.

⁷⁸ In plants, hybridization can be connected to polyploidy. The phenomenon is called *allopolyploidy*. An example is the cultivated grain triticale, which is a hybrid of wheat and rye (Tikhnenko et al. 2003).

⁷⁹ Boxhorn 1995. Examples of these plant families include *Oenothera*, *Primula* and *Brassica*.

⁸⁰ E.g., Reinikainen 1991, 137–139.

⁸¹ Lucey et al. 2009. The species originates from a cell culture of Henrietta Lacks (1920–1951). Her cervical cancer cells that are used in experiments worldwide were obtained by samples (without permission) during her fatal illness and formed the “immortal” HeLa cell line. Only in 2013 was the dispute over the cells settled with the Lacks family (Callaway 2013).

⁸² Blount et al. 2008; Philippe et al. 2009.

⁸³ Ratcliff et al. 2011.

The fossil record also provides evidence for biological evolution. Transitional fossils are remains of life forms that have characteristics of two taxonomically different organismal forms⁸⁴. These types of fossils were also considered important by Darwin to obtain proof for his theory⁸⁵. Transitional fossils can be observed between different taxonomical ranks. Fossils that link different animal phyla (basic body plans) together include transitional forms between annelids (segmented worms), mollusks, brachiopods (lamp shells), priapulids (penis worms), arthropods and lobopods (velvet worms)⁸⁶. In the plant kingdom, similar observations between pteridophytes (ferns; reproduction via spores) and conifers are available in the fossil record⁸⁷. Regarding transitions between vertebrate classes, there are several fossils linking aquatic vertebrates to amphibians⁸⁸, reptiles to mammals via synapsids (mammal-like reptiles)⁸⁹ and dinosaurs to birds⁹⁰. Within the class of mammals, the evolutionary path of cetaceans (whales) has been unraveled during the last few decades⁹¹. At the level of individual species, the classic examples include the evolution of the horse⁹² and of the giraffe⁹³. Recently, fossil evidence for the radical change in body form in the evolution of flatfish (Pleuronectiformes) has been discovered and analyzed⁹⁴.

Molecular evidence for evolution includes the comparison of deoxyribonucleic acid (DNA) sequences across taxa and comparing these to the morphological data derived from living species and fossils. For example, the initially morphological connection of whales to artiodactyls was based on fossil data. However, the comparison of genetic material provides independent evidence of this and, as a result, whales are being re-classified as belonging to the same order (Cetartiodactyla) as, *e.g.*, ruminants, pigs and hippopotamuses⁹⁵.

Potential falsification of evolutionary theory is considered crucial in order to make the theory “scientific”. YEC and ID authors have suggested that evolutionary theory would not be easily or at all subjected to falsification, which would make it a question of faith, *i.e.*, evolutionary theory would become a religion⁹⁶. Karl Popper, who had previously described evolutionary theory as difficult to test and “almost tautological”, eventually accepted the

⁸⁴ Strickberger 1996, 48–49. For examples of these forms that are not only between species but between orders or phyla, see Conway Morris 1998; Paps et al. 2008, 2009.

⁸⁵ Darwin 1859, 264–265.

⁸⁶ Conway Morris 1998, 100–106, 128–134; Liu et al. 2006, 2008.

⁸⁷ Purves et al. 2004, 588–594.

⁸⁸ Zhang et al. 2010.

⁸⁹ Synapsids were “mammal-like reptiles” and the principal taxon of large land vertebrates during the Permian and Triassic periods (Meng et al. 2011); the molecular regulation of the transition between reptiles and mammals is also being unraveled regarding the formation of jaw bones and their transformation into middle ear ossicles (Takechi and Kuratani 2010). The evidence is routinely dismissed in creationist writings, such as by Woodmorappe (2001).

⁹⁰ Bakker 1986, 298–322; Chiappe 2009; Xu and Guo 2009; Foth 2012. Creationist dismissals by, *e.g.*, Doyle 2007.

⁹¹ Thewissen and Bajpai 2001; Thewissen et al. 2007; Gingerich et al. 2009.

⁹² Strickberger 1996, 429.

⁹³ Mitchell and Skinner 2003.

⁹⁴ Friedman 2008. The study analyzes very well preserved fossils showing the gradual migration of the flatfish eye to the present position of both eyes on only one side of the head.

⁹⁵ Milinkovitch et al. 1993. Not only are whales classified with the artiodactyls. They are deeply embedded within the order and cannot be considered to be an outgroup.

⁹⁶ *E.g.*, Morris 2001; Puolimatka 2009, 139–142.

concept of natural selection as logical and testable⁹⁷. In particular, Popper emphasized that “the chancelike character of mutations... can, by selection, have a downward effect on concrete living organisms—an effect that can be amplified by a long sequence of generations linked by heredity”. Thus, selection can ultimately derive from random events “*without being random in its turn* [original emphasis]”. However, Bertram Murray partly disagrees and claims that theoretical biology would not be scientific, as it differs from, *e.g.*, physics in a crucial respect⁹⁸. According to him, biologists test their theories by verification of hypotheses, whereas physicists test explanatory hypotheses by falsification. Murray calls for a unifying biological theory that would predict a range of facts. Although Murray claims that in its present state (written in 2001), theoretical biology is not scientific, he simultaneously suggests a form of unifying theory that would overcome the dilemma.

Anomalies in the fossil record, such as finding fossils of apparently modern organisms in Precambrian rocks, have been suggested as examples of potential falsification of evolutionary theory⁹⁹. Although this would certainly require re-interpretation of the theory, it has been stated that evolutionary theory is not dependent on the fossil record: it was formulated without the present knowledge of fossils and it would stand without them supported by the evidence of present life forms and genetic data. However, the hereditary character and change that are inherent in evolutionary theory provide the potential basis for its falsification. Some specific points are as follows¹⁰⁰:

- Mutations would not occur.
- Mutations would not be passed to subsequent generations.
- Mutations would not produce any changes in the phenotype.
- There would not be differences in the reproductive success of individuals of the same species in nature.

Obviously, repeated and carefully monitored occurrences of proven separate creation would also yield robust evidence against biological evolution and for creationism.

2.2.3 Common misconceptions about evolutionary theory

The way evolutionary theory is comprehended by evolutionary biologists differs significantly from that of laymen and even biology students¹⁰¹. There are, in fact, several common misconceptions of evolutionary theory that appear frequently not only in creationist writings

⁹⁷ Popper 1978.

⁹⁸ Murray 2001. Murray suggests three laws of evolution to be tested. “1. Genotypes and phenotypes with the greatest Malthusian parameter increase more rapidly than those with smaller Malthusian parameters. 2. In the absence of changes in selection factors, a population will reach and remain in an evolutionary steady state. 3. Selection favours those females that lay eggs or bear as few young as are consistent with replacement because they have the highest probability of surviving to breed again, their young have the highest probability of surviving to breed, or both.”

⁹⁹ RationalWiki 2013a.

¹⁰⁰ RationalWiki 2013a.

¹⁰¹ Alters and Nelson 2002.

but also in other media. In addition, (higher) education does not necessarily make a difference, as biology majors and non-majors hold practically similar views and misconceptions about evolution. In the 21st century, 35% of college graduates in the USA held the view that “humans and dinosaurs lived at the same time” and 42% did not accept the concept of humans developing from other species. Brian J. Alters and Craig E. Nelson have listed the derivation of some of the most important misconceptions regarding evolution but also other academic subjects as follows:

- *Misconceptions from everyday experience* (such as mutations being always detrimental) hindered understanding.
- Pupils were eager to accommodate new knowledge into the framework of *old misconceptions*, such as assuming evolution to be teleological—progressive and targeted at specific goals.
- *Taught misconceptions* derived from, e.g., parents or previous teachers.
- *Vernacular misconceptions* (equivocations in argumentation theory) were caused by the use of specific words in different manners in everyday life *vs.* science, for example, when referring to evolution as only “a theory”.
- *Religious misconceptions* included denial of common descent or the geological age of the earth.
- College graduates failed to understand that evolution does not imply change in the characteristics of individuals but in the proportion of individuals with a certain characteristic in the population.

Mark Isaak has listed some specific points that are often used as “evidence” against evolution¹⁰².

- There are no observations of evolution taking place.
- Evolution violates the second law of thermodynamics.
- There are no transitional fossils.
- Only chance is held responsible for the origin and development of life.
- Evolution is only a theory.

In addition to these common misconceptions and claims, some additional misconceptions have been observed as follows¹⁰³:

- Popularized writings about evolutionary theory are interpreted as actual state-of-the-art science. Evolutionary opponents often discuss and attempt to refute evolutionary writings in book format, although the major part of scientific research is published in journal articles.

¹⁰² Isaak 2003. For example, regarding the second law of thermodynamics, it is stated that entropy increases in a closed system. However, the earth is not a closed system, as the sun provides external energy. The concept of “a theory” is also present in the list of misconceptions by Alters and Nelson (2002). The claims contain also fallacies: *ad ignorantiam* (“no observations”, “no transitional fossils”), straw man (“only chance”) and equivocation (“theory”).

¹⁰³ Nieminen 2012.

- Most evolutionary critics equate evolution with the development of animal forms and disregard plants, fungi and microbial life. This leads to oversimplifications, for instance, regarding the Cambrian explosion with many novel animal (but not plant) forms appearing in the fossil record¹⁰⁴.
- Transitional forms are understood as being intermediate between modern species or between higher taxa. Instead, transitional forms are intermediate to the ancestors of the present species. Sometimes they can be represented by actual fossils; sometimes they are hypothetical.

Regarding argumentation, oversimplification or misunderstanding of evolution can lead to fallacious arguments, which is analyzed further in this thesis and in the original publications I–IV.

2.3 THE CREATIONIST WORLDVIEW

2.3.1 Young-earth creationism

YEC is a worldview based on literal interpretation of the Bible, especially Genesis in the OT. YEC proponents support the notion that the six days of creation were of the same duration as the 24-hour days of the present world and that the sequence and appearance of life forms occurred precisely in the order depicted in Genesis 1¹⁰⁵. The Fall and banishment from Eden were—according to YEC proponents—factual history experienced by the first human couple. In addition, the global flood (Noah’s flood) was an actual historical event that took place exactly as described in Genesis including the fact that all terrestrial and avian animal populations were decimated to one breeding pair¹⁰⁶. YEC proponents oppose scientists as well as OEC and ID advocates for accepting the geological age of the earth¹⁰⁷.

YEC proponents also consider the historicity of Genesis as theologically pivotal. They claim that without literal creation and literal Fall there would be no need for redemption and salvation¹⁰⁸. This would undermine the significance of Christ. Regarding the accuracy of the Biblical narrative, YEC proponents claim that any proven error in the Bible would make it

¹⁰⁴ Creationists often cite Gould (1989), in which many Cambrian fossils were (erroneously) classified as belonging to novel, later extinct phyla. Conway Morris (1998) provided an easily approachable update to Gould’s theory. Parker (2003) included several theories regarding the causes of the Cambrian explosion.

¹⁰⁵ AiG 2012.

¹⁰⁶ AiG 2012. According to the YEC model, present species descend from these original pairs that represent the Biblical “kinds” or “baramins” (Parker 1994a; Frair 2000). There have been ambitious attempts to classify modern animals into these “kinds” (Lightner 2009, 2011, 2012; Sarfati 2013a) and to establish historical timelines for Noah’s flood (Wright 2012). These have given birth to the YEC (and ID) doctrine of “new species” being able to develop but no “new kinds” (Sarfati 2013b). The classification by “kind” often but not always coincides with the families of modern taxonomy (Wilson and Reeder 2005). The method of “baraminology” has been tested in science (with dinosaur taxonomy) and it yields results that are incompatible with the possibility of 8 dinosaur forms (Senter 2011) diversifying into the hundreds of known forms (Anon 2013) in the few millennia available according to the YEC theory.

¹⁰⁷ E.g., Stambaugh 1996; AiG 2012; CMI 2013.

¹⁰⁸ Shackelford 1997.

unreliable as a whole. It is not explicitly stated whether faith in the YEC interpretation of the literalness of the Bible is a prerequisite for salvation¹⁰⁹ as YEC sources are in this respect contradictory, but some authors regard it as inconsistent for a Christian to believe in evolution¹¹⁰.

The strategy of how YEC theorists attempt to prove their doctrine includes re-interpretation of scientific data to show that evolutionary theory is not objectionable only based on religion, but also flawed as science¹¹¹. The proof of this requires that evidence regarding the age of the earth as older than approximately 6000 years must be demonstrated false by YEC theorists. Examples of this include geological claims¹¹², astronomical data regarding the age of the universe¹¹³ and biological claims for the age of, *e.g.*, fossil remains¹¹⁴. YEC proponents have attempted, for example, to prove in a feasible manner that geological formations, such as the Grand Canyon¹¹⁵ or oil deposits¹¹⁶, could have formed very rapidly during the last millennia. They have claimed that dinosaurs and humans co-existed by utilizing scientific articles¹¹⁷, petroglyphs¹¹⁸ and interpretations of the Bible¹¹⁹. The possibility of biological diversification is dismissed by the claim of “genetic entropy”, an alleged phenomenon of constant deterioration of life due to accumulating mutations¹²⁰. The actual methodology that has produced evidence about the age of the earth is doubted, for example, regarding radiometric dating¹²¹ and dendrochronology¹²² as well as ice cores from glaciers¹²³.

¹⁰⁹ Ham 1987; YEC Headquarters 6 Day Creation 2011.

¹¹⁰ Weinberger 2005.

¹¹¹ Scott 1997.

¹¹² Morris 1972, 21–33.

¹¹³ Snelling 1997; Henry 2001; Psarris 2002ab, 2004.

¹¹⁴ Reinikainen 2003; Catchpoole and Sarfati 2006.

¹¹⁵ Parker 1994b.

¹¹⁶ Snelling 2007.

¹¹⁷ Catchpoole and Sarfati 2006.

¹¹⁸ Ham 2007a.

¹¹⁹ Morris 1972; Reinikainen 2003; Ham 2010a.

¹²⁰ Sanford 2006; AiG 2007a; Williams 2008; Sanford et al. 2008; Sanford 2013. Sanford based his claim on a paper by Crow (1997) that discussed mutations in the absence of natural selection (as could be the case regarding human reproduction). Based on Sanford’s claims, Williams (2008) calculated the number of generations (110) and years (2200) it would take for a human population of 10 persons to become extinct. However, this becomes very contradictory if examined against the background of other pivotal YEC claims, such as an actual Biblical global flood that left only eight human survivors in the year 2348 BCE (Wright 2012). Thus, humanity should have been extinct millennia ago. Furthermore, if “genetic entropy” began after the Fall with the birth of Adam’s first son (in 3874 BCE according to Wright 2012), humans would have all perished due to “genetic entropy” before the flood. Even more contradictory is the alleged decimation of all terrestrial animals to the population number of two in 2348 BCE, as based on Sanford et al. (2008) and Williams (2008), “genetic entropy” would rapidly have been fatal to populations of this size. For scientific evidence against mutations accumulating see, *e.g.*, Reed 2005; Ávila et al. 2006; Baer et al. 2006; Hall et al. 2008. Examples of beneficial mutations (which, according to creationists, do not occur) are also available (Tishkoff et al. 2006; Carlsson et al. 2009).

¹²¹ Baumgardner 2003; Snelling 2009.

¹²² Batten 2013.

¹²³ Woodmorappe 2002.

2.3.2 Old-earth creationism and intelligent design

OEC is a creationist worldview that is more loosely defined than YEC. Basically, OEC proponents accept the geological age of the earth by referring to divergent translations or interpretations of the Hebrew word “yom” (יֹם), “day”. An OEC explanation to accommodate the geological age with Scripture is “the gap theory” that states that there would have been a large gap in time between Genesis 1:1 and Genesis 1:2¹²⁴. One form of OEC claims that there was a pre-Adamic special creation that was destroyed before the creation of the first humans, which would consequently accommodate the geological age of our planet. “The day–age theory” states that the days of creation were actually longer periods of time, perhaps millions of years. At present, OEC organizations are less visible than those of YEC and ID. However, **Old Earth Ministries** have maintained their activities¹²⁵. The organization accommodates quite widespread views and concentrates on refuting specific YEC claims about the age of the earth. It has been stated that within the various creationist disciplines, the widest gap in doctrine would be between YEC and OEC¹²⁶.

In recent decades, OEC has become more diverse and the “classical OEC” can be said to have been mostly replaced by ID theories or TE. Similar to OEC, ID is also diverse in its doctrine and theology but more uniform in its scientific claims. Basically, ID has quite effectively revived Paley’s design argument¹²⁷. ID theorists state that there are biological structures and processes that could not have evolved via biological evolution and, as a consequence, they must have been designed by an intelligent agent¹²⁸. The ID movement is principally administered by university-based antievolutionists that generally do not endorse YEC¹²⁹.

Generally, ID claims that the existence of a supernatural agent (“God”) could be proven by observing the works of this “designer”¹³⁰. Some specific points raised by ID supporters are as follows:

- There is a scarcity of transitional fossils¹³¹.
- Some biochemical structures and processes are “irreducibly complex”¹³², *i.e.*, they cannot be broken down into their components without loss of function and, thus, they cannot be explained by natural selection. Therefore, they must have been specially designed.

¹²⁴ Scott 1997.

¹²⁵ <http://www.oldearth.org/>. Founded in 2003, the organization endorses “progressive creationism”, emphasis on the ongoing process of guided biological evolution, but it also accommodates TE and other types of OEC.

¹²⁶ Scott 1997.

¹²⁷ Paley 1809.

¹²⁸ *E.g.*, Davis and Kenyon 1993, 144–148. For scientific rebuttals against the concept, see, *e.g.*, Thwaites 1985. Thwaites explains the emergence of totally new proteins (*i.e.*, not only the ones that are formed by modifying existing proteins and accepted by ID proponents) by the example of bacterial enzymes capable of digesting nylon—a substrate not available before the chemical industry started producing this compound.

¹²⁹ Scott 1997.

¹³⁰ Scott 1997.

¹³¹ *E.g.*, Johnson 1993, 33–45; Puolimatka 2009, 135, 137, 178, 286, 408, 412.

¹³² Behe 1996.

- The emergence of life and the formation of new beneficial structures by mutations and natural selection are too unlikely to have occurred¹³³. An example of this, according to some ID theorists, is the development of drug resistance in malaria.

In addition to “irreducible complexity” (IC), ID proponents refer to statistical assertions that would make the emergence of life and complex structures too unlikely to have taken place. The principal theorist and proponent of this idea is William A. Dembski¹³⁴. Basically, Dembski claims that it would be possible to detect design by eliminating chance and regularity; if they are eliminated, design emerges automatically. This means that to have a creator agent acting in evolution, Dembski would have to be able to “eliminate the possibility that life and its complexity originated from natural law”¹³⁵.

Taken together, ID accepts the age of the earth and natural selection when discussing relatively minor transitions, *e.g.*, between animals of the same taxonomical order (cat family, dog family, *etc.*)¹³⁶. However, ID considers that the existence of a “designer” can be observed in biochemical structures and processes.

2.3.3 Rebuttals of creationism in natural sciences

Since the 1960s, creationists have published a huge amount of evolutionary criticism that is often presented in the form of scientific data that are re-interpreted either as evidence for creationism or against evolution. Many of these claims are shared by YEC and ID/OEC proponents. Examples of these include the paucity of the fossil record¹³⁷, the alleged sudden appearance of “all animals” in “clearly separate forms” in the “Cambrian” period¹³⁸ and calculations of the probability of particular biological structures developing “by chance”¹³⁹. In addition to these re-interpretations, there are frequent accusations of atrocities having been committed in the name of evolution¹⁴⁰ and appeals to the undesirable moral consequences of the acceptance of evolutionary theory¹⁴¹. Since the 1990s, the ID movement has challenged scientists with claims of IC¹⁴², biological or molecular structures that—according to ID theorists—could not have been formed without (supernatural) intervention by an intelligent agent¹⁴³. Oft-repeated examples are the bacterial flagellum¹⁴⁴, the blood-clotting cascade¹⁴⁵ and the

¹³³ Behe 2007, 44–102.

¹³⁴ Dembski 1998.

¹³⁵ Deming 2008; Näreaho 2010, 90–103.

¹³⁶ See also below for essentialist thought as suggested by Järnefelt 2007.

¹³⁷ Morris 1972, 77; Puolimatka 2009.

¹³⁸ Creationists often place the Cambrian in quotation marks in order to indicate that YEC authors do not accept the geological age of the earth. However, if source criticism is employed it is highly plausible that most phyla enter the fossil record only after the Cambrian, including both important animal phyla (such as nematodes) and the principal forms of plants (University of California, Museum of Paleontology 2013).

¹³⁹ *E.g.*, Puolimatka 2009, 302.

¹⁴⁰ Morris 1972, 54–55; Grigg 2005; Puolimatka 2010, 141–201, 462–477.

¹⁴¹ Puolimatka 2009, 477; Bergman 2012.

¹⁴² Behe 1996, 39–45.

¹⁴³ Behe 1996; Davis and Kenyon 1993, 144–148.

¹⁴⁴ Behe 1996, 69–73; Eirich 2000; DeVowe 2004; Batten 2008. For potential plausible naturally occurring evolutionary paths to flagellum, see Matzke 2003; Pallen and Matzke 2006.

complement part of the immune system¹⁴⁶. The number of rebuttals from natural sciences is probably equally large. Detailed refutations of creationist claims have appeared in book and article formats¹⁴⁷ and in systematic form in Internet sites¹⁴⁸. Briefly, there are dozens or hundreds of creationist claims that have been answered. However, the creationist–evolutionist debate has not shown clear signs of attenuation.

In addition to individual scientists refuting creationism, scientific organizations have also taken stands against YEC and ID. The National Academy of Sciences (U.S.) issued in 1999 a comprehensive statement about creationism¹⁴⁹. The report assesses the creationist views on the origin and diversification of life. Especially regarding YEC, the reports states that “There are no valid scientific data or calculations to substantiate the belief that Earth was created just a few thousand years ago” and that “The arguments of creationists are not driven by evidence that can be observed in the natural world”. The authors conclude that “Creationism, intelligent design, and other claims of supernatural intervention in the origin of life or species are not science because they are not testable by the methods of science”. The Center for Inquiry issued a position paper on the ID movement and concluded that “There is no legitimate scientific debate between ID and evolution, and there is no controversy within the scientific community concerning the status of evolutionary theory”¹⁵⁰.

Although a large part of the scientific rebuttals consists of answering specific scientific issues brought forth by creationists, many scientists have also entered the debate concerning the alleged immoral consequences of evolutionary theory. To summarize, several YEC and ID/OEC authors have repeatedly linked evolutionary theory to, for instance, Nazism, Stalinism, eugenics, abortions, mass murders and genocide¹⁵¹. In addition, individual scientists are targeted to character assassination with accusations of forgery (Haeckel)¹⁵², incompetence, racism, *etc.* (Darwin)¹⁵³.

2.3.4 Creationism and philosophy of science

The understanding of causalities can be seen as one of the hallmarks of science¹⁵⁴. Usually both YEC and ID present their theories as if there was empirical evidence for them¹⁵⁵. Scientific theories should be susceptible to critical testing. According to Kirk Fitzhugh¹⁵⁶, the possible proof for ID (and YEC) should be based on assessing whether the evidence presented is

¹⁴⁵ Behe 1996, 81–97. Refuted by, *e.g.*, Robinson et al. 1969, who demonstrated that existing animals (whales) lack components that Behe considers absolutely pivotal for the clotting system to function.

¹⁴⁶ Behe 1996, 131–139. For counter-evidence against IC of the clotting system, see Nonaka et al. 1999.

¹⁴⁷ Young 1985.

¹⁴⁸ *E.g.*, Isaak 2006; Sober 2007; Boudry and Leuridan 2011.

¹⁴⁹ Steering Committee on Science and Creationism 1999.

¹⁵⁰ Forrest 2007.

¹⁵¹ Morris 1972, 1974; Reinikainen 1991; Johnson 1993, 1995; Harris and Calvert 2003; Sarfati 2007; Puolimatka 2009, 2010; Reinikainen 2011, 2013c.

¹⁵² Luskin 2009.

¹⁵³ Bergman 2004, 2005; Brace 2006.

¹⁵⁴ Fitzhugh 2010.

¹⁵⁵ *E.g.*, flood geology (Parker 1994b), “rotting dinosaur bones” (Reinikainen 2003, 2013a), IC structures such as flagellum (Behe 1996; Sarfati and Matthews 2011).

¹⁵⁶ Fitzhugh 2010.

appropriate to warrant “any ID theory as amenable to scientific scrutiny in the manner to which theories in evolutionary biology have been subjected”. Regarding testability, Fitzhugh claims that the IC concept is one that “confuses the testing of explanatory hypotheses with the testing of theories”. Basically, ID theory claims that there is an intelligent agent that has characteristic behavior, inducing novel characters in life forms. However, this claim requires a more general theory about intelligent agents that have causal powers on biological entities. Whereas ID proponents claim that the existence of such agents has been proven by observation of biochemistry, several authors disagree, because the claim would have to be independently validated. The suggestions of Behe¹⁵⁷ and Dembski¹⁵⁸ to unravel design are thus used to identify intelligent behavior but are not designed to unravel any existence of intelligent agents capable of this. In order to achieve this, ID would have to be able to set up testing to demonstrate the presence of an intelligent agent in natural or experimental conditions¹⁵⁹. One possible scenario would be to observe special creation in a test site approved by evolutionists and ID proponents¹⁶⁰.

ID also lacks unification. According to Boudry and Leuridan, this could be accomplished by the accommodation of previously known observations (a strategy used by YEC and ID) or by predicting new observations¹⁶¹. By accommodation, this could be achieved by placing natural phenomena under a simple and clearly stated intention of the designer. Furthermore, if such explanations were clearly superior to those provided by natural sciences and if they could provide valid predictions, unification might ultimately appear¹⁶². In summary, Boudry and Leuridan commented that the ID theorists should continue to present auxiliary hypotheses about the intentions and attributes of the designer, but that these assumptions should be “unifying and not *just* tailored to individual observations (which they typically are)” [original emphasis]. These auxiliary hypotheses would be especially important when discussing imperfections in nature¹⁶³. These phenomena are often dismissed by ID proponents by referring to unknown motives of the alleged designer. According to Näreaho, this is not a satisfactory answer: when the design hypothesis meets an obstacle the answer is in unknown motives, which makes the hypothesis useless as a research program.

In addition, the philosophical basis of ID (and YEC) based on the design argument rests nowadays heavily on the “fine-tuning argument”—a claim that physical laws of the known universe are fine-tuned to permit organic life as we know it¹⁶⁴. This has been rejected based on three principles. *i*) The argument rests on probability. It claims that the present set of natural laws was too improbable to come into existence without a designer. However, David

¹⁵⁷ Behe 1996.

¹⁵⁸ Dembski 1998.

¹⁵⁹ Fitzhugh 2010.

¹⁶⁰ Nieminen 2012.

¹⁶¹ Boudry and Leuridan 2011. In evolutionary theory, for instance, the similarities between whale fossils and artiodactyls enable the prediction that their DNA should also indicate similar patterns of descent.

¹⁶² Boudry and Leuridan 2011. The authors suggest a breed of beetles that would contain verses of the Hebrew Bible on their carapace with some gaps in the text. If this occurred, ID could predict what the missing texts would contain (based on the Bible) and there would be some undiscovered beetles with these missing fragments. In addition, the phenomenon would be very difficult to explain based on natural sciences.

¹⁶³ Näreaho 2010, 64–110.

¹⁶⁴ Deming 2008; McGrath 2010, 111–126.

Deming¹⁶⁵ points out that the concept of probability only has any meaning when discussing repeating occurrences and that it is intellectually fallacious to assign probability values to unique events. Multiple universes (\approx repeating occurrences) can be discussed speculatively but there is as yet no observational evidence for them. In addition, the alleged probabilities have been disputed and there are calculations showing that the origin of life is within the boundaries suggested by the fine-tuning argument theorists¹⁶⁶. *ii*) It is also as yet impossible to know whether the universe was designed to contain life, or whether life just evolved in the universe. *iii*) The anthropic principle states that it is a tautology “that observers will observe cosmos that allows for their existence”. Altogether, the issue of fine-tuning remains controversial and it seems that based on different worldviews and preconceptions, one can accept the fine-tuning argument and its criticism either as being consistent with theism and trinitarianism¹⁶⁷ or with the secular worldview¹⁶⁸.

The use of probabilities as proof for the existence of a “designer” has also been heavily criticized. For instance, Behe has claimed that some biochemical novelties require two mutations to occur and he calculated the probability of such an occurrence to be infinitesimally small¹⁶⁹. However, there is no evidence that this should be the case. There is no obstacle to believing that the mutations could not occur one after another, especially if the first mutation is neutral¹⁷⁰. This is also scientifically problematic, as ID proponents basically state that some natural phenomena are not only unexplained at present but that they are totally inexplicable¹⁷¹. In addition, the ID and YEC calculations on probability appear to assume that only a single genomic constitution is capable of producing the “desired” outcome¹⁷². However, we know that there are thousands or millions of forms of known proteins with subtle differences in their respective DNA sequences, not only between species but also between individuals. For example, there are between seven and eight billion current genomes that can all produce a functional human being and we have no reason to assume that the number of other genomes also capable of producing humans would not be higher. As it is virtually impossible to assess all these different but equally functional forms of DNA and protein—different structures but the same functions—the calculations of probabilities regarding the existence of these molecules become essentially meaningless¹⁷³. The same impossibility of calculating probabilities in any reasonable manner has also been the target of criticism regarding the works of Dembski¹⁷⁴.

The actual background of creationist beliefs has been assessed by philosophers of science and by psychologists. As creationism is regarded to be pseudoscience by natural scientists¹⁷⁵, there have been attempts to assess whether the creationist worldview is at all

¹⁶⁵ Deming 2008.

¹⁶⁶ Carrier 2004a.

¹⁶⁷ McGrath 2010, 120.

¹⁶⁸ Deming 2008.

¹⁶⁹ Behe 2007, 59.

¹⁷⁰ Durrett and Schmidt 2008, 2009.

¹⁷¹ Crouch et al. 2006.

¹⁷² See also below Järnefelt 2007 for teleo-intentional thinking.

¹⁷³ Essentially, ID proponents should not simply calculate the probability of a specific DNA sequence (for, e.g., hemoglobin) being formed by chance. They should calculate the probability of “any molecule, protein or other, that can aid an organism to transport oxygen” being formed by chance.

¹⁷⁴ Fitelson et al. 1999; Deming 2008.

¹⁷⁵ Shermer 2011.

rational. Järnefelt¹⁷⁶ assessed the thinking patterns of ID proponents based on the “Kitzmiller case”¹⁷⁷. She observed that the ID theory depended highly on essentialism. “An organism that is meant to be of one form cannot enable the development of another kind of organisms.” This would mean that an organism would have a basic essential form (such as a dog) and it would be able to change only within the boundaries of this form. This type of thinking also appears to be present in YEC theory concerning “created kinds”, as explained above. In addition, ID proponents appear to have accepted that plausible evolutionary paths have been proposed, for example, for the evolution of flagellum but they dismiss this, as the intermediate forms would not have functioned as flagella but would have divergent functions¹⁷⁸. This is a form of teleo-intentional reasoning: an organism or a subcellular structure would have to serve its assigned function, which can be true of human artifacts but there is no reason that it should be automatically applied to biological systems¹⁷⁹.

While these data would indicate that creationism is irrational, it has also been suggested that at its basal level creationism is actually not at all about natural sciences as understood by scientists, but that it could be a *para-science*: a social movement of amateur scientists and philosophers who as persons are rational but whose claims—the actual product of the thinking processes—are nevertheless unreasonable¹⁸⁰. It has been difficult for creationists to design experiments, they have not predicted new findings and it has been claimed that creationism would not be falsifiable¹⁸¹. Instead of influencing scientific knowledge by taking part in research and/or professional debates, creationists try to alter the content of textbooks, curricula, *etc.*, by legal actions and/or piecemeal criticism of selected data. Regarding creationism, John S. Wilkins proposed the concept of bounded rationality¹⁸². This involves choices by an individual about the proper social norms to follow, not rational choices about how to interpret the natural world. Wilkins suggests that this type of rationality is not restricted to the social world but aspects of it can saturate education and science. For example, it is not uncommon to observe false data being transmitted from one textbook to another if it is supported by authoritative persons or institutions. Furthermore, the learning experience during childhood and education is influenced by this bounded rationality. These factors create commitments that influence the outcome of learning. Depending on the commitments, the outcome can be—in the context of the present study—a creationist worldview or a view that accommodates evolutionary theory. Both are rational but represent different types of rationality. According to Wilkins, this would make it very unlikely to argue committed creationists out of their beliefs by presenting scientific rebuttals of high quality. As a community, creationists would “be unwilling to endanger their epistemic choices, particularly when they have made an entire scheme out of them”¹⁸³. This also leads to the situation in which creationist research

¹⁷⁶ Järnefelt 2007, 40–43.

¹⁷⁷ See below for details of the court case.

¹⁷⁸ Järnefelt 2007, 75.

¹⁷⁹ Järnefelt 2007, 71.

¹⁸⁰ Cavanaugh 1985. See also Shermer 2002 for discussion on the causes of popularity regarding pseudoscientific claims.

¹⁸¹ Raoult 2008.

¹⁸² Wilkins 2011.

¹⁸³ This statement is, however, not necessarily very well substantiated and could in fact be a form of the “poisoning the well” fallacy (see below for details).

cannot be considered to be actual science, as it conjures a supernatural entity as a requirement¹⁸⁴. Especially ID could be considered as a research program that is very different from scientific research regarding both its premises and outcomes.

2.3.5 Creationism and natural theology

The concept of natural theology is central when discussing creationism, as some forms of natural theology attempt to prove God's existence by observing His works, *e.g.*, the natural world as creation. However, the concept is not well-defined or demarcated, leading to confusion when discussing natural theology¹⁸⁵. This is not restricted to Christian theology, and Pannenberg links its origins with Stoicism. Initially, natural theology did not attempt to prove the existence of God, as a supernatural origin of the material world was taken for granted¹⁸⁶. However, eventually arguments from nature came to be associated with philosophical attempts to prove God's existence. In the scope of the present study, the most relevant cases of natural theology are those that utilize scientific data as source material for apologetics attempting to prove God's existence based on the findings of natural sciences.

Regarding these attempts to prove the existence of a deity, Augustine of Hippo not only speculated on the *rationes seminales* and the subsequent "evolution" of innate created potentials of animals and plants, but he also strictly opposed the habit of Christians of "talking non-sense on these topics"¹⁸⁷. Karl Barth opposed natural theology and in principle denied all knowledge of God apart from God's own revelation¹⁸⁸ but, according to McGrath, this opposition was specifically targeted at the form of natural theology that attempts to "demonstrate the existence and determine the character of God without recourse to divine revelation"¹⁸⁹. The Vatican does not discuss the issue of natural theology as directly in its official documents. However, the Catechism of the Catholic Church states as follows: "God, who creates and conserves all things by his Word, provides men with constant evidence of himself in created realities"¹⁹⁰. This can be interpreted in the manner that the "created realities" could include evidence from the material world. However, these potential aspects of revelation could be taken as secondary, as the Holy See explicitly refers to revelation in history and Scripture as follows: "God has revealed himself to man by gradually communicating his own mystery in deeds and in words"¹⁹¹. Recently, Andrew Moore criticized the form of natural theology that has relevance in the present study (finding evidence for God in natural sciences). He stated that Christians should not be "under an obligation to show that their beliefs are justified in the terms set by the dominant social context" and that beliefs would not need to be legitimized by the way of natural sciences¹⁹². However, Joshua Moritz writes that "the theory of common ancestry and the evolution of all life is as scientifically certain as any given theory... science, as such, is not

¹⁸⁴ Näreaho 2010, 103–110.

¹⁸⁵ Pannenberg 2004a, 76.

¹⁸⁶ Pannenberg 2004a, 78.

¹⁸⁷ Augustinue of Hippo \approx 415, I, 19:39.

¹⁸⁸ Morrison 2001.

¹⁸⁹ McGrath 2010, 26–27.

¹⁹⁰ Holy See 1993.

¹⁹¹ Holy See 1993.

¹⁹² Moore 2010.

(and never has been) in the business of making unalterable pronouncements about the nature of reality”¹⁹³.

McGrath has proposed—in contrast to the apologetic form—a novel approach to natural theology¹⁹⁴. In his concept, nature can be “seen” in a “specifically Christian manner”. The attempt to demonstrate the existence of God via observation of nature is rejected. Instead, Christian faith can be “a tool of making sense” of scientific observations. The framework for this would be the triad of “truth, beauty, and goodness”. In a similar manner, Moritz did not dismiss natural sciences but stated that “God is at work in every detail of this process [development of life and ontogeny of individual humans]”¹⁹⁵. An example of an independent use of this approach is that of Karl E. Peters when he pondered the modern concepts of cosmology¹⁹⁶. “Each individual is a particular stream of energy, matter, and life that flowed out of the original inflation called the Big Bang. Each of us is 14 billion years old—all human beings. Each of us is embedded in the universe and in her or his own unique way embodies the universe. Each is a special ‘child’ of the universe.” In the theology of Peters, the traditional concepts of systematic theology become intertwined and accommodated to scientific data: “...organized religion is one of many activities that can enable salvation”¹⁹⁷. These modern interpretations of natural theology have dispersed far from the (creationist) apologetic interpretation, in which nature is studied with “an expectation that it will offer ‘proof’ of the existence of God”¹⁹⁸. Other modern theologians have attempted to reconcile the concept of evolution with that of theism and salvation by referring to original sin as “a universal human condition” instead of a historical act, and salvation as “fulfillment” of human life, also in culture and biology¹⁹⁹.

2.3.6 Creationism and evolutionary theory in the court

The creationist–evolutionist debate is not restricted to the scientific arena or public discussion. In the U.S., there have been several court decisions regarding the teaching of evolution *vs.* creation in public schools²⁰⁰. Before 1968, it was a question of trying to keep evolution from being taught. As a result of the “Scopes trial” in Tennessee in 1925, the science teacher John Scopes was forbidden to teach evolution²⁰¹. In consequence, it was *de facto* a crime to teach evolutionary theory for more than four decades in the USA. This changed after the Epperson *vs.* Arkansas trial²⁰²: the U.S. Supreme Court decided in 1968 that it was unconstitutional to prohibit

¹⁹³ Moritz 2011.

¹⁹⁴ McGrath 2010, 28–34.

¹⁹⁵ Moritz 2013.

¹⁹⁶ Peters 2012.

¹⁹⁷ Peters 2012: “Salvation may involve preventing evil by saving an individual, group, society, or even the planet from being disrupted, impaired, or destroyed. It can also be rescuing and restoring individuals and communities to wellbeing and well-functioning—healing after being disrupted or impaired. And it may also include maintaining individuals and communities in the restored dynamic harmony.”

¹⁹⁸ McGrath 2010, 34.

¹⁹⁹ Lancaster 2005.

²⁰⁰ Reviewed in Forrest 2007.

²⁰¹ Moore 2000; Linder 2008; University of Minnesota Law Library 2013.

²⁰² U.S. Supreme Court Center 1968.

the teaching of evolution in Arkansas and that the curriculum could not be altered according to religious beliefs. In 1982, again in Arkansas, creationists attempted no longer to ban the teaching of evolution but to have “creation science” included in the curriculum alongside evolutionary theory. In the case *McLean v. Arkansas Board of Education*²⁰³, it was ruled that this would be unconstitutional.

In 1987, the court case *Edwards v. Aguillard*²⁰⁴ was caused by an earlier decision by the state of Louisiana to have “balanced treatment of creation-science and evolution-science in public school instruction”. The U.S. Supreme Court prohibited the teaching of creationism in public school science classes. This is now considered the “legal standard” for creationism cases in courts²⁰⁵.

Finally in 2005, ID entered the court in the *Kitzmiller et al. v. Dover Area School District* case²⁰⁶. This time, the local School District Board required that students should know “gaps/problems in Darwin’s Theory and other theories of evolution including, but not limited to, intelligent design.”²⁰⁷ Furthermore, an ID textbook, *Of pandas and people*²⁰⁸, was to be made available for 9th grade students. In the ruling, ID was considered unscientific and not in this respect different from creationism and religion.

Although it must be emphasized that the evidence for or against a scientific theory is not determined by a legal authority²⁰⁹, especially the Kitzmiller trial included several scientific experts on both sides of the debate. At present there is, thus, a strong scientific and legal case in the U.S. against the different types of creationism regarding their plausibility to explain the emergence, age and diversification of life on the earth.

2.4 ARGUMENTATION AND FALLACIES

In argumentation theory, fallacies are “violations of rules for critical discussion”²¹⁰. In a debate, it is possible only to point out the fallacies of the opponent as an academic exercise, which can take the form of quibbling if the significance of fallacies is not acknowledged. In fact, it has been argued that fallacies are not only “improper substitutes for arguments” but that a fallacy is also “a procedure used for the fixation of beliefs that has an unacceptably high tendency to generate false or unfounded beliefs...” In addition to theoretical consequences of fallacies for the generation of beliefs, recent empirical data also show that incivil discussion can polarize public views on an issue and affect the acceptance of contentious scientific issues, such as evolution or climate change²¹¹. In the context of the present study, this means that if the arguments for or against evolution are justified with fallacies, the actual content of a claim can be judged based

²⁰³ *McLean v. Arkansas* documentation project 2005. The ruling by judge Overton is famous as it states that “creation science” is religion, not science (Forrest 2007). This verdict has been heavily criticized by the creationist communities, e.g., by Laudan 1983 and Johnson 1993 (80–89).

²⁰⁴ U.S. Supreme Court Center 1987.

²⁰⁵ Forrest 2007.

²⁰⁶ National Center for Science Education 2008.

²⁰⁷ Forrest 2007.

²⁰⁸ Davis and Kenyon 1993. The book is source material for the present study.

²⁰⁹ This would be an “appeal to authority” fallacy, see below for details.

²¹⁰ van Eemeren and Grootendorst 1992.

²¹¹ Anderson et al. 2014.

on the fallacy and not only on the evidence. This is especially important regarding an audience with existing biases, as fallacies can significantly affect the audience's evaluation²¹².

Fallacies can be classified with a complex taxonomy including formal and informal fallacies and their subdivisions²¹³. For the scope of the present work, however, the taxonomical classification of fallacies was kept to a minimum, as the main goal was not to assess argumentation theory and the formal exposition of fallacies but to use the analysis of fallacies in a practical manner to assess the significance of argumentation in the creationism–evolution debate. This is similar to studies investigating the utilization of fallacies in, *e.g.*, political decision-making²¹⁴. The most relevant fallacies for the present project can be briefly presented as follows:

Ad hominem fallacies attack the opponent's character or circumstances instead of the actual issue or scientific evidence. This is used to raise suspicions about the opponent's credibility and, thus, about the opponent's opinions on the actual issue²¹⁵. *Ad hominem* is considered quite effective even in cases when it is exposed and addressed²¹⁶. The direct form of *ad hominem* uses character issues to disqualify the opponent. Typical examples include accusations of racism, mental imbalance, dishonesty, lack of formal education and alleged connections to political or religious (or atheistic) affiliations. *Tu quoque* disqualifies and creates suspicions on the motives of the opponent by referring to "inconsistencies in the other party's current position and his former practices"²¹⁷. For instance, the arguer can make an appeal to former statements of the opponent and accuse the opponent of contradictions. *Poisoning the well* fallacy is a form of *ad hominem* that involves a tactic "to silence an opponent violating her right to put forward argument" based on the accusation that the opponent cannot help being opposed to the issue²¹⁸. This can be an effective way of "discrediting whatever the source has to say in the future". This strategy commonly occurs, for instance, in referrals to the opponent's sex, when a person is judged unqualified to comment on the issue of motherhood as a man or when a childless politician is considered unsuitable to assess the effects of an economical decision on families with children.

Appeals to authority are fallacies that emphasize the person who presents an argument instead of the content of the claim²¹⁹. Briefly, the fallacy states that an argument "is right because an authority says it is right"²²⁰. The authorities can be experts on the issue or represent authoritative power. Appeals to court decisions, famous historical figures and politicians as well as religious leaders are typical appeals to authority. In addition, the presenter of the argument can refer to personal qualifications, academic degrees, experience, *etc.* as authoritative²²¹.

²¹² Yap 2013.

²¹³ Curtis 2001.

²¹⁴ Sahlane 2012.

²¹⁵ van Eemeren and Grootendorst 1992; Yap 2013.

²¹⁶ Yap 2013.

²¹⁷ van Eemeren and Grootendorst 1992; Sahlane 2012; see also Scriven 1987. Scriven also links *ad hominem* to statistical fallacies, when an opponent refutes an argument by referring to track record indicators, *e.g.*, by claiming that the arguer has not produced work of high quality in the past and, thus, the present work should be dismissed.

²¹⁸ Walton 2006.

²¹⁹ Jovičić 2004.

²²⁰ van Eemeren and Grootendorst 1992; Goodwin 1998.

²²¹ For instance, it is quite typical in debates about the conversion therapies of sexual minorities to appeal to books or testimonials of alleged conversions to the general sexual norm instead of actual scientific results (*e.g.*, Rautkoski 2012).

Appeals to unknown authorities can also be common, taking the form of *appeals to popularity* (*ad populum*). This can be realized by quoting numbers or proportions of the population that believe, for instance, in special creation, as a proof against evolution²²².

Taxonomically related to the *ad hominem* fallacies are the *guilt by association* and *appeal to consequences* (*ad consequentiam*) fallacies²²³. The *ad consequentiam* argument attempts to reject a claim because of its alleged undesired consequences, such as claiming that same-sex marriage would cause break-up of families or loss of traditional values. The guilt by association fallacy links the opponent's view to distasteful or evil phenomena instead of concentrating on the issue and its evidence. Very typically, a viewpoint is associated with Nazism, communism, fundamentalism, inquisition or Stalinism²²⁴. Appeals to consequences also give rise to *appeals to fear or force* (*ad baculum*), where the opponent is threatened with sanctions²²⁵.

The *slippery slope* fallacy is very common in religious debates. In this fallacy, an action is claimed to initiate consecutive steps that ultimately lead inevitably to disastrous results²²⁶. In order to maintain that the slippery slope argument is not fallacious, the presenter would have to be able to present logical causal relationships between all steps of the argument. However, regarding natural sciences, an undesirable outcome (such as eugenics) may emerge from applying a theory to other aspects of life, but this still does not disprove the theory. In these cases, even a potentially valid slippery slope becomes an *ad consequentiam* fallacy.

Appeal to ignorance (*ad ignorantiam*) is an argument based on lack of evidence for or against a particular claim²²⁷. This is related to the fallacy of many questions or loaded questions or lists of unresolved issues that are taken as an argument for the reasoner's claim. Although a question is not an argument to begin with, the fallacy of many (or loaded) questions can be used as a strategy to introduce opinions without stating them explicitly. One form of the appeal to ignorance is the *argument from incredulity*, where an argument is dismissed based on the personal disbelief of the opponent²²⁸. In this context it is also suitable to mention *ad nauseam*, where an argument is repeated without presenting additional evidence or viewpoints; *ad ridiculum*, associating an argument to ridicule or subjecting it to mockery instead of considering evidence; and *ad misericordiam*, appealing to pity as an argument for one's position²²⁹.

False dilemmas are arguments in which a complex issue is simplified into few (usually two) choices and the reasoner then implies that a choice should be made between these

²²² A common example in religious discussion about female ordination is to appeal to the majority of Christian denominations in the world having only male ordination (e.g., Marjokorpi 2012).

²²³ van Eemeren and Grootendorst 1992; Godin 1999; Curtis 2001.

²²⁴ This occurs commonly in health issues, where proponents of vegetarianism, avoidance of animal fats or abstinence are associated with "terrorists" or "fascists" instead of considering the actual evidence of potential health benefits or risks (e.g., Vartiainen 1997).

²²⁵ van Eemeren and Grootendorst 1992; Woods 1998. This is very common in religious discussion, e.g., when a person is threatened with supernatural punishment if he clings to allegedly false doctrines, and in several texts, e.g.: "...taking vengeance on them that know not God, and that obey not the gospel of our Lord Jesus Christ: Who shall be punished with everlasting destruction..." (2 Tess. 1:8–9).

²²⁶ van Eemeren and Grootendorst 1992; Woods 2000. Typically, it is claimed that the acceptance of same-sex marriage leads first to polygamy, then the acceptance of interbreeding, pederasty and finally marriage with animals.

²²⁷ Walton 1999a; Curtis 2001; Hahn and Oaksford 2007. Debates on sexual orientation are, again, common examples of this. The lack of definite proof for the genetic or epigenetic nature of homosexuality is taken as proof of sexual orientation as a choice.

²²⁸ Dawkins 1986. When using the argument from incredulity, one often appeals to irrationality, difficulties in understanding an issue or the reasonability or logical simplicity of the claim one defends.

²²⁹ Curtis 2001; Dowden 2010.

alternatives, although other choices would actually be available²³⁰. This fallacy occurs quite often when presenting a person with a choice of two alternative worldviews (*e.g.*, atheism or Christianity) among many others that are left unmentioned.

Hasty generalization is a fallacy involving conclusions that are based on limited sources but taken as universal²³¹. Typically, conclusions are based on skewed source material and there would be contradictory data that are dismissed or not discussed²³². Hasty generalization can also include *ignoring base rates*, where a decision is based on specific (possibly rare or anomalous) cases while ignoring general data about the issue²³³.

Equivocation is a form of the vernacular misconception introduced in the context of common misconceptions about evolutionary theory²³⁴. This is a fallacy of using words in an ambiguous manner to create unclarity. A typical example in the context of the present study is the use of the word “theory”. This word is generally understood by scientists as a well-proven scientific explanation of natural phenomena, whereas creationists often use it with the meaning of an explanation that is unproven and rivaled by other hypotheses²³⁵. Equivocations can also be conceptual, in which case, for instance, the concept of “chance” is understood very differently among creationists and evolutionary proponents.

Previous assessment of potential argumentative fallacies in creationist texts does exist. However, this often takes the form of recognition and does not proceed to discussing the context of the fallacy (with or separate from the presentation of scientific claims about creation or evolution) or the possible influence the fallacy could have on the audience of the creationist–evolutionist debate. As an example, RationalWiki lists the relevant fallacies that occur in creationist claims with simple recognition²³⁶. In a slightly more obscure manner, the TalkOrigins archive dismisses the discussion about the alleged connections between evolutionary theory with racism by stating that the issues are not significant in the concept of evolution²³⁷. Although this is true from the scientific point of view, the suggestion by Yap of fallacies being able to generate false beliefs²³⁸ should be taken seriously. In this context, fallacies can become very relevant in the acceptance or refusal of a claim, while still being irrelevant in the field of natural sciences. In concert with this suggestion, Stempien and Coleman assessed the presence of

²³⁰ Curtis 2001; Dowden 2010; Tomić 2013. The basic form of this fallacy can be summarized as follows: “Whoever is not with me is against me”(Matt. 12:30).

²³¹ Walton 1999b.

²³² This is also common regarding health issues, including for example alternative medicine. The cases when patients experience amelioration after visiting an alternative therapist are considered relevant, but other cases with no effects or deleterious effects are neglected (Lindeman 1998).

²³³ Curtis (2001) calls this the “base rate fallacy” or “neglecting base rates”: “When one has both generic and specific information, it might seem reasonable to ignore the general information in favor of the more specific. This would indeed be the right thing to do if one had to choose only one type of information, but one should instead use all of the information that one has. There is always some possibility that an observation or test may be wrong, and the probability that it is wrong is affected by the base rate.” This occurs when, *e.g.*, a single anomalous result from a scientific analysis is considered to be very relevant or—alternatively—as a proof that the method is useless. Ignoring base rates is also a manifestation of experiential thinking regarding confirmation bias.

²³⁴ van Eemeren and Grootendorst 1992; see also Corcoran 1989 for ambiguity.

²³⁵ In religious debate, “euthanasia” is often subjected to equivocation. Proponents of euthanasia use the word in the context of voluntary death assisted by medical doctors; opponents refer to euthanasia in the context of the Holocaust (also the fallacy of guilt by association or the *Hitler card*).

²³⁶ RationalWiki 2013bc.

²³⁷ TalkOrigins archive 2007.

²³⁸ Yap 2013.

persuasive rhetorical devices in creationist debates and particular texts²³⁹. “Name-calling” (which could be classified as *ad hominem*) was present with similar frequencies (19.0–20.1%) on both the evolutionist and creationist sides, but evolutionary proponents utilized more “explanation” (not fallacious). This was considered to be a reason why evolutionary scientists were relatively unable to hold the attention of the audience, whereas the creationist strategy included emotional techniques that were targeted at “common folk”.

2.5 EXPERIENTIAL THINKING

In order to understand how people reach their conclusions, it is crucial to assess the cognitive processes that lead to decision-making. Experiential thinking is a cognitive process that is considered evolutionarily old and useful, as it provides answers rapidly in everyday situations, where it is of importance to interpret and organize information automatically²⁴⁰. Although highly beneficial, experiential thinking can also create and enforce false beliefs, similar to the phenomenon observed with fallacies. The phenomenon of experiential thinking contains the concept of cognitive heuristics²⁴¹, methods of reasoning in order to make decisions. However, this use of heuristics can cause errors of judgment leading to erroneous conclusions regarding, *e.g.*, the efficacy of a medical treatment²⁴². This can be caused by sub-phenomena of cognitive heuristics: confirmation bias and pseudodiagnostics²⁴³. These two manifestations of experiential thinking are treated separately in the following list and in the analyses. In addition to this, emotional assessment of data includes magical beliefs that are clearly related to ideological commitment²⁴⁴. All this can cause a “tendency to assign moral significance to morally neutral objects”²⁴⁵. In the analysis, these aspects are expressed as “moral issues”.

Based on existing literature on experiential thinking, its most significant aspects can be briefly expressed as follows²⁴⁶:

- Experiential thinking prefers concrete information, which is often presented as personal experience. This can take the form of testimonials, narratives and metaphors.
- Confirmation bias means that a person seeks information that is consistent with his or her previously existing concepts and beliefs. At the same time, contradictory data are considered unreliable or simply dismissed. Null information (zero data) is also

²³⁹ Stempien and Coleman 1985.

²⁴⁰ Epstein 1994; Lindeman 1998.

²⁴¹ Sherman and Carty 1984; Marsh et al. 2004.

²⁴² Sherman and Carty 1984.

²⁴³ Sherman and Carty 1984; Lindeman 1998: “Cognitive heuristics, like those of confirmation bias and pseudodiagnostics, also explain why an ineffective medicine or treatment seems to be effective.”

²⁴⁴ Lindeman et al. 2000: “...the strongest relation to magical food and health beliefs were vegetarianism and ideological commitment to food choice.”

²⁴⁵ Lindeman 1998: “...this kind of assumption reflects dichotomic good-or-bad thinking and a confusion between physical/health and moral/symbolic accounts, both of which are elements of magical contamination beliefs.” The moral issues embedded in the magical thinking are given separate classification in the present study.

²⁴⁶ Doherty et al. 1981; Mitroff 1981; Sherman and Carty 1984; Denes-Raj and Epstein 1994; Epstein 1994; Lindeman 1998; MacCoun 1998; Nickerson 1998; Pacini and Epstein 1999; Lindeman 2011.

ignored. In other words, alternative hypotheses or solutions are not considered, although they would be available.

- When the information used to judge an outcome or reach a decision is not actually relevant to the issue, one resorts to pseudodiagnosticity. This category includes instances when base rates are ignored²⁴⁷ and sample size is not taken into consideration.
- Experiential thinking is characterized by generalization and stereotypical thinking by holistic, concrete and emotional concepts. This leads to the re-organization of complex or threatening information into a more easily controllable form.
- Even if an issue *per se* is morally neutral, it is given moral (ideological) significance in experiential thinking. Furthermore, magical beliefs and concepts may also be involved.
- If opinions are based on experiential thinking, they are prone to be very resistant to change. Logical evidence, contradictory information or zero data do not have much influence on beliefs based on experiential thinking.

The aspects of experiential thinking are not restricted to everyday decision-making, inexpert opinions or religiosity. For example, confirmation bias is present in scientific thought²⁴⁸ and can also provide commitment to one's hypotheses in the face of opposition²⁴⁹. Still, the testing and consideration of not only one's own hypothesis but also alternatives can be regarded as a significant part of scientific thinking.

The above brief presentations of fallacies and experiential thinking reveal similarities between these phenomena. Both include the tendency towards making generalizations based on inadequate data (hasty generalization, confirmation bias) and re-organization of complex data into controllable form (false dilemmas and generalizing, stereotypical thinking). In addition, the use of personal experience as testimonials is common to both (appeal to authority). The habit of giving moral significance to neutral issues is also obvious (*ad hominem*, *ad consequentiam* and guilt by association, moral issues in experiential thinking). Taken together, the similarities between these two procedures of analyzing arguments and thinking patterns could provide a fruitful approach to assessing texts that are in strong opposition to prevalent scientific (and theological) data despite detailed, oft-repeated rebuttals providing contradictory evidence. Regarding the creationist–evolutionist debate, it is possible that both sides fail to concentrate on the actual scientific issues and utilize emotional experiential thinking instead. This can lead to general failure of communication and a stalemate that could be evidenced by the continuous re-appearance of the same creationist arguments for decades. It would be of benefit for scientists, science educators and ultimately creationists to be able to break this vicious circle of conflict.

²⁴⁷ As seen above, ignoring base rates can also be classified as a fallacy, but it is also present in the continuum: confirmation bias → pseudodiagnosticity → ignoring base rates (Doherty et al. 1981) when there is a "failure to identify and select diagnostically relevant information", such as placing too much emphasis on a few diverging values rather than on the majority of reliable results. This is discussed further in the original articles, *e.g.*, when assessing radiometric dating methods (I–III).

²⁴⁸ Hergovich et al. 2010.

²⁴⁹ Mitroff 1981.

3 *Aims of the Study*

3.1 AIMS

As the aspects of creationism directly related to natural sciences have been thoroughly assessed previously, the present study did not aim to prove the actual claims either true or false. Instead, based on the widespread use of data derived from natural sciences in YEC, OEC and ID theories, their emphasis on literal interpretation of the Bible and their apparent resistance to change regardless of scientific rebuttals, the aim was to conduct a textual analysis of creationist texts, to assess their argumentation and thinking patterns and, based on this, to evaluate the effects of these aspects on creationist (YEC and ID/OEC) theology. To enable the practical division of the material into separate peer-reviewed scientific papers, the overall goal was further divided into four consecutive sub-studies with their specific aims as follows:

1. To analyze creationist texts that aim to disprove evolution or prove creation for their argumentation and argumentative fallacies (I) and to analyze whether the possible fallacies are presented in a scientific context, which could affect the reception of these claims by their audience. In addition, pro-evolutionary texts are analyzed in the same manner.
2. To analyze creationist and pro-evolutionary texts for aspects of experiential thinking and to assess whether the possible experiential thinking patterns can be linked to the potential fallacies (II).
3. To present a method of analyzing creationist texts for fallacies, experiential thinking and scientific content in a systematic manner (III).
4. Finally, to assess how the potentially fallacious utilization of scientific data and experiential thinking affect the theological aspects of creationism, especially the principal disciplines of systematic theology (IV).

3.2 HYPOTHESES

The hypotheses of the project were formulated as follows:

1. Creationist texts are principally aimed at proving the creationist theory or disproving evolution. If the scientific content is justified with arguments regarding, *e.g.*, the character of evolutionary proponents or scientists, alleged consequences of evolutionary theory or its association with distasteful phenomena, it is expected that the texts contain fallacious argumentation (I, III).
2. Applying the religious worldview to scientific data brings aspects of experiential thinking into creationist texts (II–III).
3. It would be of benefit for both sides of the creationist–evolutionist debate to assess systematically fallacies and experiential thinking, and not only the scientific aspects of

creationist writings. With this method the emotional debate on creationism/evolution could concentrate on the actual science (I–III).

4. Using scientific data to prove religious views without recognition of experiential thinking can lead to fallacious argumentation and careless theology in YEC and ID/OEC²⁵⁰ (IV).

²⁵⁰ OEC has mostly been superseded by the various forms of ID, for which reason OEC *per se* was not included in the analyses.

4 *Materials and Methods*

4.1 SAMPLED TEXTS

4.1.1 Creationist authors

Creationist authors²⁵¹ of high visibility and/or influence on the creationist theory were selected for analysis. Creationist texts in book format were chosen to represent both YEC and ID/OEC and a relatively long time period from the early 1970s to 2013 in order to gain insight into the possible changes of creationist theory over time. In addition to English-language texts, some Finnish authors with high local visibility were selected for analysis in order to include a Finnish perspective and to assess whether the claims and argumentative strategies of creationists are shared across language barriers.

Henry M. Morris (1918–2006) was a hydraulic engineer who started his career as a writer in the early 1960s with *The Genesis flood* (with John Whitcomb)²⁵². In this early book, he used his knowledge of hydraulics to justify the literalness of Noah's flood. Altogether, Morris wrote more than 60 books, most of which were opposed to evolutionary theory. In the early 1970s, he wrote his perhaps most influential works: *The remarkable birth of planet earth* (1972) and *Scientific creationism* (1974), which were chosen as the principal sources of analysis regarding Morris's work. Morris was a YEC proponent, who believed in the six-day literal creation and literal global flood. He coined the term "creation science" to describe his method of utilizing scientific data and alleged discrepancies as proof for creation. Morris's approach to evolutionary theory was clearly stated in his own words: "The final and conclusive evidence against evolution is the fact that the Bible denies it."

Pekka Reinikainen (born 1947) is a Finnish YEC proponent. He is a medical doctor and has worked both as a practicing physician and as a university teacher. He has written several books about evolution including the ones chosen for analysis: *The forgotten Genesis* (Unohdettu Genesis 1991), *Dinosaurs and the enigma of the Bible* (Dinosaurukset ja Raamatun arvoitus 2003), *Darwin or intelligent design* (Darwin vai älykäs suunnitelma 2011) and, in 2013, *Does God exist?* (Onko Jumala olemassa?). Reinikainen has given numerous lectures (with live audiences and on television) about creationism and evolution and participated in debates. In addition to his activities in the creationism–evolution debate, Reinikainen has actively criticized alternative therapies and remedies in book and article format²⁵³.

Michael J. Behe (born 1952) has a PhD in biochemistry and works as a biochemistry professor at Lehigh University, Pennsylvania, and as a senior fellow of the Discovery Institute's

²⁵¹ I have listed here particular YEC proponents in alphabetical order followed by significant ID/OEC theorists and various creationist organizations. Finally, oft-cited pro-evolutionary Internet sites are introduced.

²⁵² Schudel 2006.

²⁵³ Reinikainen 2013d, Wikipedia 2013.

Center for Science and Culture²⁵⁴. Behe is considered one of the most influential ID proponents and theorists. In his 1996 book *Darwin's black box: The biochemical challenge to evolution*, Behe introduced the concept of IC. In its original form the IC concept signifies that complex molecular structures or cascades could not have evolved naturally and if one takes away one part of an IC system, the whole system ceases to function. In *The edge of evolution* (2007), Behe attempted to calculate statistical odds for the possibility of mutations appearing at a rate that would be feasible for biological evolution. Although Behe is a tenuous ID proponent, he has refused to speculate on the identity of the "designer"²⁵⁵.

Phillip E. Johnson (born 1940) is a retired professor in law of the University of California, Berkeley. Johnson is considered one of the founders of the ID movement and the phrase "intelligent design" became widely known from his book *Darwin on trial* (1993). Johnson opposes methodological naturalism and would like to replace it with "theistic realism". He is also known for his "wedge strategy", an aggressive campaign by the ID movement to introduce supernatural into the public's understanding of science²⁵⁶. Johnson himself has described the strategy as follows²⁵⁷: "Our strategy has been to change the subject a bit, so that we can get the issue of intelligent design, which really means the reality of God, before the academic world and into the schools." In addition to *Darwin on trial*, Johnson's 1995 book *Reason in the balance: The case against naturalism in science, law & education* was analyzed in this work.

Tapio Puolimatka (born 1953) is a Finnish university professor of pedagogics²⁵⁸. He has PhD degrees in pedagogics and social/political sciences. In addition to his academic career, Puolimatka has published two locally influential works about evolution that were chosen for the analysis: *Faith, science and evolution* (Usko, tie ja evoluutio 2009²⁵⁹) and *A test of openness in science discussion* (Tiedekeskustelun avoimuuskoe 2010). Puolimatka criticizes in these books especially the "naturalistic demarcation criteria"—the exclusion of supernatural explanations from natural sciences²⁶⁰. Although Puolimatka does not explicitly state his relation to the creationist–evolutionist debate, an analysis of his texts links him most closely with ID/OEC²⁶¹.

4.1.2 Creationist organizations, journals and other texts

In addition to texts in book format, there are several creationist (both YEC and ID) organizations that publish creationist material in journals and Internet sites. **Answers in Genesis** (AiG; Hebron, Kentucky, established in 1994²⁶²; original organization established in Australia in the 1970s) currently has offices in the United Kingdom and the USA²⁶³. AiG had a total revenue of

²⁵⁴ NNDB 2013. Discovery Institute is a U.S. (Seattle) based think tank that promotes ID. The Institute has participated in several legal campaigns to promote ID in school curricula.

²⁵⁵ Behe 2007.

²⁵⁶ Pennock 2003.

²⁵⁷ Nickson 2004.

²⁵⁸ Puolimatka 2013.

²⁵⁹ The analysis is based on the 2nd edition in 2009.

²⁶⁰ Puolimatka 2009, 2010.

²⁶¹ Nieminen 2012.

²⁶² Charity Navigator 2013a.

²⁶³ www.answersingenesis.org.

\$19,370,417 in 2011²⁶⁴. It represents YEC and its mission is to “relate the relevance of a literal Genesis to the church and the world today with creativity”. AiG publishes the journals *Answers Research Journal*, *Answers Magazine* and *Kids Answers*. AiG also maintains the *Creation Museum*²⁶⁵ (Petersburg, Kentucky) and is in the process of building a “1:1 replica of Noah's ark”. AiG also has cooperation with a private evangelical university, the Liberty University (Lynchburg, Virginia)²⁶⁶ with enrollment at 64,096 in 2012–2013²⁶⁷. The University has an obligatory class of creation science²⁶⁸ required for all students, including biology majors, and two other courses related to creation science²⁶⁹. The annual federal financial aid for the University was \$445 million in 2010²⁷⁰.

Creation Ministries International (CMI) is a YEC organization that has offices in Australia, Canada, New Zealand, South Africa, the United Kingdom and the USA. CMI has mission statements similar to those of AiG and the two organizations share common descent²⁷¹. CMI publishes the journals *Creation* and *Journal of Creation*²⁷². No revenues of the US/Australian/New Zealand/South African/UK CMI were publicly available at the time of the writing of this thesis. However, the Canadian branch reported a revenue of CAD 579,542 in 2010²⁷³.

Institute for Creation Research²⁷⁴ (ICR) was founded by H.M. Morris in the 1970s and the organization is one of his legacies to creationism. ICR considers itself to be “a leader in scientific research within the context of biblical creation”. ICR is a YEC organization that concentrates on conducting research on the young age of the earth, including studies on

²⁶⁴ Charity Navigator 2013a.

²⁶⁵ The museum is similar to museums of natural history in its exhibits, such as dinosaur models, but the explanations about the exhibits are Biblical according to the AiG mission and Statement of Faith.

²⁶⁶ AiG 2007b; Ham 2009a.

²⁶⁷ Forbes List 2013.

²⁶⁸ <http://www.liberty.edu>. The University has a *Center for Creation Studies* that organizes the classes. “The center seeks to equip students to defend their faith in the creation account in Genesis using science, reason and the Scriptures.” In addition to Liberty University, AiG recommends 54 other Bible Institutes, Universities & Colleges and Seminaries that “have affirmed in writing their personal agreement with AiG’s statement of faith” (AiG 2013ab). AiG also recommends parents and prospective students to utilize an “Institution Questionnaire” that helps one “to discern if the institution is truly biblical or not” (Hodge 2013). The listed institutions include several that give tuition in biology, geology and other natural sciences based on the YEC doctrine.

²⁶⁹ Liberty University 2012, 5. In this 2012–13 Undergraduate Catalog (Doctrinal position) it is stated: “We affirm that all things were created by God. Angels were created as ministering agents, though some, under the leadership of Satan, fell from their sinless state to become agents of evil. The universe was created in six historical days and is continuously sustained by God; thus it both reflects His glory and reveals His truth. Human beings were directly created, not evolved, in the very image of God.” Requirements of taking the creation science classes can be found on pp. 111–112 of the Undergraduate Catalog. On the Forbes List (2013) of America’s top colleges, Liberty University was 636/650 on 1 July 2013.

²⁷⁰ Pareene 2011.

²⁷¹ AiG is actually a spin-off of the originally Australian CMI. The separation led to lengthy financial and legal disputes that were settled in 2009. However, the YEC doctrines of both organizations have remained very similar.

²⁷² *Creation* is a magazine that is more popularized than the *Journal of Creation* (formerly *Creation ex Nihilo Technical Journal*), which is more “technical” and requires some scientific knowledge on the part of the reader.

²⁷³ Open Charity 2013. <http://www.opencharity.ca/charity/118878891RR0001>.

²⁷⁴ www.icr.com.

radiometric dating and “flood geology”. ICR publishes the journals *Acts & Facts* and *Days of Praise* as well as *Impact* articles that are published in the Internet²⁷⁵. ICR has published the “Principles of Scientific Creationism”, which are quite similar to the Statements of Faith by AiG and CMI and concentrate on the literal interpretation of Genesis²⁷⁶. In addition to the publications of AiG, CMI and ICR, their Mission statements and Statements of Faith were also used for analysis to assess the theological implications of the YEC worldview. In 2011, ICR had an annual revenue of \$6,172,280²⁷⁷.

UK Apologetics (UKA) is an organization founded by Robin A. Brace in 2001²⁷⁸. The founder aimed to establish an “internet-based Christian ministry”. The website contains a subdivision called “Challenging evolution”²⁷⁹ that concentrates on articles promoting YEC. Many articles are shared by CMI, which is advertised on the UKA homepage. Similar to the other analyzed YEC organizations, UKA has issued a Statement of Faith²⁸⁰. The most relevant passages in the Statement regarding the creationist–evolutionist debate are about the literal interpretation of OT: “The Bible, in its original form, is in its entirety the Word of God and is fully reliable in fact and doctrine”. UKA also has original articles (especially by Brace) that were used as sample material for the present study. No information on the budget or revenue of the organization was available.

In contrast to YEC organizations, ID proponents have not issued clear statements of faith. Among influential ID organizations, **The Intelligent Design and Evolution Awareness (IDEA) Center** promotes ID theory and publishes online articles mainly authored by Casey Luskin²⁸¹. The annual revenue of IDEA was \$54,000 in 2012²⁸². **Intelligent Design Network Inc. (IDN)** emphasizes its goals as follows: “We promote the scientific evidence of intelligent design because proper consideration of that evidence is necessary to achieve not only scientific objectivity but also constitutional neutrality”²⁸³. IDN also publishes online texts mainly written or co-authored by John H. Calvert²⁸⁴. The last reported annual revenue of IDN was \$9,700²⁸⁵. **The Discovery Institute (DI)** is an ID organization that, in addition to debating scientific issues, also concentrates on other aspects of society and the debate of religious *vs.* “materialistic” culture²⁸⁶. The most prominent fellows in its Center for Science and Culture are, in addition to Behe, *e.g.*, William A. Dembski²⁸⁷ and Richard Weikart²⁸⁸. In 2010, the total revenue of DI was \$4,323,149²⁸⁹.

²⁷⁵ Especially the *Impact* articles were used for analysis.

²⁷⁶ ICR 2013.

²⁷⁷ GuideStar 2013.

²⁷⁸ <http://www.ukapologetics.net/>.

²⁷⁹ UKA 2013a.

²⁸⁰ UKA 2013b.

²⁸¹ <http://www.ideacenter.org/>; IDEA 2013a. Luskin has degrees in science and law and he has participated in both scientific and legal aspects of the creationist–evolutionist debate (IDEA 2013b).

²⁸² FindTheCompany 2013.

²⁸³ <http://www.intelligentdesignnetwork.org/index.htm>.

²⁸⁴ IDN 2013a. Calvert is a lawyer and also has a BA in geology. He was the managing director of Intelligent Design network in 2013 (IDN 2013b).

²⁸⁵ Faqs.org 2013.

²⁸⁶ <http://www.discovery.org/>.

²⁸⁷ Dembski is the pioneer of combining information theory to ID with his concept of “specified complexity” (1998).

4.1.3 Sampled evolutionist texts

Although the emphasis of the present study was on creationism, selected evolutionist texts were also analyzed for comparison, regarding the analysis of argumentation, fallacies and experiential thinking. The major part of evolutionary research is published in peer-reviewed journals, but several evolutionary proponents have also participated in the creationist–evolutionist debate in book and article format. These are the articles that mostly contain rebuttals of particular creationist claims on natural sciences. For this reason, peer-reviewed scientific papers were not included in the analyses.

The sampled evolutionist texts derive from the 1980s to the present day. In book format, **Willard Young's** *Fallacies of creationism* (1985) was chosen due to its systematic way of assessing most available creationist claims in detail. Other notable evolutionary proponents were included as selected examples of, *e.g.*, a certain argumentative fallacy.

In addition to books, oft-cited and highly visible evolutionists' Internet sites refuting creationism were sampled for analysis. **The TalkOrigins archive** is a "usenet newsgroup devoted to the discussion and debate of biological and physical origins"²⁹⁰. The site concentrates on frequently repeated creationist (YEC and ID) claims about evolutionary theory and provides rebuttals that represent the mainstream scientific views on the issue. **The Panda's Thumb** is a similar newsgroup and discussion forum that has actively refuted creationist claims with detailed online articles²⁹¹. Rebuttals and texts of these organizations were analyzed not for the actual scientific content but for possible argumentative fallacies and experiential thinking patterns. In addition, literature searches located other relevant evolutionist texts that were included in the analyses, such as particular Internet articles, magazine and journal articles, *etc.* No information on the budgets or revenues of the organizations was available.

4.2 ANALYSES

4.2.1 Analysis of argumentation and fallacies (I–III)

Argumentation was regarded as fallacious, if the arguments for a writer's position regarding the validity of evolutionary theory included appeals to personal characteristics, authority, *etc.*, based on the theory of fallacies (I). The writer's position within the creationist–evolutionist debate was assessed according to the writer's statements or opinions and classified as YEC, ID/OEC or evolutionary proponent. The context of the arguments was also assessed, *i.e.*, it was analyzed whether the arguments that were considered fallacious (*ad hominem*, appeals to consequences, false dilemmas, *etc.*) were presented in the same text (article, journal issue, book) that also contained material about the scientific aspects of the debate. Arguments were thus

²⁸⁸ Weikart has been active in his writings on the alleged moral consequences of evolutionary theory, especially in his 2004 book *From Darwin to Hitler: Evolutionary ethics, eugenics, and racism in Germany*.

²⁸⁹ Charity Navigator 2013b.

²⁹⁰ <http://www.talkorigins.org/>.

²⁹¹ <http://pandasthumb.org/>.

considered fallacious if they were irrelevant when discussing the actual scientific proof for or against evolution. In natural sciences, support for hypotheses is ultimately based on observational evidence, statistical procedures and their interpretation. To summarize, the present analysis of the texts included analyses of individual statements, arguments and their context. The actual analysis (I, III) included several aspects as follows:

- Source criticism of a “scientific claim” (*e.g.*, all animal forms appeared simultaneously and clearly separately in the Cambrian explosion²⁹²).
- Assessment of whether the claim has been refuted by scientists and whether the rebuttal is scientifically valid.
- Analysis of whether the claim contains fallacies, *i.e.*, some of the arguments used for the justification of the claim do not actually provide proof for or against evolution (*e.g.*, discussing the character of a scientist)²⁹³.
- Analysis and classification of the fallacies.
- Analysis of the context of the fallacy and assessment of whether it can be relevant in the context of creating false beliefs in the audience.
- For comparison, similar analyses were conducted on selected evolutionist claims against creationism.

The analyses did not attempt to prove creationist or evolutionist theories “true” or “false” but to assess whether creationists present a valid case against evolution and whether their evidence material is relevant regarding the falsification of evolutionary theory.

4.2.2 Analysis of experiential thinking and its connections to fallacies (II–III)

The analysis of aspects of experiential thinking was based on previous reports on the subject (reviewed in II). The most discernible aspects of experiential thinking were classified as follows:

- Experiential thinking uses personal experience (the subjects’ own experience or experiences of others) as the principal tool to assess data. The experience can take the form of, *e.g.*, testimonials, narratives and metaphors. From the viewpoint of natural sciences, these are not considered adequate forms of proof for or against a theory.
- Confirmation bias signifies that a person seeks information consistent with existing beliefs. In contrast, contradictory or null information tends to be disregarded.
- Pseudodiagnosics is present when irrelevant information is presented as pivotal to the issue (such as disproving evolution).
- Experiential thinking tends to give neutral issues (such as a theory in natural sciences) moral significance.
- Experiential thinking leads to opinions that are not prone to reassessment but are highly resistant to change.

²⁹² *E.g.*, Wieland 1994; Puolimatka 2009, 230; Woetzel 2009; Woodmorappe 2009; Reinikainen 2013c.

²⁹³ For the use of a similar method of argumentation to justify military intervention see Sahlane 2012.

The analysis of the selected texts regarding experiential thinking was basically similar to the analysis of argumentation. It included assessment of a claim and its scientific validity and subsequent analysis examining whether the claim was presented with arguments that could reflect experiential thinking. In addition, an analysis was made of whether the aspects of experiential thinking had similarities to the argumentative fallacies. This allowed an assessment of whether the classification of fallacies and that of experiential thinking could have overlap, *i.e.*, whether the same argument could be assessed to be both fallacious and to contain features of experiential thinking. Both creationist and pro-evolutionary texts were analyzed in the same manner.

4.2.3 Constructing a method for systematic analysis of creationist claims (III)

In order to combine the analyses of scientific claims, argumentation and experiential thinking and their context, selected examples of oft-repeated creationist claims were assessed for article III. In this case, it was assessed whether the potential features of experiential thinking present in a single piece of writing could be linked to possible fallacies in the same text. To present the results in a compact form, the analyses were combined and presented in table format. This yielded a systematic procedure to assess scientific claims regarding evolution or creationism.

4.2.4 Analysis of theological aspects of YEC and ID/OEC (IV)

Basically, the analysis of theological aspects in creationist writings did not differ significantly from the analyses of fallacies and experiential thinking. The work began by identifying the arguments against evolution or in favor of creationism. Subsequently, the arguments were analyzed for explicit theological statements, such as those present in the Statements of Faith of creationist organizations. In addition, more concealed theological implications were searched for (*e.g.*, defining the identity of the alleged “designer” in ID). The utilization of scientific results by creationists was also assessed in the context of its possible ramifications in theology. Finally, an assessment was made of the possible theological implications of the scientifically fallacious arguments about evolutionary theory, such as *ad hominem*.

For the theological analysis, the claims and arguments in creationist texts were classified under specific topics of systematic theology: God, revelation and bibliology, theodicy, christology, soteriology, ecclesiology and, to a lesser degree, anthropology, eschatology and sacraments. The texts were analyzed for the presence of arguments with ramifications to these topics and the results were presented in table format. The results of the analysis (= creationist doctrine) were compared to major Christian nominations in order to assess whether the creationist doctrine is contained within the Christian worldview or whether there are implications of divergence.

4.2.5 Statistical analyses (I–II)

The prevalences of selected fallacies (I) and aspects of experiential thinking (II) were calculated by documenting the occurrence of fallacies or experiential thinking aspects in the cited sample texts. Multiple occurrences within a particular reference were not recorded due to the very large

differences in text length (*e.g.*, single-page articles *vs.* books). The texts were classified as YEC, ID/OEC or pro-evolutionary and the distribution of prevalences was analyzed with the χ^2 test or, if the test criteria were not met, with the Fisher's exact test using the SPSS v19.0 program (IBM, Armonk, NY, USA). It must be emphasized that the texts were not randomly selected but chosen in order to include the most commonly-occurring creationist claims and their rebuttals. Thus, the results of the statistical analyses are not necessarily directly applicable to other texts on the creationist–evolutionist debate. The results are presented as the percentage of texts within a category (YEC, ID/OEC or pro-evolutionary) that contained at least one occurrence of a fallacy or an aspect of experiential thinking. The p value <0.05 was considered statistically significant.

5 Results and Discussion

5.1 ARGUMENTATION

5.1.1 Fallacies in creationist texts (I)

Fallacious argumentation was very prevalent in the sampled writings. The fallacies with the highest prevalence (100%) were *tu quoque* in ID/OEC, appeals to authority (88%) in YEC and *ad hominem* and *tu quoque* (both 56%) in pro-evolutionary texts. The prevalence of direct *ad hominem* did not differ between the classifications (YEC, ID/OEC or pro-evolutionary) but the prevalences of the other fallacies were generally lower in the analyzed pro-evolutionary texts ($p < 0.05$). ID/OEC had a higher prevalence of *ad ridiculum* compared to the other text types ($p < 0.001$).

Regarding *ad hominem*, the principal YEC sources contained several oft-repeated accusations against evolutionary proponents, especially Darwin. He was portrayed as racist²⁹⁴, cowardly²⁹⁵, sadist²⁹⁶, unqualified²⁹⁷, mentally unstable and possibly psychotic²⁹⁸, male supremacist²⁹⁹ and a result of inbreeding³⁰⁰. In the ID/OEC writings, these aspects were not as visible. Some exceptions to this included more subtle *ad hominem* arguments, such as referring to Darwin's education as a "theologian" wishing to live his life as "a rural priest"³⁰¹ and placing him in an anachronistic situation by accusing him of not condemning the destruction of primitive races (also the *ex silentio* argument)³⁰².

While living evolutionary proponents were not as directly attacked, some cases of direct *ad hominem* were observed. For example, many scientists and philosophers were accused of atheism³⁰³, which would not necessarily be a character fault in the countries of Western or

²⁹⁴ Brace 2006.

²⁹⁵ Brace 2006.

²⁹⁶ Bergman 2005.

²⁹⁷ Brace 2006. Also Puolimatka 2009, 16. "The first-hand research material of Darwin was limited to evolutionary changes especially in the finches of the Galapagos Islands." This is, furthermore, incorrect, as Darwin personally collected samples of, e.g., South American fossils, birds and beetles (see, e.g., Steinheimer 2004). Evolutionary scientists in general are also portrayed to be dishonest (Morris 2006).

²⁹⁸ Bergman 2004.

²⁹⁹ Bergman 2007.

³⁰⁰ Brace 2006.

³⁰¹ Puolimatka 2009, 27. For Darwin's education (including medicine, natural history and botany), see, e.g., Ranta 2011, 14–18.

³⁰² Puolimatka 2009, 22. The accusation is anachronistic, as it places a historical figure in the framework of a modern concept of preserving primitive cultures. In addition, Darwin showed clear sympathy for, e.g., the demise of Australian aborigines and the New Zealand Maori (Darwin 1839, 322) and condemned the U.S. slavery much more harshly than most of his contemporaries (Darwin 1861). While both the accusations and the defense are obviously irrelevant to the actual scientific evidence for evolution, the habit of choosing only one-sided arguments on Darwin's character can be quite revealing when considering experiential thinking, especially the confirmation bias.

³⁰³ Johnson 1995, 91.

Northern Europe, but among the creationist audience there can be unfavorable opinions of atheists³⁰⁴ and, thus, this can also be classified as *ad hominem*. In addition to this, scientists whose material had been used to promote creationism had raised arguments against this type of re-interpretation of their data. These persons were criticized for dishonesty or for yielding to the consensus opinion of the majority of natural scientists³⁰⁵.

The *tu quoque* also occurred frequently. Here the opponent (in this case the evolutionist) is judged erroneous based on his/her past writings or actions³⁰⁶. This type of argument occurred repeatedly in the sample material in the form of quotes of evolutionists claiming problems in evolutionary theory or alleged affirmations of evolutionary theory collapsing. In a similar manner, evolutionary theory was often presented as religion instead of being based on evidence³⁰⁷. A quote that occurred very often was that of Stephen Jay Gould: “The extreme rarity of transitional forms in the fossil record persists as the trade secret of paleontology”³⁰⁸. Another often occurring citation was that of Niles Eldredge: “We paleontologists have said that the history of life supports that interpretation [gradual change], all the while really knowing that it does not”³⁰⁹.

Still another subtype of *ad hominem* is the poisoning the well fallacy, which, according to Douglas Walton, is very significant, as it violates the future right of the opponent to present argument on the issue³¹⁰. Thus, it is “a way of discrediting whatever the source says in the future”. In the sample material, poisoning the well was observed when creationists (both YEC and ID/OEC) dismissed the rebuttal of creationist claims by stating that scientists would not consider supernatural explanations in any case³¹¹. Thus, it was implied that it is not evidence, but the naturalistic worldview that prevents scientists from accepting the creationist argument. Also related to the *ad hominem* are appeals to authority. In the sample material, those in favor of creation or opposed to evolution were often mentioned with authoritative merits³¹². Appeals to authority can also take the form of referring to unknown authorities (scientists) who are allegedly in doubt about evolution³¹³. The appeal to unknown authorities was also combined with the appeal to consequences, for instance, by Jerry Bergman: “Numerous scientists have noted that one result of the general acceptance of Darwinism was the acceptance of the belief

³⁰⁴ Zuckerman 2009.

³⁰⁵ An example is the case of Mary Schweitzer and “dino blood” (e.g., Wieland 1997). Instead of “blood”, Schweitzer et al. (1997, 2005) discovered some remnants of soft tissues after demineralization of fossils, and fragments of heme, a substructure of hemoglobin (see also Schweitzer and Staedter 1997). Schweitzer has openly criticized the use of her findings as proof for YEC theories (Fields 2006). This has led to accusing her of not being “a true evangelical Christian” (Catchpoole and Sarfati 2006) and of dishonesty under peer pressure (Reinikainen 2003, 117). The creationist interpretations have also been heavily criticized by evangelicals (Moore 2011a–c).

³⁰⁶ Sahlane 2012.

³⁰⁷ Morris 2001.

³⁰⁸ Johnson 1993, 43; DeMar 2002; Puolimatka 2009, 419–422.

³⁰⁹ Eldredge 1985, 144. Puolimatka (2009, 419–422) quotes Eldredge without accurate references. For the uncited quotes and emerging creationist canon, see below.

³¹⁰ Walton 2006.

³¹¹ E.g., Harris and Calvert 2003; Leisola 2012.

³¹² This can take the form of introducing the persons quoted as “Nobel-prize winners” (Reinikainen 2011, 81) or introducing well-known historical scientists as proponents for Christianity and creationism (Morris 1982; Kay 2006; Puolimatka 2009, 368–369).

³¹³ Morris 1972, iv; Davis and Kenyon 1993; Luskin and Gage 2008.

that humans 'are accidental...' and humans are not 'the *raison d'être* of the universe' as all theistic religions teach...³¹⁴ [leading to life having allegedly no purpose].

Character assassination of evolutionary theory was analogous to the *ad hominem* claims against Darwin's character. These *ad consequentiam* and guilt by association fallacies were very common in both YEC and ID/OEC texts of the sample material. Most often, these arguments associated (the acceptance of) evolutionary theory to Nazism, Stalinism, mass murders, eugenics, abortions, immorality, *etc.*³¹⁵ Such arguments can be regarded as fallacious when considering the scientific merit of evolutionary theory (or the creationist theories), as it is the actual evidence that determines the validity of a theory. In some cases, this took the form of slippery slope arguments that associated evolutionary theory via allegedly logical steps to eugenics and genocide³¹⁶. Criticism against the use of the guilt by association fallacy was refuted by the ID/OEC supporter Puolimatka³¹⁷, who argued in favor of associating evolutionary theory with Hitler as follows: "Those who present this type of critique would not certainly want to say that it would not be rational to study the factors that participated in taking Hitler and the national socialist Germany to atrocities". This is a valid argument when assessing the reasons behind historical events, including genocide. However, if the issue is associated with discussing the validity of evolutionary theory (as interposed in the same book), it becomes a fallacy³¹⁸. In addition, it has been argued that the character of a respondent (such as using character witnesses in a court of law) would be important when assessing the reliability of a witness³¹⁹. It is, thus, possible to suggest that a similar approach would not be fallacious when applied to the case of proving or disproving evolution. Johnson does, in fact, use this type of narrative³²⁰ in his book *Darwin on trial*. However, even in the context of a court case, the character of Darwin or the possibility of evolutionary theory being used as rationalization for atrocities is irrelevant when assessing whether there is ample proof for evolution. Thus, this potential defense fails and the *ad hominem*, *ad consequentiam*, *etc.* remain fallacious in the scientific context³²¹.

³¹⁴ Bergman 2001.

³¹⁵ Several examples are listed above. The claim is also poorly supported, as alternative hypotheses for the rise of totalitarianism exist. For instance, Stalin (1907) condemned Darwinism (as it did not endorse revolution) and Hitler (1936, 70) rationalized his ideas by appealing to divine authority: "So glaube ich heute im Sinne des allmächtigen Schöpfers zu handeln: indem ich mich des Juden erwehre, kämpfe ich für das Werk des Herrn." See below for confirmation bias as an aspect of experiential thinking that dismisses or ignores alternative hypotheses. In addition, evolutionary theory is considered "depressing" (Nickson 2004) and an obstacle to fulfillment of life (Puolimatka 2010).

³¹⁶ Bergman 2005; Brace 2006; Puolimatka 2009, 477.

³¹⁷ Puolimatka 2010, 469.

³¹⁸ It would be interesting to ponder whether the recognition of the invalidity of the Hitler card regarding proofs for or against evolutionary theory by the creationist author would make the association not fallacious. However, the concept of guilt by association does not include or demand direct claims in the explicit form of "evolution was used as a basis for Nazism, therefore evolutionary theory is false". On the contrary, it is the association that is fallacious, as it presents the issue (evolution) in an unfavorable light in the context of its validity. An example is the book title *From Darwin to Hitler* (Weikart 2004).

³¹⁹ See also Yap 2013.

³²⁰ See also below for aspects of experiential thinking. Johnson (1993) is, also by its title (*Darwin on trial*), a narrative of "suing Darwinism", by using witnesses (testimonials, *etc.*) and the court case as a metaphor for the creationist–evolutionist debate.

³²¹ Yap 2013.

Appeals to fear and/or force (*ad baculum*) were present when (YEC) writers took the acceptance of evolutionary theory as being inconsistent with Christianity³²² and warned of dire consequences if the literal interpretation of Genesis were discarded³²³. The *ad baculum* was sometimes accompanied with *ad misericordiam*, of which there were several examples³²⁴. Mostly, the *ad misericordiam* arguments were anecdotal stories of creationists or critics of evolutionary theory being denied academic positions or publishing in scientific journals³²⁵. Regarding the validity of evolutionary theory, it is of no significance if these anecdotes are true (which they may well be) or false. Again, as they do not discuss the actual scientific evidence, they are fallacious when considering the potential proofs against evolution.

When claiming that evolutionary theory would not have explanations for a debated scientific issue, creationist authors argued with the *ad ignorantiam* fallacy³²⁶. Quite often the sampled writers appealed to unresolved issues as proofs against evolutionary theory³²⁷. Obviously, the fact that one theory does not have the specific answers to questions regarding, e.g., abiogenesis or the possible state of the space-time continuum before the Big Bang, does not mean that another theory would be automatically correct. Related to the *ad ignorantiam* is the argument from incredulity. For example, in 1972, Morris appealed to personal disbelief and described evolutionary theory as “mindless reasoning” and “hard to imagine”.

When assuming that a complex issue can be described as a choice between two alternatives from which an audience has to choose from, one commits the fallacy of false dilemma. In the sampled creationist texts this was exemplified, for example, when presenting creation as the only option in the face of isolated problems with evolutionary theory or hypotheses concerning abiogenesis³²⁸. False dilemmas also appeared relatively frequently when creationist authors discussed the supposed consequences of accepting evolutionary theory by stating that if the creation model were true, people would be treated accordingly as the image of God, but if evolution were accepted, everybody could do whatever one pleases³²⁹. The meaning of life is also simplified into a false dilemma: belief in literal creation gives life meaning and its rejection makes life meaningless³³⁰.

Straw man arguments distort the opponent’s message into a form that can be more easily attacked³³¹. The fallacy comes principally in two forms, of which the “hollow man” type

³²² See also original publication IV.

³²³ International Council on Biblical Inerrancy 1978.

³²⁴ Johnson 1993; Harris and Calvert 2003; Puolimatka 2009, 28–34; Reinikainen 2011, 15.

³²⁵ Morris 1998.

³²⁶ Walton 1999a, Curtis 2001.

³²⁷ In some cases in the sample material, the *ad ignorantiam* was simultaneous with the *many questions* fallacy (Walton 1999c), where arguments are presented as lists of questions (which, in the case of the present study, evolutionary theory supposedly would not be able to answer). For instance, Reinikainen (2011, 24–25) presented a long list of questions “that high school students are [allegedly] not allowed to discuss during lessons”.

³²⁸ Reinikainen 2011: “The RNA world did not resolve this problem. Thus, only creation is left as an option.” Obviously, other options do exist including time-travelers, unknown entities and space aliens as illustrated by Behe (2001), etc. In addition, scientific treatises of the RNA world disagree with creationists (Gilbert 1986).

³²⁹ Reinikainen 1991, 56. Creationists are in these cases, *de facto*, dismissing discussion about the autonomy of ethics (e.g., Brink 2007; Weisberger 2007).

³³⁰ Morris 1974, 178.

³³¹ Aikin and Casey 2011.

was more commonly encountered in the sample material³³². For example, the complex concept of natural selection was distorted into a simplified struggle for survival that would also (from the alleged evolutionists' point of view) automatically lead to morally questionable behavior towards fellow human beings³³³.

Hasty generalizations are fallacies, in which conclusions are made based on too limited sources³³⁴. Generally, the overall tendency in the sampled texts was that creationists used to present one isolated problem or an unsolved issue in evolutionary theory and concluded that the one issue would make the whole concept and theory of evolution collapse. For instance, the astronomical findings regarding the heat flux of the planet Uranus³³⁵, the >30% difference between human and chimpanzee Y chromosomes³³⁶ and the alleged finding of soft tissues from *Tyrannosaurus rex* bones³³⁷ were all individually interpreted as adequate counter-evidence to disprove the whole evolutionary theory³³⁸ (and to prove the YEC worldview).

Equivocations entail the use of words or concepts in an ambiguous manner in a debate resulting in unclarity³³⁹. Typical equivocations in the sampled texts use the words "theory"³⁴⁰, "Darwinism"³⁴¹, "chance" and "randomness"³⁴². In addition, the sample material revealed particular conceptual equivocations of potentially high significance when considering the persistence of the creationist case. In several works, both YEC and ID/OEC, the concepts of ancestors and transitional forms were discussed in a manner that revealed confusion about the evolutionary definitions of these concepts³⁴³. In these cases, especially when discussing the

³³² The "weak man" type of argument selects the weakest points from the opponent's argumentation while knowing that stronger ones would exist. The "hollow man" argument fabricates a distorted argument from the original one by the opponent and attacks the distortion (Aikin and Casey 2011).

³³³ Grigg (2005) gives a good example of this by writing: "The core idea of Darwinism is selection. The Nazis believed that they must direct the process of selection..." Other Christian approaches to evolutionary theory are also given the straw man treatment, for example, by Reinikainen (2011): "According to TE, God allowed the weak to perish and favored the survival of the strong for billions of years." Both the concept of natural selection and the theology among TE supporters are much more complex and the simplifications do not do either of them justice.

³³⁴ Walton 1999b. See also below for confirmation bias as an aspect of experiential thinking.

³³⁵ Henry 2001; Psarris 2002b.

³³⁶ The original paper by Hughes et al. (2010) examined not the whole genome but only the Y chromosome. This has gradually been equivocated by creationists to signify the whole genome. Carter 2010; Deem 2010; Reinikainen 2011, 9, 23; Brown 2013; Thomas 2013. For scientific discussion on human and chimpanzee evolution, see Bakewell et al. 2007.

³³⁷ Reinikainen 2013ab.

³³⁸ Reinikainen 2013a.

³³⁹ van Eemeren and Grootendorst 1992.

³⁴⁰ The statement "evolution is just a theory" has become almost a classic. Creationists refer to the concept of something hypothesized but unproven (Sarfati 2013c) and natural scientists to the concept of a well-proven combination of facts with explanatory power over an issue.

³⁴¹ In the sample material, this appears as the equivocation of social Darwinism with Darwinism (e.g., Bergman 1999, 2012).

³⁴² When referring to chance, creationists in the sample material equivocate random mutations as being the only factor that creates evolution (Reinikainen 2011, 31), thus equivocating evolutionary theory to random events. This overemphasis on chance is also straw man argumentation.

³⁴³ Reinikainen 1991, 236–244; Johnson 1993, 66; Davis and Kenyon 1993, 37–38; Brown 2013. The authors discuss the cytochrome c DNA sequences of various organisms (McLaughlin and Dayhoff 1973) but fail to

evidence for evolution derived from molecular biology, ancestors (such as ancestral amphibians) were equivocated to present-day organisms. Creationist authors failed to recognize that the living amphibians are not any closer to the common ancestor of amphibians and mammals than present mammals are. The same takes place when considering transitional forms. Creationists sought transitional forms that are in-between present-day forms and not the actual ancestral points of divergence that did not necessarily bear close resemblance to the modern forms of either branch³⁴⁴.

5.1.2 Fallacies in evolutionist texts (I)

Not dissimilar to creationist writings, *ad hominem* also appeared in pro-evolutionary publications³⁴⁵. In particular, the credentials of creationists as qualified participants in the debate about evolutionary evidence were questioned. Furthermore, *tu quoque* was observed in the context of refuting creationist claims. A typical example was to mention—when evolutionary proponents or evolutionary theory were accused of being responsible for various atrocities—that Christianity has also been responsible for evil³⁴⁶.

Appeals to authorities in the sampled texts of evolutionary proponents mostly discussed the potential significance of introducing creationism (in the form of ID) in classrooms. Decisions by authorities certainly can be valid arguments when considering whether particular items belong to school curricula. However, appeals to authorities when refuting creationist claims from the scientific point of view can make them fallacious in that context. The authorities included appeals to laws³⁴⁷ or court cases³⁴⁸ as additional arguments against creationism. In these instances, it would be prudent to acknowledge clearly that appealing to court cases is not intended to disprove creationism *per se*, as the scientific resolution of the creationist–evolutionist debate does not depend on lawsuits; the evidence should be assessed in the scientific community and not in court.

Appeals to consequences appeared in pro-evolutionary texts as warnings against accepting ID or other forms of creationism in school curricula. Mankind is seen as being on the brink of “a marvelous future, or disaster” and creationism is seen to lead to the latter³⁴⁹. In addition, the political consequences of creationism are represented as leading to overall religious fundamentalism in society³⁵⁰. Again, it is possible and worth discussing whether the adoption of the creationist worldview could be detrimental to scientific thinking and education,

realize that ancestral amphibians have also evolved since the divergence of mammalian and amphibian ancestors and, thus, their DNA has not been stagnant for hundreds of millions of years.

³⁴⁴ For instance, when discussing the fossil record for horse evolution, Reinikainen (1991, 145) would like to see transitional forms between present-day cows and horses and Puolimatka (2009, 173) “missing links” between humans and apes living at present as findings that would falsify creationism. See also below for more detailed discussion.

³⁴⁵ Dawkins 1989; Buchanan 2010, 2012.

³⁴⁶ E.g., TalkOrigins archive 2007: “The Bible Belt in the southern United States fought hardest to maintain slavery.”

³⁴⁷ TalkOrigins archive 2006.

³⁴⁸ TalkOrigins archive 2004.

³⁴⁹ Young 1985; this is also a false dilemma, as the future of the humankind can also be something in between the extremes.

³⁵⁰ Zimmerman 2010.

but the validity of the creationist case does not depend on its (alleged) consequences but on the evidence material.

5.1.3 The significance of fallacies in the creationist–evolutionist debate (I, III–IV)

The fallacies in the creationist writings occurred frequently in articles, journals and books that also discussed the scientific claims against evolution. Due to this, the reader inevitably encounters the fallacies while considering the validity of the “scientific claims” of creationists. For example, several of the articles published in creationist journals focused on refuting evolution based on data from natural sciences. However, the same articles also contained fallacious arguments regarding evolutionists, evolutionary theory or its alleged consequences³⁵¹. The same was true of the writings in book format, where the alleged scientific evidence against evolution was interposed with fallacies that focused on the character of evolutionary scientists (*ad hominem*)³⁵², their earlier writings that allegedly supported the creation model (*tu quoque*)³⁵³ or potential consequences of evolutionary theory (*ad consequentiam*)³⁵⁴ or slippery slope³⁵⁵. In addition, it was not always clear that the theological arguments of evolutionary proponents, such as referring to biological imperfections or unnecessary suffering as proofs against creationism, were not presented in the context of evolutionary evidence. The context of these theological claims has also been noted to be “evidence for evolution” in some other studies³⁵⁶. Because of this, it would be advisable for evolutionary proponents to express more clearly when actual evolutionary evidence is presented and when the potential theological problems of YEC and ID are being discussed.

Regarding the sample material, there are particular examples of equivocation that occurred in both YEC and ID/OEC texts. Perhaps the most significant of these regarding the creation of false beliefs by fallacies is the conceptual equivocation about “ancestors”. In evolutionary biology, ancestors are not mixtures of present life forms but, instead, (fossil) organisms that are transitional forms of the present-date lineages at the point of their divergence. Thus, the last common ancestor of cows and horses would not be a mixture of cow and horse characteristics but something different, a mammalian population that existed in the Cretaceous and gave birth to two lineages that were at the time not similar to modern cows or horses³⁵⁷. A related important equivocation is the creationist claim that “primitive life forms” (such as amphibians or fish in relation to humans) should be genetically closer to the common ancestors³⁵⁸. Although presenting this equivocation as a claim based on science, creationist authors have disregarded the fact that since the lineages of fish—amphibians—humans diverged, it is not only us humans but also the fish and amphibians that have evolved for exactly the same period of time, and their genomes have subsequently had the same amount of

³⁵¹ E.g., Brace 2004, 2006.

³⁵² E.g., Reinikainen 1991, 10, 12, 30, 32, 39, 56, 64; Reinikainen 2011, 12, 15, 26, 29–30, 42–44.

³⁵³ Reinikainen 1991, 66–70; Johnson 1993, 43–45; Puolimatka 2009, 419–421.

³⁵⁴ Morris 1972, 74–75; Reinikainen 1991, 10–11; Johnson 1995, 143–147; Puolimatka 2010, 462–477; Harker 2011.

³⁵⁵ Puolimatka 2009, 477.

³⁵⁶ Nelson 1996.

³⁵⁷ Zhou et al. 2012.

³⁵⁸ Johnson 1993, 66.

time to diverge from the last common ancestor. Furthermore, the common ancestor (often depicted as “bacteria” in creationist texts) has also evolved and its genes have been just as susceptible to change as those of its descendants.

When the creationist–evolutionist debate was considered as a whole, there was a tendency not only towards fallacies but also counter-fallacies in the sample material. In the evolutionist rebuttals, there were instances in which a fallacious argument (such as linking evolutionary theory to Nazism) was countered by linking Hitler’s background to Christianity³⁵⁹. Although the fallacious connection between racism and evolutionary theory was sometimes acknowledged by the evolutionist author (“none of this matters to the science of evolution”³⁶⁰), it can be argued that science has not been the main issue of the creationist–evolutionist argument for a considerable period of time. In the context of discussing the reasons for atrocities or the differences in worldviews, the above examples would not necessarily be fallacious. However, if we keep to the concept of evolutionary theory and its evidence, the fallacy remains.

In summary, regarding fallacies in creationist and evolutionist texts, it would be recommendable (I) also to assess the arguments and fallacies when reviewing creationist writings and not only to concentrate on refuting claims based on natural sciences. In addition, the mere recognition of a fallacy is not adequate: it is also necessary to examine the context, as arguments presented in a fallacious context can create or strengthen false beliefs³⁶¹. It is suggested that fallacies as creators of false beliefs can participate in the persistence of creationist claims for decades despite rigorous scientific rebuttals, as also observed by Stempien and Coleman³⁶². This can be supplemented by the cultural, sociological and cognitive disposals of the audience³⁶³ and, inevitably, also by religiosity³⁶⁴.

³⁵⁹ TalkOrigins archive 2008.

³⁶⁰ TalkOrigins archive 2007.

³⁶¹ Fogelin and Duggan 1987.

³⁶² Stempien and Coleman 1985.

³⁶³ Boudry et al. 2010.

³⁶⁴ Blancke et al. 2012.

5.2 EXPERIENTIAL THINKING AND CREATIONISM

5.2.1 Aspects of experiential thinking in creationist texts (II–III)

Almost all the sampled texts contained high prevalences of testimonials and inclusion of moral issues connected to proving either creationism or evolution. Although the pro-evolutionary texts had lower prevalences of confirmation bias, pseudodiagnostics and stereotypical thinking than the YEC and ID/OEC texts ($p < 0.001$), in the ID/OEC texts the prevalences of moral issues in connection with science tended to be lower ($p = 0.057$). Testimonials were abundant in the sample material (II). These appeared as follows³⁶⁵:

- Authors giving testimony for creationism or against evolution: “I think evolution is not plausible”³⁶⁶.
- Other authorities giving testimony for creationism or against evolution: “[An authority] says that evolutionary theory is flawed”³⁶⁷.
- Evolutionary scientists quoted to prove that evolutionary theory is flawed: “Even [an evolutionary biologist] says that evolutionary theory is in trouble”³⁶⁸.
- Giving testimony that evolutionary scientists or evolutionary theory are evil: “[A scientist] was racist and he formulated the evolutionary theory”³⁶⁹.
- Extracting selected scientific results to be used as testimony against evolution: “These [scientific results] prove that the earth is young”³⁷⁰.

The reliance on testimonials can be quite high in creationist texts. For example, in the sample material there are articles and book chapters that are mainly dedicated to quotes of evolutionary proponents allegedly confirming problems in evolutionary theory and, as a result, supporting (involuntarily) creation³⁷¹. In a rather extreme case, 61% of the text of an article (excluding titles, subtitles and references) consisted of direct quotes³⁷². When sentences of the type “N. N. wrote

³⁶⁵ The “quotes” are simplified examples of a particular testimony by the author of this thesis.

³⁶⁶ Morris 1972, iv: “I personally became convinced...”; Reinikainen 1991, 7: “I am a former atheist. My conviction was based on evolutionary theory.”

³⁶⁷ Morris 1972, iv: “Many other scientists [unnamed authorities] can give a similar testimony.”

³⁶⁸ A very common quote is as follows: “The extreme rarity of transitional forms in the fossil record persists as the trade secret of paleontology” (e.g., Johnson 1993, 44; Davis and Kenyon 1993, 96; originally in Gould 1980, 179–185).

³⁶⁹ E.g., Hodge 2007: “Mass murderer Jeffrey Dahmer, for example, lived his life believing evolution was true history...”

³⁷⁰ For instance, the (distorted) scientific finding of “dino blood” is considered “a deathly blow to evolutionary theory” (Reinikainen 2013a).

³⁷¹ DeMar 2002 (arguing with direct quotes that evolutionists admit evolution being a religion; see also *tu quoque*; Reinikainen 1991, 66–69; Bergman 1999 (43% of the article consists of quotes). Henry and Dyke (2011) give a good example of using quotes from evolutionary scientists as alleged admittance of lack of transitional forms in a *tu quoque* manner.

³⁷² Bergman 2010. The article contains approximately 4130 words (excluding titles, subtitles and references). Direct quotes (marked by quotation marks or indent) represent approximately 2510 words and the sentences leading to quotes (for example, “Oxford University Professor of the History of Science... concluded that...”) \approx 360 words, from which the percentages were calculated.

that..." were also included, only 31% of the text represented the personal work of the author (still including paraphrasing).

The use of narratives and metaphors in creationist writings was concomitant with claims regarding scientific issues. Johnson³⁷³ utilized the narrative of a court case (*Darwin on trial*) as the framework in his book refuting evolutionary theory. There are also many cases where creationist writers present anecdotal stories instead of scientific evidence in writings that also contain scientific issues. Common examples were (alleged) cases where creationist or ID-inclined scientists were forced to renounce their views based on peer pressure, their papers were rejected from scientific journals or they were excluded from academic positions³⁷⁴. Although these narratives may well be sincere and true, they do not represent actual scientific evidence. They can be quite relevant when discussing the policies of scientific journals or university recruiting but in the scientific context, in addition to being examples of experiential thinking, they represent the fallacy of *ad misericordiam*. Metaphorical language was present by associating the creationist–evolutionist debate with religious allegory: "Evolution is a lie. Just as Satan tempted Eve in the Garden of Eden with a lie resulting in sin and death, the lie of evolution is resulting in a continuation of the same things"³⁷⁵. Some texts refer to the debate metaphorically in terms of warfare or battle between the forces of good (creationism) and evil (evolutionary theory)³⁷⁶. For example, Jim Gardner wrote: "I believe creation versus evolution is the most foundational issue facing the church today... The battle is raging between Satan, the usurper, and Jesus Christ, the Creator"³⁷⁷.

Confirmation bias signifies that a person preferentially seeks information that is consistent with existing beliefs but underutilizes or dismisses contradictory data³⁷⁸. This can lead to seeing definite patterns [that can enforce one's existing beliefs] where none actually exist³⁷⁹. Pseudodiagnosics is a cognitive phenomenon in which presented information is considered relevant regardless of the actual relevance³⁸⁰. Regarding the sampled creationist writings, particular examples of taking insufficient information and processing it through confirmation bias and pseudodiagnosics to prove creation were observed. This type of analysis

³⁷³ Johnson 1993.

³⁷⁴ E.g., Harris and Calvert 2003; Puolimatka 2009, 28–44; Reinikainen 2011, 15.

³⁷⁵ Ham 2009b.

³⁷⁶ E.g., Ham and Ham (2011) wrote: "The family is under attack today like never before... A generation is arising around us that knows not the things of God, allowing (and even encouraging) pre-marital sex, abortion, homosexuality, gay marriages, gay clergy, and easy divorce. By and large, they do not believe there is such a thing as absolute truth or absolute morality. Not only is this degenerate generation arising, it already *has* arisen. While a remnant of truth seekers remains, the attack on the family has the potential to eliminate Christian absolutes from our society. The attack is coming from those who build their thinking on the anti-God beliefs that are destroying society. This attack on the Word of God has resulted in the demise of the family unit—the very unit God uses to transmit the knowledge of himself to each generation and the world around. *The central issue in the battle is what people believe about origins, for these beliefs determine their worldview* [original emphasis]." This paragraph includes many aspects of fallacious argumentation (guilt by association, appeals to consequences, *ad baculum*, false dilemma) and experiential thinking (moral issues, narrative/metaphors and testimonials that appear later in the same article). See also Ham (1987) for metaphorical juxtaposition of good and evil: "Creation versus evolution is the bottom line."

³⁷⁷ Gardner 2011.

³⁷⁸ MacCoun 1998.

³⁷⁹ Nickerson 1998.

³⁸⁰ Lindeman 1998.

demands rather detailed assessment of the scientific validity of the original claim, source criticism, analysis of the possible aspects of experiential thinking and the significance of all these aspects to the creationist case. Thus, the detailed analyses in the original articles II–III are not repeated here. However, the example regarding facial muscles and expressions and their differences between apes and humans³⁸¹ is presented here as follows:

- Humans have twice as many facial muscles as gorillas.
- Humans, thus, also have many more facial expressions.
- No evolutionary pathway has been proposed to explain this³⁸².
- Thus, evolutionary theory collapses³⁸³.

When the claim is examined according to the scheme above, the results are as follows:

- Humans have actually only 0–2 facial muscles more than chimpanzees and gorillas (24 *vs.* 22–24)³⁸⁴. The discrepancy can be caused by counting muscles on both sides of the face (=48) for humans but not for apes, which is usually not done in anatomical studies. Thus, the claim fails in source criticism. Furthermore, the presented information fails to be relevant although it is considered relevant.
- The number of facial expressions that can be hypothetically realized would, thus, not be widely different in humans and apes.
- Plausible evolutionary pathways have been proposed for the development of facial muscles³⁸⁵. Here again the claim fails in source criticism. Confirmation bias either prevents from seeking available information and the writer is satisfied with the original claim or, *e.g.*, the available contradictory data can be acknowledged but dismissed. Pseudodiagnosics presents the claim as something that would be very relevant and cause potential collapse of evolutionary theory.

Related to confirmation bias are the aspects of ignoring base rates³⁸⁶ and simplification of complex data into a form that is more easily controllable. The example of the creationist approach to radiometric dating is a commonly occurring issue. It is claimed that there are serious flaws (particular erroneous datings given by the method of evolutionary proponents) that consequently would disprove evolutionary theory. Creationists can generalize this as a proof for the young age of the earth³⁸⁷. The base rate to consider would be the fact that radiometric dating usually gives results that are considered reliable and reproducible, and isolated instances of (alleged³⁸⁸) failures of the method do not make it generally unreliable³⁸⁹.

³⁸¹ Burgess 2006, 2007; Gurney 2010; Reinikainen 2013b.

³⁸² This is also an *ad ignorantiam* argument.

³⁸³ This can also be taken as an example of hasty generalization.

³⁸⁴ Putz and Pabst 2009; Diogo and Wood 2011.

³⁸⁵ Burrows et al. 2006; Diogo et al. 2009; Diogo and Wood 2011.

³⁸⁶ Doherty et al. 1981.

³⁸⁷ Swenson 2001.

³⁸⁸ Some “mistaken” results of radiometric dating cited by creationists are due to using methods that were not suitable for samples of young rock. In fact, creationists provided a radiometric dating laboratory with

Simplifying a complex issue occurs when complex data are polarized to present two extremes. These instances are the same that appeared with the fallacy of false dilemma. For example, the statements that evolution is the only alternative for an atheist³⁹⁰ and that only the creation model would be the alternative to the RNA world hypothesis³⁹¹ regarding the origin of life on the earth are not only false dilemmas. They also represent experiential thinking patterns by simplifying multiple alternatives into only two.

The association of the morally neutral evolutionary theory with moral issues was highly evident in both YEC and ID/OEC texts³⁹². Very typically, evolutionary theory was associated with various atrocities as also examined above for the *ad hominem*, guilt by association, *ad consequentiam* and slippery slope fallacies. These examples and those regarding false dilemmas and hasty generalizations suggest that the analyzed argumentative fallacies and aspects of experiential thinking could be closely interrelated.

Is experiential thinking also present in natural sciences, including evolutionary theory? In fact, aspects of experiential thinking, such as confirmation bias with dismissal of contradictory data can, obviously, also be encountered in scientific research. Generally, science is not a realm free from experiential thinking. It is characterized by conservatism (called resistance to change in this study) and this can be regarded as institutionalized confirmation bias³⁹³. Many established scientific theories have been initially and strongly rejected (such as the theory of continental drift) but also strongly defended by their initially few proponents, also due to bias. In fact, it has been suggested that confirmation bias *per se* would not necessarily be a hindrance to high-quality research but that it could help scientists to persist with their ideas even in the face of peer pressure and resistance to change³⁹⁴. It can be argued that the same opportunity should be afforded to creationists, including clinging to their ideas despite strong opposition. In this case, it should be remembered that ideas *per se* do not form a scientific theory. Especially regarding natural sciences, hypotheses must be tested with rigorous experimentation. Although several creationists have also raised the issue of commitment to one's worldview as something not to be dismissed³⁹⁵, it is the lack of gathering of independent evidence and subsequent testing that sets them apart from the methodology of natural sciences. This author suggests that creationists should, moreover, be able to perform experimentation and gathering of evidence, as their theories are not only theological (which could be assessed by rational logic) but also naturalistic. This is emphasized by the fact that a large part of the sampled texts was based on repeating and re-interpreting scientific data. Natural scientists have

samples of young lava to be dated. The laboratory had, however, issued a previous warning that their method was not reliable for samples younger than 2 million years (reviewed in Henke 2013).

³⁸⁹ Wiens 2002.

³⁹⁰ *E.g.*, Morris 1974, 12; Puolimatka 2009, 142–143, 157.

³⁹¹ Reinikainen 2011.

³⁹² Some examples for the alleged deterioration of moral values due to evolutionary theory (abortion, sexual misconduct, *etc.*) include Johnson 1995, 135; Harris and Calvert 2003; Puolimatka 2009, 466–467. Examples regarding atrocities, such as those committed by the Nazis, are available above.

³⁹³ Nickerson 1998. Thus, there is not necessarily a strict dichotomy between scientific thinking and creationist thinking when it comes to biases.

³⁹⁴ Mitroff 1981.

³⁹⁵ Laudan 1983; Puolimatka 2009, 504–562; Puolimatka 2010, 142–242; Reinikainen 2011, 11–15.

to do the experimentation and analyses for their hypotheses to be accepted by peer-review and eventually published as scientific papers.

5.2.2 Linking experiential thinking and fallacies (I-III)

The interpretation of, *e.g.*, testimonials depends on the viewpoint. When analyzing texts for argumentation and fallacies, a claim (“a person converted to theism because of problems in evolutionary theory”) can be classified as an appeal to authority fallacy. When assessing the presence of aspects of experiential thinking, the same quote becomes a typical testimonial that replaces or supplements actual evidence as proof. In a similar manner the claim presented above, that humans would have significantly more facial muscles than apes and that this would be very significant regarding the creationist–evolutionist debate, can be taken as hasty generalization. A pattern emerged that linked aspects of experiential thinking to fallacies (Table 2), for example, as follows:

- Appeals to authorities, *tu quoque*, poisoning the well, *ad misericordiam* and quote mining can be the result of using testimonials instead of actual scientific evidence.
- *Ad hominem*, *ad consequentiam*, guilt by association, *ad misericordiam* and *ad baculum* can derive from the attachment of moral issues to a scientific theory.
- Hasty generalization can be caused by confirmation bias, pseudodiagnostics and ignoring base rates.
- False dilemmas emerge when a person simplifies issues into a more controllable form.

It is possible that by using rhetoric that derives from experiential thinking, an author inevitably utilizes testimonials, narratives and confirmation bias and ignores base rates. When these aspects appear in a text that attempts to prove creationism or to refute evolutionary theory, they become scientifically irrelevant as they do not contain actual evidence. Subsequently, these aspects become fallacies when they are analyzed with argumentation theory. This suggests that experiential thinking can lead to fallacious argumentation in the context of science.

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

Fallacies	Experiential thinking	Example(s), direct citations in italics
Direct <i>ad hominem</i>	Attaching moral labels	Evolutionists [Darwin] portrayed, for example, as a racist, sadist, psychotic or plagiarist. ¹
<i>Tu quoque</i>	Testimonials, attaching moral labels	"...most evolutionists... will freely admit that there are no 'missing links' although there have been several missing link hoaxes!" ²
Poisoning the well	Attaching moral labels	"Evolutionists refuse to consider supernatural explanations." ³
Appeal to authority	Testimonials	"...hundreds, perhaps thousands of scientists... have become creationists in recent years." ⁴
Appeal to consequences or pity, guilt by association, slippery slope, <i>ad baculum</i>	Attaching moral labels	"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." ⁵
Equivocation	Presenting complex issues in a simplified form	Evolutionary theory = Darwinism = social Darwinism. Thus, evolutionary theory is evil. ⁶
Straw man	Presenting complex issues in a simplified and/or flawed form	"According to evolutionists, a hydrogen atom formed by the Big Bang created the whole universe and life." "Evolutionary images... influence you to associate dark-skinned people with animals." ⁷
False dilemma	Presenting complex issues in a simplified form	"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." ⁸
Hasty generalization	Confirmation bias, pseudodiagnosics, dismissal of counter-evidence	One problem with evolutionary theory causes the whole concept to collapse, e.g., regarding radiometric dating methods. Differences in chimpanzee and human chromosome Y (>30%) generalized to the whole genome. ⁹

Selected references: ¹Bergman 2004; Brace 2004; Bergman 2005; Brace 2006. ²Johnson 1993, 44; Davis and Kenyon 1993, 23; Brace 2004; Puolimatka 2009, 419–422. ³Harris and Calvert 2003; Puolimatka 2009, 42, 158; Leisola 2012. ⁴Puolimatka 2009, 201–205, 239; Reinikainen 2013c, 146–149. ⁵Morris 1972, 74; Johnson 1995, 135, 144; Bergman 1999; Harris and Calvert 2003; Puolimatka 2009, 466–467. ⁶Bergman 1999, Grigg 2010; Puolimatka 2010, 187–197; Bergman 2012. ⁷Walker 2008; Puolimatka 2009, 140–141; 168; Reinikainen 2011, 17. ⁸Leisola 2012. ⁹Swenson 2001; Carter 2010.

5.2.3 Method for assessing creationist claims based on analyses of natural sciences, argumentation and experiential thinking patterns (III)

In the present project, a multidisciplinary method to assess creationist (or any other) claims by combining scientific source criticism, argumentation analysis and assessment of experiential thinking was proposed, and the method was tested by performing analyses with examples of common creationist claims. The selected samples included creationist claims originating from re-interpretation of natural sciences. Detailed results of the analyses are not presented in this summary but can be found in the original publication III; only some aspects of the method itself are introduced here.

The analysis was divided into three phases. In the first part, the scientific content of a claim was analyzed systematically including the validity of the claim (source criticism), whether the scientific content was accurately presented and whether the scientific result as interpreted in

the claim was supported by other studies. In the second part, the context of the claim was examined for the potential presence of experiential thinking patterns. The aspects were recognized and classified as listed above as testimonials, confirmation bias, pseudodiagnosics, *etc.* The third part of the process was to assess whether the text contained argumentative fallacies, to classify them and to analyze the context of these fallacies regarding the scientific content. When presented in the same text (article, journal issue, book, *etc.*) that also included (alleged) scientific evidence for creationism or against evolution, the fallacies were considered significant for the possible creation of false beliefs in the audience.

Finally, the results of the analysis were summarized to express in compact form the findings and their potential significance when the claim is presented to its audience. In the case of the selected examples, the scientific claims were based on experiential thinking and relied on the simultaneous presence of argumentative fallacies. A detailed example of links to theological consequences can be seen below with the claim regarding the “equation of creation”³⁹⁶.

5.2.4 Why do creationists utilize experiential thinking (II–III)?

Experiential thinking appears to be an innate quality of human cognition. It is assumed that experiential thinking directs both animal and human behavior but also directly influences the way we think³⁹⁷. This leads to a situation in which people respond in a rational, unbiased manner only to the “degree to which they are aware” and the underlying tendencies are experiential. The experiential system draws heavily on emotionally significant experiences, which can include the testimonials, commitment, moral issues, *etc.* observed in the sample material. The situation of creationists can be related to the fact that people often have conflicts between two beliefs and tend to consider the irrational one more compelling. In addition, while whereas religious ideas can be counter-intuitive, they tend to be so only to a minor degree, which makes them easy to remember³⁹⁸.

Regarding the origins of life, the experiential, teleological and essentialist explanation appears to be innate to human beings and can be employed in complex cognitive problems leading eventually to irrational beliefs³⁹⁹. Children tend to explain natural phenomena in terms of purpose. When questioned about, *e.g.*, the origin of thunderstorms, children usually choose a causal agent (“someone” or “something”) over physical–reductionist explanations (“just happens”)⁴⁰⁰. When creationist beliefs were investigated in particular, 8–10-year-old children were exclusively creationist regardless of their background, religious or secular⁴⁰¹. Evolutionary concepts emerge only when these intuitive beliefs in the stability of species are challenged. This suggests that the intuitive perception is the default state against which alternative explanations (in this case, evolution) can be elaborated⁴⁰². The environment of a person is also of importance. Its social cues tend to dictate the beliefs of the person and it depends on the type of exposure

³⁹⁶ Cumming 2009.

³⁹⁷ Denes-Raj and Epstein 1994.

³⁹⁸ Näreaho 2010, 16–18.

³⁹⁹ Blancke and de Smedt 2013.

⁴⁰⁰ Kelemen and DiYanni 2005.

⁴⁰¹ Evans 2001.

⁴⁰² Kelemen and DiYanni 2005.

that is available whether these social norms can be overcome⁴⁰³. It has been suggested that active learning, experiential and experimental, would be the best way to introduce scientific data to learners.

These phenomena offer explanations for the persistence of creationist claims despite rigorous scientific assessment, as also observed in the sample material. The present study supplements this by offering a method to recognize and measure the manifestations of experiential thinking that can cause fallacious argumentation and ultimately enforce anti-science beliefs, such as creationism.

5.3 CREATIONIST THEOLOGY (IV)

5.3.1 YEC doctrine

In the present study, the focus was on the possible divergence from general Christian doctrine that could be observed in the sampled creationist texts or Statements of Faith. Briefly, the YEC doctrine did not significantly differ from mainstream Christianity regarding God and trinitarianism. However, regarding creation, the sampled YEC authors made a very clear case for their belief in the inerrancy and historicity of Genesis based on the Statements of Faith by major YEC organizations⁴⁰⁴. Basically, recent creation as depicted in the literal interpretation of Genesis was surmised to be pivotal for all other issues of Christianity⁴⁰⁵. The Bible was considered “the supreme authority”, also regarding “its assertions in... history and science”⁴⁰⁶. Although this doctrine was present in the Statements of Faith, YEC authors supplemented the Biblical revelation with scientific results as “proofs for creation”⁴⁰⁷. In a striking form, this was expressed by Reinikainen: “The evidence for creation is based on thousands of tonnes of fossil material... and on the genetic mechanisms...”⁴⁰⁸ In a similar manner: “Some people are naïve and unaware of science and believe in creation by faith”⁴⁰⁹.

⁴⁰³ Wilkins 2011.

⁴⁰⁴ International Council on Biblical Inerrancy 1978; AiG 2012; CMI 2013; Creation Studies Institute 2013. Some YEC authors state that accepting evolution would necessarily mean that the Biblical God was a liar (Marsden 2005).

⁴⁰⁵ Ham (2010b) expresses this clearly: “It needs to be clearly understood that over the past 200 years the Bible’s authority has been increasingly undermined, as much of the Church has compromised with the idea of millions of years (this began before Darwin) and has thus begun reinterpreting Genesis. When those outside the Church saw Church leaders rejecting Genesis as literal history, one can understand why they would have quickly lost respect for all of the Bible.” Thus, to lose faith in the literal interpretation of Genesis would cause a collapse of the Christian faith as a whole. This is, obviously, an example of hasty generalization that also appears in Reinikainen (1991, 357–358): “The question about the historicity of the flood is extremely relevant to the reliability of Christianity... if everything had become stratified during billions of years... the revelation of the Bible would become unreliable.”

⁴⁰⁶ Sharp 2013.

⁴⁰⁷ *E.g.*, Bergman 2002; Sharp 2013.

⁴⁰⁸ Reinikainen 2011, 159.

⁴⁰⁹ Pritchard 2013.

YEC authors brought forth several examples of scientific information as evidence for their model of creation, such as data about particular animal species⁴¹⁰. They also interpreted Biblical passages, for example the Book of Job, on the basis of YEC worldview by equivocating the Behemoth with dinosaurs⁴¹¹. When the scientific claims upon which the alleged evidence was based were analyzed in a systematic manner, alternative hypotheses for the phenomena also emerged⁴¹². Thus, by selecting scientific data as definite proof for creation, YEC authors simultaneously subjected the claims to potential falsification.

An example of this was the YEC claim of evolutionary theory being falsified by the problem of whale ancestry⁴¹³. YEC authors stated that there would not be transitional fossils between land mammals and whales. Their claim was supported with aspects of experiential thinking. A testimonial by a paleontologist⁴¹⁴ (from 1962 before the finding of major transitional whale fossils) was quoted as evidence leading to an appeal to authority argument. Alternative hypotheses (evolution) were dismissed and the actual fossil finds⁴¹⁵ were disregarded. The data were considered pivotal evidence against evolution⁴¹⁶ (pseudodiagnosics), resulting in hasty generalization. In addition, moral issues were brought forth as additional evidence by accusing scientists of attacking Biblical authority, “hyping up their findings” (*ad hominem*) and by questioning their competence due to alleged naturalistic biases⁴¹⁷ (poisoning the well). Finally, YEC authors subjected their religious views (and thus the Bible) to falsification by referring to atavisms (hind legs of whales appearing as proof for their evolutionary ancestry as land mammals): “[this] would be a serious challenge to explain on the basis of creation model”⁴¹⁸. Thus, in the selected examples (IV), scientific data were processed by YEC authors by using experiential thinking also resulting in fallacies when attempting to formulate logical theology. YEC authors repeatedly took *falsifiable data from natural sciences and presented them as definite proof for the historicity of Genesis*. They also *expressed demands of supplementing revelation by scientific results*. This suggests that *scientific information was forming a superior level of proof required for the YEC faith in the Bible*. This would be a form of scientism.

The concept of Genesis requiring external (scientific) proof is obviously one that concerns natural theology: should observations of the material world supplement or replace the revelation in the Bible or in Christ? The sampled YEC authors did not directly discuss the issue

⁴¹⁰ Bergman 2002.

⁴¹¹ Morris 1972, 32–33; Reinikainen 1991, 260; Steel 2001; Reinikainen 2003; Ham 2010a.

⁴¹² Campione and Evans (2011) demonstrated that the species referred to by Reinikainen (2003) did not live in the Mediterranean area but in North America (although there definitely were dinosaurs in the region of the present Israel; Schulp et al. 2008). Mitchell (1992, 126–127), in his relatively new poetic translation of the Book of Job, made a good case of translating the alleged referrals to dinosaurs (tail, sinews of thighs) as genitals, similar to some other translations, such as the Douay-Rheims Catholic Bible (2001) and the Latin Vulgate Bible (2001). While mentioned as a hypothesis by Reinikainen (1991), this alternative is disregarded.

⁴¹³ Wieland 1998; Long 2005; Sarfati 2005.

⁴¹⁴ Slijper 1962, 17: “We do not possess a single fossil of the transitional forms between the aforementioned land animals and the whales”. The quote appears, *e.g.*, in Long 2005 and Sarfati 2005.

⁴¹⁵ Thewissen and Bajpai 2001.

⁴¹⁶ Sarfati 2005.

⁴¹⁷ Wieland 1998.

⁴¹⁸ Wieland 1998. Reports on hind legs on whales have actually been published, *e.g.*, by Andrews 1921 and by Theobald 2012. The claim does not pass the test of source criticism, as crucial reference material is disregarded.

of whether scientific data can prove theism. The question was assessed by refuting the attempts to accommodate the literal interpretation of Genesis to science—*i.e.*, YEC authors warned against changing their doctrine based on sciences. According to them, the Biblical teaching of creation should not be modified to accommodate “the current scientific consensus”⁴¹⁹. The YEC Statements of Faith also emphasize the Bible and incarnation, but the analysis revealed a more contradictory position. In the sample material, the widespread use of particular scientific results to support the YEC model of creation suggests that, in theory, YEC relies on Scripture for revelation but, in reality, could place emphasis on scientific data being necessary to prove the historicity of the Bible. This is in contrast with major Christian denominations including the Roman Catholic Church⁴²⁰ and the major protestant denominations of Europe⁴²¹.

Regarding salvation, some sampled YEC writers apparently regard acceptance of creationism as a prerequisite for going to Heaven. However, creationist beliefs alone are not sufficient without placing “trust in Jesus Christ, the Creator and Redeemer”⁴²². Yet, according to Ham (2008), the trust in Christ does not appear to suffice without the basic belief in recent creation. While the sampled authors avoided using direct threats of damnation caused by the acceptance of evolutionary theory, there are several instances where they contrasted Christianity and Darwinism: “...it is basically inconsistent to be a Darwinian and a Christian”⁴²³. Similar indications exist regarding YEC ecclesiology. Although those accepting evolutionary theory are not unequivocally excluded, the message of some sampled YEC authors is one of a congregation consisting of people that share the YEC worldview⁴²⁴. In addition, while accusing evolutionary theory of racism and discussing the concept of “inter-racial marriage”, YEC authors emphasize that Christians should refrain from marrying “non-Christians”⁴²⁵. The studied YEC authors do not explicitly state whether this should be interpreted as it not being suitable for creationists to marry evolutionary proponents, but the potential for this interpretation exists when the YEC definitions for Christians (above) are assessed. In summary, *YEC doctrine has indications of exclusivity regarding salvation, ecclesiology and marriage* regarding those who do not accept the YEC concept of creation.

The theodicy of YEC proponents concentrated on refuting the validity of TE or ID and the potentially old age of the earth by referring to the uncompensated suffering⁴²⁶ that would have been in vain unless the earth were young. In fact, the same question of unnecessary evil has been raised by evolutionary scientists when considering the consequences that ID theory would have on theology⁴²⁷. However, YEC theorists in the sample material mostly utilized theodicy to argue against all concepts of old earth, including not only evolutionary theory but

⁴¹⁹ Kulikovsky 2005.

⁴²⁰ Holy See 1993.

⁴²¹ Morrison 2001.

⁴²² Ham 2008.

⁴²³ Weinberger 2005.

⁴²⁴ AiG 2012.

⁴²⁵ Ham 1999: “When Christians marry non-Christians, it negates the spiritual (not the physical) oneness in marriage, resulting in negative consequences for the couple and their children.” This is obviously, from the viewpoint of argumentation, an appeal to consequences and *ad baculum*.

⁴²⁶ The same argument appears in Ham 2007a; Reinikainen 2011, 42. See also Mackie 1982, 150–176, for the concept of “unabsorbed evil”.

⁴²⁷ Conway Morris 2005.

also OEC, ID and TE⁴²⁸. Their answer to the actual problem of evil was that of the Fall and original sin⁴²⁹. In addition, YEC authors declined to answer the problem of evil in the temporal world and understood it in eschatological terms⁴³⁰ similarly to some modern protestant theologians⁴³¹.

The demonization of evolutionary theory and its proponents (including TE advocates) was very widespread in the sample material. Examples of this have been discussed above regarding both argumentation (appeals to consequences, guilt by association, slippery slope, *etc.*) and experiential thinking—linking of moral issues to ethically neutral scientific concepts. In several instances, the principal antagonist to the YEC Christianity was claimed to be evolutionary theory, which, according to YEC authors, has contributed to most aspects of the modern world that YEC proponents considered immoral⁴³². In addition, evolutionary theory was considered to be the major threat for the Christian worldview and the principal cause for apostasy and deterioration of Christian values⁴³³. In some cases, evolutionary theory was associated with Satan⁴³⁴.

5.3.2 ID/OEC doctrine

In contrast to YEC, many ID/OEC writers refrained from stating clear opinions on aspects of Christian doctrine. Exceptions to this were Johnson⁴³⁵ and Puolimatka⁴³⁶, who explicitly stated their Christian conviction. Other ID/OEC theorists declined to identify the “designer” as a particular deity or as a supernatural entity⁴³⁷. Thus, the ID/OEC worldview *per se* does not necessarily take a stand on the entity responsible for creation or “design”⁴³⁸ and in the sample material there are ID theorists who could be classified as agnostics. Thus, unlike YEC, *ID theory contained aspects that clearly diverged from major Christian doctrine in relation to God and creation*. Regarding revelation and the position of the Bible, the sampled ID/OEC proponents do not assess them in detail. However, as ID mostly accepts the old age of the earth, the literal

⁴²⁸ E.g., Reinikainen 2011, 42.

⁴²⁹ Morris 1972, 74.

⁴³⁰ Reinikainen 1991, 38.

⁴³¹ Pannenberg 2004b, 161–174.

⁴³² Ham 2007b: “...lawlessness, homosexuality, pornography, and abortion... Creation versus evolution is the bottom line.” Ham 2010b: “It is accurate to say that the increasing acceptance of homosexual behavior and gay marriage has gone hand in hand with the popularity and acceptance of millions of years and evolutionary ideas. But this does not mean that every person who believes in millions of years/evolution accepts gay marriage or condones homosexual behavior. But the more people (whether Christian or not) believe in man’s ideas concerning the history of the universe, regardless of what God’s Word appears to be plainly teaching, the more man’s fallible ideas are used as a basis for determining ‘truth’ and overriding the Bible’s authority.”

⁴³³ Reinikainen 2011, 9.

⁴³⁴ Gardner 2011.

⁴³⁵ Johnson 1995, 49–50.

⁴³⁶ Puolimatka 2009, 539–544; Puolimatka 2010, 48–49.

⁴³⁷ Behe (2007) wrote: “One can’t leap directly from design to a transcendent God” and offered several (humorous) alternatives to the identity, including “a dope, a demon, or a deity” and, in Behe (2001), “an angel—fallen or not; Plato’s demi-urge; some mystical new age force; space aliens from Alpha Centauri; time travelers; or some utterly unknown intelligent being”.

⁴³⁸ E.g., IDEA 2013c; Intelligent Design Network 2013c.

interpretation of Genesis is not required in ID theory. Nor do ID theorists analyze the concepts of salvation or ecclesiology based on their concept of a “designer”.

In addition to the identity of a “creator” or “designer”, ID/OEC also differed from YEC in theodicy. As noted above, the question of theodicy in ID has been criticized by both YEC and evolutionary proponents. Of the sampled ID authors, Behe basically claimed ignorance and asked whether “a hateful, malign being [made] intelligent life in order to torture it?” and answered “Maybe, maybe not”⁴³⁹. Theologically, this is not a satisfactory answer. Puolimatka has attempted to assess the issue in more detail. He referred to alleged compensatory benefits of suffering, especially pain⁴⁴⁰. However, this approach of “absorbed evil” compensating for animal suffering has been rebutted in detail, and Puolimatka failed to take into account higher-level suffering (natural disasters, malevolence, *etc.*) as well as the free-will defense and its potential applications to animal suffering⁴⁴¹. Thus, basically the ID/OEC theodicy remains superficial and fails to answer the challenge presented by YEC and evolutionary theorists in a comprehensive manner.

Regarding the concept of evil, ID/OEC theorists were very similar to the sampled YEC authors in their opinion of evolutionary theory and its proponents. The association of evolution with atrocities and immorality appeared especially in the writings of Puolimatka, who dedicated dozens of pages to assess the alleged connections of evolutionary theory to, *e.g.*, Nazism⁴⁴².

5.3.3 Creationist canon?

Creationist writings contained numerous citations that—when analyzed for experiential thinking patterns—were presented as testimonials for their case (II, IV). While the reliance on testimonials supplemented with confirmation bias to prove religious experiences⁴⁴³ can be quite significant, testimonials are not actual evidence from the viewpoint of natural sciences. In addition, these quotes have begun to be presented without adequate citations⁴⁴⁴, which further emphasizes their apparent authority as testimonials for the creationist faith.

Some of the most frequently occurring quotes used out of context are listed in IV. In addition, creationist organizations provide their readers with additional testimonials on their

⁴³⁹ Behe 2007, 237–238.

⁴⁴⁰ Puolimatka 2009, 259–267.

⁴⁴¹ Mackie 1982, 150–176.

⁴⁴² Johnson 1995, 144; Harris and Calvert 2003; Puolimatka 2009, 469; Puolimatka 2010, 187–197.

⁴⁴³ Mackie 1982, 13–18; Pannenberg 2004a, 168–171.

⁴⁴⁴ *E.g.*, Puolimatka (2009, 423) referred to the writing of Todd (1999) only anonymously as “a professor of biology”. Furthermore, Puolimatka has not examined the context of the notorious quote “Even if all the data point to an intelligent designer, such an hypothesis is excluded from science because it is not naturalistic”. Puolimatka emphasized that the quote derives from the journal *Nature*, which is “one of the most significant scientific publications in the world”. However, the quotation does not come from a scientific paper but from a correspondence and the text of Todd actually continues to accept all kinds of worldviews, not only the naturalistic one. Thus, there are indications that the quote has become an oft-repeated creationist refrain, the original context of which is disregarded. The same quotation also appears in other articles without context (*e.g.*, Harris and Calvert 2003).

Internet sites entitled, for example, as “12 quotes from leading evolutionists”⁴⁴⁵ and “Truth matters. More useful quotes for creationists”⁴⁴⁶.

The quotes by evolutionary scientists that have been taken out of context and used to prove the YEC or ID/OEC case were, according to the analysis, sometimes repeated without source criticism or discussion of the context. When considered as arguments, they are basically irrelevant to evolutionary theory, as it is the actual evidence and not the opinions of scientists that matter as proofs for a theory. In the field of experiential thinking, these quotes function as testimonials, which are employed using confirmation bias and disregard for context in order to prove the hypothesis of creation. They are considered as pivotal evidence (pseudodiagnostics), although they do not represent actual evidence at all. Thus, the sampled creationists seemed to quote these sentences in a similar manner to quoting Biblical passages. It remains to be seen whether *these quotes will form a basis of a special creationist canon* to supplement the Bible.

5.3.4 Creationism and Christianity

Although creationist (especially YEC⁴⁴⁷) doctrine shares many significant aspects with general Christian doctrine, there were also crucial differences when compared to major denominations. These divergences included the *requirement of scientific evidence for the accuracy of the Bible, especially OT (IV)* that was visible as scientism in YEC texts. In ID, some authors could be better classified as agnostics than Christians regarding creation on the basis of their writings⁴⁴⁸.

As noted above when discussing the various creationist organizations, their annual revenues can be considerable. Economically, these organizations present a product: material in written form to prove evolution to be wrong and creation right. Thus, it can also be of importance for the consumers to know the quality of the product, *i.e.*, how good a case creationist writers make of defending their view. These potential consumers include persons willing to find more information to support their notions, those wanting to supplement their knowledge about the creationist–evolutionist debate and those attempting consciously to form

⁴⁴⁵ Creationism.org 2013: *E.g.*, “Scientists who go about teaching that evolution is a fact of life are great con-men, and the story they are telling may be the greatest hoax ever. In explaining evolution, we do not have one iota of fact. Dr. T. N. Tahmisian (Atomic Energy Commission, USA) in ‘The Fresno Bee’, August 20, 1959. As quoted by N. J. Mitchell, *Evolution and the Emperor's New Clothes*, Roydon Publications, UK, 1983, title page.” This is a typical Internet site, it does not present the quotes in context but basically takes the fragments as testimonials to be distributed further.

⁴⁴⁶ *E.g.*, Truth Matters 2013. The message of distributing the quotes further is present here: “Please feel free to use these quotes but always be sure to include the original source of the quote.” However, not all creationists in the sample material follow this advice. Reinikainen (2011, 43) cites the “S.C. Todd” quote without references. In addition, the testimonial of “Antony Flew converting to theism” appears without references in, *e.g.*, Puolimatka (2010, 313) and Reinikainen (2011, 80).

⁴⁴⁷ According to the analysis, no unified “ID doctrine” could be defined and aspects of ID (such as the refusal to identify the “designer” as the Christian God) could not be included within the Christian religion.

⁴⁴⁸ The author is well aware that many ID authors openly propagate their Christian faith (Johnson 1995; Puolimatka 2009) and that there is a strategy in the ID community to allow “for the intervention of the deity in evolution” (Scott 1997). However, in the present study the focus remains on the texts; and when analyzing the sampled texts *per se*, we can see that some authors refuse to identify the designer (Behe 2007). Although this ambiguity may well be a strategy to import ID into school or university curricula (the “wedge strategy”; Forrest 2007), it is outside the specific aims of the present study to assess the (hidden) motivations of ID proponents.

an unbiased idea on the appearance of life and biodiversity. For the Christian public, it can also be useful to assess how the creationist doctrine affects the Christian worldview. Based on the analyzed material, a considerable amount of the product was of inferior quality. It was not based on solid science but on testimonials and confirmation bias, it used low-quality arguments, fallacies, for proof, and resulted in unexpected effects on Christian doctrine. This is not very different from the creationist method of utilizing scientific data. Creationism can be considered as a pseudoscience⁴⁴⁹. It fails as science as it fails to produce ideas that lead to new discoveries, to influence existing hypotheses, initiate new lines of research or put their assertions into use (such as Dembski's design filter). Regarding creationist theology, this author tentatively suggests that YEC and ID theology could in a similar manner be classified as "pseudoteology". For example, in the case of theodicy and revelation, alternative theological hypotheses and the doctrines of various denominations are disregarded or dismissed and theology is discussed in a superficial manner. The creationist doctrine does not augment Christian theology, nor does it produce new discoveries or influence existing theological research. Thus, creationist assertions do not form a coherent unity either as plausible science (III) or theology (IV).

5.3.5 Creationism and science

Although the principal aim of the study was not to assess whether creationists are "right" or "wrong" in their denial of evolution, there are several aspects of analysis that weaken the creationist case:

- All analyzed creationist claims have been refuted by scientists in detail. The dismissal of these rebuttals by the creationist community indicates confirmation bias and other aspects of experiential thinking. This does not mean that the claims would be false based on the presence of these aspects. However, the disregard for alternative hypotheses, *etc.*, decreases the probability of the creationist hypothesis being the correct one. At present, the probability is considered so small that the creationist hypothesis cannot be considered worth pursuing. This would require significant new development of the creationist theory instead of using repeatedly refuted claims.
- Creationism lacks unification and generalization. An example of this is the alleged concept of "genetic entropy"⁴⁵⁰ (see above). In addition to not being consistent with actual genetic observations of no loss in viability of populations and no accumulation of harmful mutations in the presence of selection, "genetic entropy" is also inconsistent with the YEC timeline of Noah's flood (all decimated animal populations should have become extinct millennia ago) and with the ID concept of geological age (if our planet is billions of years old, "genetic entropy" should have made all populations unviable). Natural sciences will probably not take creationist claims seriously as long as internal contradictions, such as the example above, persist.
- The utilization of out-of-context citations instead of actual evidence material is very different from scientific method. For example, creationists repeatedly refer to the

⁴⁴⁹ Shermer 2011.

⁴⁵⁰ For a more detailed analysis of the concept "genetic entropy", see III.

“forged embryological drawings” of Haeckel⁴⁵¹. However, the drawings were never actual evidence for evolution. Comparing the embryos themselves is the evidence.

- Creationists have brought forth a suggestion that the worldview of scientists has significant effects on the interpretation of results⁴⁵². This could provide a valid hypothesis, but empirical evidence should be provided. For instance, Puolimatka suggested that all scientists should explicitly inform their audience of their worldview⁴⁵³. However, if we consider the tendency to use *ad hominem* arguments and appeals to authorities by both creationists and scientists, this could in fact be quite unwise. In peer review, scientists should concentrate on the actual evidence and its presentation and not the characteristics of the author. The possibility of the reviewer (unconsciously or consciously) doubting the results based on the author’s religious convictions cannot be ignored⁴⁵⁴.
- Creationists have also postulated that the present scientific method rests on Christian worldview⁴⁵⁵ and, thus, Christian thought should not be excluded from natural sciences⁴⁵⁶. This assertion also rests on experiential thinking and fallacies. The claim can be supported by evidence but, at the same time, evidence for other influences on the emergence of modern science also exists⁴⁵⁷. Thus, there is clear confirmation bias present. In addition, the claim is a genetic fallacy⁴⁵⁸: even if Christianity participated in the emergence of the scientific method, there is no evidence that it would be required for the continuing success of science⁴⁵⁹.
- Based on the analysis, the current forms of YEC and ID/OEC do not fit well into the classification scheme on the interaction between religion and science: conflict, independence, dialogue or integration⁴⁶⁰. As long as conflict is present, creationism also utilizes selected scientific data via confirmation bias as evidence for the case of creation theology. Thus a fifth model of interaction is proposed: biased re-interpretation of scientific results.

⁴⁵¹ Luskin 2009; Puolimatka 2010, 392–394. Haeckel introduced the concept “ontogeny recapitulates phylogeny” and produced embryological drawings to support his claim. It has been established that the drawings contained details not visible in the microscope but added by Haeckel. Evolutionary biologists never totally accepted Haeckel’s claim and, as scientific proof, the drawings are ultimately irrelevant and only the actual embryos matter. Thus, this becomes an *ad hominem* fallacy.

⁴⁵² Puolimatka 2009, 437–562.

⁴⁵³ Puolimatka 2009, 56.

⁴⁵⁴ This possibility is, of course, an *ad consequentiam* argument. However, in the sample material there is ample evidence of character assassination (Bergman 2004, Brace 2004; Pigliucci et al. 2004; Bergman 2005; Brace 2006; Reinikainen 2013b) and poisoning the well (Leisola 2012; Reinikainen 2013b) on both sides of the debate suggesting that—when known—the character and affiliations of the author do have an influence on the assessment of the reliability of results. Thus, not disclosing their worldviews could protect the authors on both sides of the creationist–evolutionist debate from being disqualified based on character.

⁴⁵⁵ Johnson 1995, 205–218; exactly the same text in Puolimatka 2009, 132–138.

⁴⁵⁶ Harris and Calvert 2003; Puolimatka 2009, 132–138.

⁴⁵⁷ Carrier 2006.

⁴⁵⁸ Curtis 2001: “[It] is fallacious to either endorse or condemn an idea based on its past—rather than on its present—merits or demerits, unless its past in some way affects its present value.”

⁴⁵⁹ Carrier 2006.

⁴⁶⁰ McGrath 2011, 45–50.

5.3.6 Aspects of Finnish creationism

The sampled Finnish authors included both YEC and ID/OEC creationism. As observed in the original publications, the Finnish authors did not clearly differ from those writing in English when fallacies and experiential thinking were considered. The Finnish creationist texts consisted for a large part of the same claims that are presented by the major creationist organizations⁴⁶¹, for example, the CMI magazine *Creation* is also available in Finnish translation⁴⁶².

The Finnish examples of ID/OEC relied quite heavily on guilt by association and appeals to consequences, especially by associating evolutionary theory with maltreatment of creationist scholars and with atrocities (Nazism and Stalinism, euthanasia, *etc.*)⁴⁶³. In addition, the agnosticism present in the writings of Behe⁴⁶⁴, as well as Davis and Kenyon⁴⁶⁵, could not be discerned. In this respect, Finnish ID/OEC did not show clear divergence from Christianity.

The use of poorly referenced quotes as testimonials was quite evident in the sampled Finnish texts, including appeals to uncited authorities (such as Antony Flew converting to theism⁴⁶⁶) and using oft-quoted evolutionist testimonials without citing the original source (such as the Eldredge quote⁴⁶⁷). This suggests that the emergence of a creationist canon could have progressed quite far among Finnish creationists, as the source criticism of the quotes has failed.

The sampled Finnish authors displayed qualities that are more often associated with North American than European creationism⁴⁶⁸. The analyzed claims were mostly shared by Finnish and American creationists and there was widespread reference to creationism as “science” in the Finnish texts⁴⁶⁹. YEC as “creation science” has outspoken supporters⁴⁷⁰ and the

⁴⁶¹ An example of this is Puolimatka (2009). The book has >90 pages that mostly consist of translations of English-language creationist texts without marking the passages as direct quotations (Nieminen 2012, Supplementary material).

⁴⁶² <http://www.luominen.fi/lehti/>. The magazine “Luominen” mostly consists of translations. In addition, the Internet site presents many quotes as testimonials (evolutionists allegedly admitting weaknesses or problems with the theory). Some original Finnish creationist material has been written, *e.g.*, by Leisola et al. (2012) in the creationist journal *Bio-Complexity*, of which he is the editor-in-chief. The journal has been published since 2010. A total of 10 articles and 10 reviews have so far (as of December 2014) appeared in the journal. The journal “aims to be the leading forum for testing the scientific merit of the claim that intelligent design (ID) is a credible explanation for life”.

⁴⁶³ Puolimatka 2009, 2010.

⁴⁶⁴ Behe 2007.

⁴⁶⁵ Davis and Kenyon 1993.

⁴⁶⁶ Reinikainen 2011. In fact, it appears that Flew converted to agnostic deism (Carrier 2004b). Regardless of the accuracy of the claim, evolutionary theory cannot be proved wrong by these types of testimonials.

⁴⁶⁷ Puolimatka 2009, 2010.

⁴⁶⁸ Blancke et al. 2013. Many European countries use American claims “adjusted and adapted to local needs” and “European creationists often find it superfluous to disguise their beliefs as creation science”.

⁴⁶⁹ *E.g.*, Reinikainen 2003, 22: “Why is the critical evaluation of evolution not allowed during lessons?”; Puolimatka 2009, 618: “...natural sources of information are inadequate in scientific research, because the basic premises of scientific research cannot be justified based on only natural sources of information.”; Reinikainen 2011, 9: “Experiential science has shown that neodarwinism cannot explain the existence of nature.”

⁴⁷⁰ *E.g.*, Reinikainen and Leisola are YEC supporters (Leisola 2012; Reinikainen 2013d).

journal *Creation* is published in Finnish translation⁴⁷¹ without adjustments to a specific Finnish perspective. The situation has some similarities to the discussion in the United States: without banning evolutionary theory, creationism is introduced as a scientific “alternative”⁴⁷². Briefly, Finnish creationism is mostly English-language creationism translated into Finnish, with identical claims reproduced in book and article format.

5.3.7 Towards a unified theory of creationism?

Based on the present study, a hypothetical pattern is emerging. In this model, experiential thinking and applying it to natural sciences in general and evolutionary theory in particular are the principal explanatory causes for the patterns detected in the sampled creationist texts.

The most important aspects of experiential thinking—testimonials, confirmation bias (dismissal or disregard of contradictory evidence, disregard for base rates), pseudodiagnostics and attachment of moral significance—are the tools with which the sampled writers appear to process scientific data regarding evolution. The use of these tools leads automatically to fallacies. The excessive use of testimonials (quotes) causes appeals to authorities and *tu quoque*. Confirmation bias results in hasty generalizations, false dilemmas, *etc.* Inclusion of moral significance when written out regarding proof or disproof of evolution comes out as appeals to consequences, guilt by association, direct *ad hominem* and poisoning the well. *Thus, argumentative fallacies can be an unavoidable outcome of utilizing the paradigm of experiential thinking when working within the paradigm of scientific evidence.* Based on the sample material, it appears that for the selected creationist authors, the question of creationism–evolution rests on experiential thinking, although it is quite plausible that they could display rational thinking patterns in other areas of life. It is well known that experiential thinking is shared by practically everyone, also by scientists in their everyday life and possibly in some aspects of their work. However, there appears to be a general discrepancy between the thinking patterns of creationists and evolutionary scientists regarding the origin and development of life on the earth. This difference would not easily be resolved by repeating the scientific rebuttals and counter-fallacies. This author suggests here that *the alternative approach would be to acknowledge the thinking patterns and argumentation, and to assess their significance for the potential audience and their irrelevance as scientific evidence.* This would not necessarily solve the stalemate of the creationist–evolutionist debate but it could help the scientific community concentrate on the actual evidence.

Theologically, the sampled creationists seemingly take up labile and statistical data derived from science and treat them as dogmatic through the lens of experiential thinking. They use results prone to refinement as factual testimonials to prove their Biblical interpretation. This can lead to demanding evidence for Biblical infallibility from data that can be skewed (confirmation bias, *e.g.*, dismissal of radiometric dating methods), irrelevant (pseudodiagnostics, *e.g.*, heat flux of planets as proof against evolution of biological organisms⁴⁷³) and inevitably,

⁴⁷¹ <http://www.luominen.fi/luominen-lehti>. The original journal “*Creation*” is published by CMI, which is based in Australia and not specifically “American”, but its claims and articles are often shared by other organizations, such as AiG.

⁴⁷² Scott 1997.

⁴⁷³ Henry 2001; Psarris 2002b.

like all scientific data, susceptible to falsification. By using falsifiable data⁴⁷⁴ to prove the literal interpretation of *Genesis*, it can be difficult to prevent falsification from entering Biblical studies. As an example of the interconnectedness of experiential thinking, fallacies and eventually theology, the claim of the “equation of creation” by David Cumming⁴⁷⁵ (III) can be presented as follows:

- Cumming claims that by using the scientifically controversial Thom units of length (megalithic yard)⁴⁷⁶, an equation with the hydrogen fine transition line, Pi and an approximation of the ratio of the weights of the moon and earth, the speed of light emerges as well as several other astronomical values.
- Scientifically, the megalithic yard is highly controversial and its approximation used by Cumming (0.829417864 m) is certainly something that could not have been used by stone-age craftsmen with this precision. In addition, from the viewpoint of physics, the units on the right and left sides of the equation do not match and the result is incorrect by a factor of 1,000⁴⁷⁷. To conclude: natural sciences do not support the equation.
- Experiential thinking is present in selected testimonials stating that the realization of the equation converted people from atheism to Christianity⁴⁷⁸. Confirmation bias can be seen in the disregard of the controversy about the reliability of the megalithic yard and the dismissal of the fact that the hydrogen fine line (in Hz) inevitably results in acquiring the speed of light. In addition, Cumming used the value 0.0123456789 in the denominator although the mass ratio of the moon to the earth is, in fact, ≈ 0.012345679 (the “8” is missing). Cummings added the figure 8 to include all figures in the decimal system. Pseudodiagnosics can be seen to be present when the author considers the scientifically flawed claim as very significant for creationism and a potential tool to assess God’s thinking patterns.
- In addition to experiential thinking, fallacies are present. Potential rebuttals by scientists are dismissed (*ad hominem* and poisoning the well) by stating that “they can’t stand the implications—that there is a Creator, and the atheists and Godless [loaded words] are on the wrong side of science now.”
- Theologically, Cumming takes approximations (Pi, megalithic yard, 99.97% correct value of speed of light, moon/earth mass ratio) as exact data that are used to prove the existence of God. This also opens the way to falsification by critical assessment of Cumming’s calculations (as evolutionary proponents have done⁴⁷⁹). In addition, Cumming makes assumptions of God’s characteristics: “[regarding the base 10 number system] An omniscient Creator *knows to use this number system to make us pay attention to this message... Earth, Sun, and Moon must have been Created to accord with the Equation of Creation* [added emphasis].” This basically adds the equation to special revelation.

⁴⁷⁴ See also Moritz 2011.

⁴⁷⁵ Cumming 2009.

⁴⁷⁶ Thom 1962; Kelley and Milone 2011, 163–165.

⁴⁷⁷ See also RationalWiki 2013d.

⁴⁷⁸ Cummings 2009: “Knight comments, ‘I was an atheist. On balance, I now believe in a Creator, a design, and an ultimate purpose. This has to be God. I’m a pragmatic humanist who now says, ‘There is no longer space in the room for atheism.’ Alan Butler added, ‘I’m inclined to say this is God, the Creator’.”

⁴⁷⁹ RationalWiki 2013d.

In summary, the claim is not supported by natural sciences. It appears to be based strongly on experiential thinking patterns and supported by some fallacies. Theologically, it demands the addition of the equation to special revelation, although the basis for the claim is weak. In a similar manner, the validity and strength of other creationist (or evolutionist) claims can be assessed with the method by examining not only the scientific content but also the aspects of experiential thinking, fallacies and—when discussing theology—also theological issues.

5.4 ARGUMENTATION, EXPERIENTIAL THINKING AND ASSESSMENT OF THE PRESENT STUDY

Considering fallacies and experiential thinking, self-assessment by scientists would obviously be of importance. Regarding the present study, the possibility of fallacious argumentation and/or the presence of experiential thinking cannot be ignored. In the case of fallacies, the fallacist's fallacy⁴⁸⁰ is something that should be taken into consideration. Regarding the present project, this would take the form of dismissing a creationist (or evolutionist) claim as flawed or untrue based on the fact that it was presented fallaciously. Yet, in the original publications (especially I), it was stated that the purpose is not to assess the truthfulness of creationist claims but their quality based on the creationist writers' exposition. As the presentation of the claims in the case of creationists—and some evolutionary proponents—includes a high number of fallacies, it can be stated that the creationist case is very weak regarding the evidence against evolution. If the arguments containing *ad hominem*, *ad consequentiam*, appeals to authorities, guilt by association, *etc.* were removed and only the scientific claims left as evidence, there would not be many—if any—issues that would not have been successfully refuted by scientific experts.

How is it possible to avoid appeals to authorities? In science, this fallacy could possibly be encountered by stating that a scientific issue is correct because of the person who supports it⁴⁸¹. This has to be distinguished from the acknowledgment of other's work, *i.e.*, using proper references. In this study there are also issues that are referred to with the names of the scientists who discovered or deduced the issues at hand. This author has attempted to keep citations apart from authority by concentrating on the actual content of the referred studies.

The possibility of hasty generalization should also be taken seriously in the present study. Although it was evident in the sample material that the fallacies were prevalent, the source material was not randomly selected. Thus, it is important to point out that the presence of fallacies is currently restricted to the sample material. However, one of the aims of the study was to construct a method of analysis allowing both sides of the creationist–evolutionist debate to recognize fallacies and experiential thinking. In this respect, it is probable that the examples presented in the original publications would also be sufficient to allow the recognition of possible fallacies in texts not included as sample material.

The question of experiential thinking in one's own work is also a complex one. Is confirmation bias present? This is related to the issue of hasty generalization: are the examples of creationist writings sufficient to reach the conclusions or were they selected based on pre-

⁴⁸⁰ Curtis 2001. A claim is not false simply because its presentation is fallacious.

⁴⁸¹ van Eemeren and Grootendorst 1992.

existing biases that the creationist case is flawed? While not randomly selected, many of the books chosen for analyses are regarded as the most significant in the creationist–evolutionist debate⁴⁸². Still, they contained lots of fallacious material. It is possible that there are creationist writings that do not conform to the results of the present study. In such cases, it would be possible to concentrate directly on the scientific content. In a similar manner to confirmation bias, it is important to consider pseudodiagnostics: are the data selected and presented in the study significant when assessing the creationist case as a whole? In order to satisfy this requirement, highly visible and cited creationist texts were chosen. The scientific discussion about the claims has not resulted in visible changes in the creationist presentation of science. Because of this, it is very useful to assess the texts in between the scientific claims in order to explain the unreceptiveness of the scientific explanations by creationists. Still, it should be emphasized that the present study did not aim to assess the actual psychological processes of creationists or evolutionists based on textual analyses alone.

The use of testimonials should also be pondered. Similar to creationist texts, there are many direct citations in the original articles of this thesis. However, this author considered that when discussing fallacies and experiential thinking, it is necessary to present adequate examples for the reader. This is a way to learn how to recognize similar fallacies if they are encountered. In this case, this author proposes that the selected quotes represent examples and not only testimonials or appeals to authorities. In addition, textual analysis, such as the present study, uses the sampled writings (including examples) as the actual source material, whereas evolutionary theory is based on observational evidence and textual material is only the form in which it is presented.

This author systematically tried to avoid attaching moral issues to the analysis. This would include discussing the effects of creationism (or evolutionary theory) on education, society, *etc.* However, in the original publication IV, it was stated that the creationist method of selecting scientific data as proof for Biblical inerrancy could conceivably cause their divergence from major Christian theology. Although this could be taken as an issue to be avoided, it was attempted to present the possibility in a neutral way. The sampled creationist texts may indicate deviation of the writers from mainstream Christianity, but obviously the choice is theirs to make without being labeled “good” or “bad”. As also stated by creationist writers⁴⁸³, it is certainly of importance to examine how people justify their participation in various atrocities, *i.e.*, how religions and/or scientific theories are (mis)used as excuses for, *e.g.*, violence. However, as also indicated in the original publications, this is irrelevant for the scientific evidence and, thus, it becomes fallacious in the context of (dis)proving a theory.

⁴⁸² The books by Morris (1972, 1974) formed the basis for YEC and the works of Behe (1996, 2001, 2007) and Johnson (1993, 1995) for ID. Regarding the Finnish discussion, Puolimatka (2009, 2010) and Reinikainen (1991, 2003, 2011) have been prolific and frequently cited especially in social media.

⁴⁸³ Puolimatka 2010, 469.

6 Conclusions

1. The sampled creationist texts contained high numbers of fallacies in the context of scientific claims against evolutionary theory. The fallacies (*ad hominem*, *tu quoque*, *ad consequentiam*, appeal to authorities, guilt by association, hasty generalization, false dilemma, *etc.*) were irrelevant for the scientific content, as evolutionary theory rests on scientific evidence and not on the character of the scientists, alleged consequences of accepting evolutionary theory, *etc.* However, pro-evolutionary texts also contained many fallacious arguments, most often *ad hominem*, *tu quoque*, appeals to authorities and *ad consequentiam* (I).
2. Aspects of experiential thinking were observed in the sampled texts. Testimonials were frequent and could in extreme cases represent more than half of a text. In addition, there were signs of confirmation bias—disregard for scientific results that did not support the creationist worldview—and repeated labeling of evolutionary theory as immoral. The utilization of experiential thinking and its manifestations (such as testimonials) in a creationist text could have caused the authors to use argumentative fallacies in the context of refuting evolution. Evolutionary proponents also utilized testimonials and moral attachment (II).
3. A systematic analysis method was suggested including the assessment of scientific content (source criticism, potential existence of contradictory data), experiential thinking and argumentation. It is recommended that writers should clearly state when they are discussing the potential falsification of a scientific theory, when they are discussing the possible consequences of a theory and when they are debating the theological content of, *e.g.*, the ID theory (III).
4. YEC authors used isolated scientific results as proof for the inerrancy of Genesis. In some cases, there was a tendency to supplement OT with evidence from the material world and natural sciences in order to make it infallible. This can be taken as scientism. In addition, particular sampled writers considered the acceptance of the YEC worldview as a prerequisite for salvation, which indicates exclusivity in soteriology, ecclesiology and theology of marriage. By contrast, whereas some ID/OEC authors identified themselves as Christian, others refused to speculate on the identity of the "designer" and appeared to be agnostic. Both YEC and ID/OEC used out-of-context quotes of scientists as proof for creationist ideas, often without examining the original content of the quote and sometimes without proper references. The quotes could be developing into a canon of texts to be utilized in addition to the Bible by YEC and ID/OEC proponents. Although YEC does not accept many aspects of ID thought, both branches of creationism show signs of separating themselves from major Christian denominations, with the potential of forming new religions (IV).

Literature

CITED SAMPLE MATERIAL

- Answers in Genesis (AiG) (2007a): Evolution—a framework in which to interpret evidence. Reason 2: evolution. <https://www.answersingenesis.org/articles/2007/06/05/reason-two-evolution>. Accessed 15 May 2013.
- Answers in Genesis (AiG) (2007b): Liberty University. Answers January–March 2007, 59.
- Answers in Genesis (AiG) (2012): Statement of Faith. <https://www.answersinGenesis.org/about/faith>. Accessed 30 March 2013.
- Answers in Genesis (AiG) (2013a): Creation colleges. <http://www.answersingenesis.org/colleges/>. Accessed 3 October 2013.
- Answers in Genesis (AiG) (2013b): Colleges in agreement with AiG’s Statement of Faith. <https://www.answersingenesis.org/colleges/all/>. Accessed 3 October 2013.
- Batten D (2008): Clarity and confusion. A review of *The edge of evolution*. *Journal of Creation* 22, 28–33.
- Batten D (2013): Tree ring dating (dendrochronology). <http://creation.com/tree-ring-dating-dendrochronology>. Accessed 31 July 2013.
- Baumgardner J (2003): Carbon dating undercuts evolution’s long ages. *Impact* #364.
- Behe MJ (1996 [2006]): *Darwin’s black box: The biochemical challenge to evolution*. 1st and 10th ed. New York: Free Press.
- Behe M (2001): The modern intelligent design hypothesis. *Philosophia Christi* 3, 165–180.
- Behe MJ (2007): *The edge of evolution. The search for the limits of Darwinism*. New York: Free Press.
- Bergman J (1999): Darwinism and Nazi race Holocaust. *CEN Technical Journal* 13, 101–111.
- Bergman J (2001): The effect of Darwinism on morality and Christianity. *Impact* #336.
- Bergman J (2002): The giraffe’s neck: another icon of evolution falls. *CEN Technical Journal* 16, 120–127.
- Bergman J (2004): Was Charles Darwin psychotic? A study of his mental health. *Impact* #367.
- Bergman J (2005): Darwin’s passion for hunting and killing. *Impact* #383.
- Bergman J (2007): Darwin taught male superiority. *Answers Research Journal* 2, 26–27.
- Bergman J (2010): Why orthodox Darwinism demands atheism. *Answers Research Journal* 3, 147–152.
- Bergman J (2012): Anders Breivik—social Darwinism leads to mass murder. *Journal of Creation* 26, 48–53.
- Brace RA (2004): 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>. Accessed 25 January 2013.
- Brace RA (2006): 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/8DARWIN.htm>. Accessed 22 January 2013.

- Brown W (2013): In the beginning: compelling evidence for creation and the flood. 32. Genetic distances. Center for Scientific Creation.
<http://www.creationscience.com/onlinebook/LifeSciences37.html>. Accessed 3 May 2013.
- Buchanan S (2010): Assessing limits to evolution and to natural selection: reviews of Michael Behe's "Edge of evolution" and John Sanford's "Genetic entropy".
<https://letterstocreationists.wordpress.com/stan-4/>. Accessed 10 February 2013.
- Buchanan S (2012): Gorilla, orangutan, chimp and human genomes: population genetics and intelligent design. <http://letterstocreationists.wordpress.com/2012/03/17/gorilla-orangutan-chimp-and-human-genomes-population-genetics-and-intelligent-design/>. Accessed 15 January 2013.
- Burgess S (2006): Designer humans. *Evangelical Times*. <http://www.evangelical-times.org/archive/item/2135/Scientific--including-creation-/Designer-humans/>. Accessed 26 March 2013.
- Burgess S (2007): Humans: purposely designed.
<https://www.answersingenesis.org/articles/am/v2/n3/humans-purposely-designed>. Accessed 26 March 2013.
- Carter RW (2010): The chimpanzee Y chromosome is radically different from human.
<http://creation.com/chimp-y-chromosome>. Accessed 1 February 2013.
- Catchpoole D, Sarfati J (2006): 'Schweitzer's dangerous discovery'.
<http://creation.com/schweitzers-dangerous-discovery>. Accessed 25 January 2013.
- Creation Ministries International (CMI) (2013): What we believe. Statement of faith.
<http://creation.com/what-we-believe>. Accessed 5 April 2013.
- Creation Studies Institute (2013): Statement of faith.
http://www.creationstudies.org/statement_of_faith.pdf. Accessed 5 April 2013.
- Creationism.org (2013): 12 quotes from leading evolutionists.
<http://www.creationism.org/articles/quotes.htm>. Accessed 28 August 2013.
- Cumming D (2009): The equation of creation. <http://www.ukapologetics.net/09/cumming2.html>. Accessed 3 April 2013.
- Davis P, Kenyon DH (1993): *Of pandas and people*. The central question of biological origins. 2nd ed. Dallas: Haughton.
- Dawkins R (1989): Review of blueprints: solving the mystery of evolution. *New York Times* 9 April, Sec VIII, 34.
- Deem R (2010): Human Y chromosome: "horrendously different" from nearest living "relative".
http://www.godandscience.org/evolution/human_y_chromosome.html. Accessed 15 May 2013.
- DeMar G (2002): The religion of evolution. <http://creation.com/the-religion-of-evolution>. Accessed 4 August 2013.
- Dembski WA (1998): *The design inference: eliminating chance through small probabilities*. Cambridge: Cambridge University Press.
- DeVowe S (2004): The amazing motorized germ. *Creation* 27, 24–25.
- Doyle S (2007): Feathery flight of fancy: alleged 'protofeathers' fail under close scrutiny. *Journal of Creation* 21, 11–12.
- Eirich D (2000): The amazing cell. Evidence for creation and against evolution!
<https://answersingenesis.org/biology/microbiology/the-amazing-cell/>. Accessed 8 April 2013.
- Frair W (2000): Baraminology—classification of created organisms. *CRS Quarterly* 37, 82–91.

- Gardner J (2011): How can we stand on Scripture in an evolution-pushing culture? <https://answersingenesis.org/theistic-evolution/god-and-evolution/how-can-we-stand-on-scripture-in-an-evolution-pushing-culture/>. Accessed 5 September 2013.
- Grigg R (2005): Eugenics ... death of the defenceless. The legacy of Darwin's cousin Galton. *Creation* 28, 18–22.
- Grigg R (2010). Herbert Spencer. The father of social Darwinism. *Creation* 32, 52–54.
- Gurney RJM (2010): Is man a spiritualized hominid? *Creation* 32, 53–55.
- Ham K (1987): The evils of evolution. <https://answersingenesis.org/creation-vs-evolution/the-evils-of-evolution/>. Accessed 7 April 2013.
- Ham K (1999): Inter-racial marriage: is it Biblical? <https://answersingenesis.org/family/marriage/inter-racial-marriage-is-it-biblical/>. Accessed 3 September 2013.
- Ham K (2007a): What really happened to the dinosaurs? <https://answersingenesis.org/dinosaurs/when-did-dinosaurs-live/what-really-happened-to-the-dinosaurs/>. Accessed 3 June 2013.
- Ham K (2007b): Interracial marriage. It's the inside that matters. *Answers* January–March 2007, 34–36.
- Ham K (2008): Do all creationists go to heaven? *Answers* July–September 2008, 64–65.
- Ham K (2009b): The human kind. <https://answersingenesis.org/charles-darwin/racism/the-human-kind/>. Accessed 22 August 2013.
- Ham S (2010a): What's so big about Behemoth. <https://answersingenesis.org/answers/biblical-authority-devotional/whats-so-big-about-behemoth/>. Accessed 10 April 2013.
- Ham K (2010b): How should a Christian respond to “gay marriage”? <https://answersingenesis.org/family/homosexuality/how-should-a-christian-respond-to-gay-marriage/>. Accessed 21 August 2013.
- Ham K, Ham S (2011): Welcome to the war. <https://answersingenesis.org/family/welcome-to-the-war/>. Accessed 22 August 2013.
- Harker BR (2011): Science and rationality. *Journal of Creation* 25, 121–127.
- Harris WS, Calvert JH (2003): Intelligent design: the scientific alternative to evolution. *National Catholic Bioethics Quarterly* Autumn 2003, 531–561.
- Henry J (2001): The energy balance of Uranus: implications for special creation. *CEN Technical Journal* 15, 85–91.
- Henry H, Dyke DJ (2011): Evolution and stamp collecting, part 2 (of 2). <http://reasons.org/articles/evolution-and-stamp-collecting-part-2-of-2>. Accessed 26 March 2013.
- Hodge B (2007): Finland school shootings: the sad evolution connection. <https://answersingenesis.org/sanctity-of-life/mass-shootings/finland-school-shootings-the-sad-evolution-connection/>. Accessed 2 February 2013.
- Hodge B (2013): Already compromised. Appendix D. Institution questionnaire. Hebron: *Answers in Genesis*.
- Institute for Creation Research (ICR) (2013): Principles of scientific creationism. <http://www.icr.org/tenets>. Accessed 5 April 2013.
- Intelligent Design and Evolution Awareness Center (IDEA) (2013a): Articles. <http://www.ideacenter.org/resources/articles.php>. Accessed 3 October 2013.
- Intelligent Design and Evolution Awareness Center (IDEA) (2013b): Casey Luskin, Staff - Discovery Institute. <http://www.discovery.org/p/188>. Accessed 3 October 2013.
- Intelligent Design and Evolution Awareness Center (IDEA) (2013c): Our beliefs. http://www.ideacenter.org/about/mission_beliefs.php. Accessed 25 April 2013.

- Intelligent Design Network (IDN) (2013a): Publications.
<http://www.intelligentdesignnetwork.org/publications.htm>. Accessed 3 October 2013.
- Intelligent Design Network (IDN) (2013b): IDnet officers.
<http://www.intelligentdesignnetwork.org/people.htm>. Accessed 3 October 2013.
- Intelligent Design Network (IDN) (2013c): Seeking objectivity in origins science.
<http://www.intelligentdesignnetwork.org/index.htm>. Accessed 25 April 2013.
- International Council on Biblical Inerrancy (1978): Chicago statement on Biblical inerrancy.
 Dallas: Dallas Theological Seminary Archives.
- Isaak M (Ed.) (2006): Index to creationist claims. The TalkOrigins archive.
<http://www.talkorigins.org/indexcc/list.html>. Accessed 14 February 2013.
- Johnson PE (1993): Darwin on trial. Talebooks. <http://talebooks.com/ebooks/291.pdf>. Accessed 2 January 2013.
- Johnson PE (1995): Reason in the balance. The case against naturalism in science, law & education. Downers Grove: InterVarsity Books.
- Laudan L (1983): The demise of the demarcation problem. In Cohen RS, Laudan L (Eds.), *Physics, philosophy and psychoanalysis* (pp. 111–127): Dordrecht: D. Reidel Publishing.
- Leisola M (2012): Preface. In Pälikkö K, *From the beginning to the last days* (pp. 6–8): Helsinki: KP-art. [in Finnish]
- Leisola M, Pastinen O, Axe DD (2012): Lignin—designed randomness. *Bio-Complexity* 2012, 1–11.
- Lightner JK (2009): Karyotypic and allelic diversity within the canid baramin (Canidae). *Journal of Creation* 23, 94–98.
- Lightner JK (2011): Determining the ark kinds. *Answers Research Journal* 4, 195–201.
- Lightner JK (2012): Mammalian ark kinds. *Answers Research Journal* 5, 151–204.
- Long JT (2005): Whale evolution: fact from fiction. <http://www.trueauthority.com/cvse/whale.htm>. Accessed 27 August 2013.
- Luskin C (2009): The constitutionality and pedagogical benefits of teaching evolution scientifically. *University of St. Thomas Journal of Law & Public Policy* IV, 204–277.
- Luskin C, Gage LP (2008): A reply to Francis Collins’s Darwinian arguments for common ancestry of apes and humans. In House HW (Ed.), *Intelligent design 101. Leading experts explain the key issues* (pp. 215–235): Grand Rapids: Kregel Publication.
- Kay M (2006): Can God stop being God? A Review of Dawkin’s *God: genes, memes, and the meaning of life* by Alister McGrath. *Journal of Creation* 20, 26–28.
- Kulikovsky AS (2005): Scripture and general revelation. *CEN Technical Journal* 19, 23–28.
- Marjokorpi S (2012): Naispappeudesta (On female ordination). <http://santtuma.blogspot.fi/2012/10/naispappeudesta.html>. Accessed 27 September 2013. [in Finnish]
- Marsden N (2005): The father of lies. *Creation* 28, 36–37.
- Morris HM (1972): *The remarkable birth of planet earth*. Minneapolis: Bethany Fellowship.
- Morris HM (1974): *Scientific creationism*. Green Forest: Master Books.
- Morris HM (1982): Bible-believing scientists of the past. *Impact* #103.
- Morris HM (1998): Bigotry in science. *Acts & Facts* 27, No. 6.
- Morris HM (2001): Evolution is religion—not science. *Impact* #332.
- Morris JD (2006): Just how well proven is evolution? *Acts & Facts* 35, No. 2.
- Parker G (1994a): “Species” and “kind”. <https://answersingenesis.org/natural-selection/speciation/species-and-kind/>. Accessed 3 June 2013.
- Parker G (1994b): The Grand Canyon. <https://answersingenesis.org/geology/grand-canyon-facts/the-grand-canyon/>. Accessed 31 July 2013.

- Pigliucci M, Banta J, Bossu C, Crouse P, Dexter T, Hansknecht K, Muth N (2004): The alleged fallacies of evolutionary theory. *Philosophy Now* 46. http://philosophynow.org/issues/46/The_Alleged_Fallacies_of_Evolutionary_Theory. Accessed 4 March 2013.
- Pritchard T (2013): How can all the scientists be wrong. http://www.creationstudies.org/Education/can_scientists_be_wrong.html. Accessed 10 April 2013.
- Psarris S (2002a): Neptune: monument to creation. *Creation* 25, 22–24.
- Psarris S (2002b): Uranus. The strange planet. *Creation* 24, 38–40.
- Psarris S (2004): Mercury—the tiny planet that causes big problems for evolution. *Creation* 26, 36–39.
- Puolimatka T (2009): Usko, tiede ja evoluutio (Faith, science and evolution). 2nd ed. Helsinki: Uusi Tie. [in Finnish]
- Puolimatka T (2010): Tiedekeskustelun avoimuuskoe (A test for openness in science discussion). Helsinki: Uusi Tie. [in Finnish]
- Rautkoski M (2012): Comment on 23 February at 13:35 in online discussion. <http://www.kotimaa24.fi/uutiset/kulttuuri/7507-kenkaan-kohdalla-elama-ei-ole-yksinkertaista#!kmt-start=10>. Accessed 27 September 2013. [in Finnish]
- Reinikainen P (1991): Unohdettu Genesis (The forgotten Genesis). Helsinki: Uusi Tie. [in Finnish]
- Reinikainen P (2003): Dinosaurusten arvoitus ja Raamattu (The enigma of the dinosaurs and the Bible). 2nd ed. Helsinki: Kuva ja Sana. [in Finnish]
- Reinikainen P (2011): Darwin vai älykäs suunnitelma (Darwin or intelligent design). Helsinki: Uusi Tie. [in Finnish]
- Reinikainen P (2013a): Evoluutio vai luominen? (Evolution or creation?). http://www.pekkareinikainen.info/fi/index.php?option=com_content&task=view&id=25&Itemid=27. Accessed 5 February 2013. [in Finnish] Webpage removed in 2014.
- Reinikainen P (2013b): Enkeleitä alemmaksi (Lower than angels). http://www.pekkareinikainen.info/fi/index.php?option=com_content&task=view&id=24&Itemid=27. Accessed 5 February 2013. [in Finnish] Webpage removed in 2014.
- Reinikainen P (2013c): Onko Jumala olemassa? (Does God exist?). Helsinki: TV7. [in Finnish]
- Sanford J (2006): Genetic entropy & the mystery of the genome. New York: Feed My Sheep Foundation.
- Sanford J (2013): Critic ignores reality of genetic entropy. <http://creation.com/genetic-entropy>. Accessed 1 June 2013.
- Sanford J, Baumgardner J, Brewer W, Gibson P, ReMine W (2008): Using numerical simulation to test the validity of neo-Darwinian theory. *Proceedings of the Sixth International Conference on Creationism*, 166–175.
- Sarfati J (2005): Whale evolution? <http://creation.com/refuting-evolution-chapter-5-whale-evolution>. Accessed 27 August 2013.
- Sarfati J (2007): 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>. Accessed 2 February 2013.
- Sarfati J (2013a): Variation and natural selection versus evolution. <http://creation.com/refuting-evolution-chapter-2-variation-and-natural-selection-versus-evolution>. Accessed 3 June 2013.
- Sarfati J (2013b): Arguments we think creationists should NOT use. <http://creation.com/arguments-we-think-creationists-should-not-use>. Accessed 6 September 2013.
- Sarfati J (2013c): Argument: evolution is *true* science, not ‘just a theory’. <http://creation.com/refuting-evolution-2-chapter-3-argument-evolution-is-true-science-not-just-a-theory>. Accessed 3 October 2013.

- Sarfati J Matthews M (2011): Refuting evolution 2. Argument: 'irreducible complexity'. <http://creation.com/refuting-evolution-2-chapter-10-argument-irreducible-complexity>. Accessed 22 May 2013.
- Shackelford DG (1997): The Relationship between the Fall, the Curse, and the Gospel, and its incompatibility with theistic evolution. *Journal of Creation* 11, 11–17.
- Sharp DB (2013): Animals that prove creation. In Sharp DB, *The Revolution against evolution*. (Chapter 5 of an online book): Lansing: Revolution Against Evolution. http://www.inplainsite.org/html/animals_that_prove_creation.html. Accessed 10 April 2013.
- Snelling AA (1997): Saturn's rings short-lived and young. *CEN Technical Journal* 11, 1.
- Snelling AA (2007): The origin of oil. *Answers* January–March 2007, 74–77.
- Snelling AA (2009): Radiometric dating: back to basics. *Answers* July–September 2009, 72–75.
- Stambaugh J (1996): Creation, suffering and the problem of evil. *CEN Technical Journal* 10, 391–404.
- Steel AK (2001): Could Behemoth have been a dinosaur? *CEN Technical Journal* 15, 42–45.
- Swenson K (2001): Radio-dating in rubble. The lava dome at Mount St Helens debunks dating methods. <https://answersingenesis.org/geology/radiometric-dating/radio-dating-in-rubble/>. Accessed 2 February 2013.
- TalkOrigins archive (2004): Claim CA610. <http://www.talkorigins.org/indexcc/CA/CA610.html>. Accessed 15 January 2013.
- TalkOrigins archive (2006): Claim CA041.1. http://www.talkorigins.org/indexcc/CA/CA041_1.html. Accessed 15 January 2013.
- TalkOrigins archive (2007): Claim CA005. <http://www.talkorigins.org/indexcc/CA/CA005.html>. Accessed 15 January 2013.
- TalkOrigins archive (2008): Claim CA006.1. http://www.talkorigins.org/indexcc/CA/CA006_1.html. Accessed 15 January 2013.
- Thomas B (2013): Are humans as close to chickens as they are to chimps? <http://www.icr.org/article/humans-close-chickens-they-are-chimps/>. Accessed 4 April 2013.
- Truth Matters (2013): More useful quotes for creationists. <http://truthmatters.info/more-useful-quotes-for-creationists/>. Accessed 3 October 2013.
- UK Apologetics (2013a): Apologetics: challenging evolution. <http://www.ukapologetics.net/Apologetics.htm>. Accessed 3 October 2013.
- UK Apologetics (2013b): Our statement of faith. <http://www.ukapologetics.net/faithstatement.htm>. Accessed 3 October 2013.
- Vartiainen HJ (1997): Terveysterroristit aisoihin (Let's keep health terrorists in check). http://yliopistolainen.helsinki.fi/yol97_6/yolmie.htm. Accessed 27 September 2013. [in Finnish]
- Walker T (2008): Evolution is inherently racist. <http://creation.com/evolution-is-inherently-racist>. Accessed 7 April 2013.
- Weikart R (2004): *From Darwin to Hitler: Evolutionary ethics, eugenics, and racism in Germany*. New York: Palgrave Macmillan.
- Weinberger L (2005): Preaching to his own choir. *CEN Technical Journal* 19, 42–45.
- Wieland C (1994): Exploding evolution. Creatures found as fossils in 'Cambrian' rocks have no evolutionary ancestors. And no new basic body plans have appeared since. *Creation* 16, 38–39.
- Wieland C (1997): Sensational dinosaur blood report! *Creation* 19, 42–43.
- Wieland C (1998): The strange tale of the leg on the whale. *Creation* 20, 10–13.

- Williams A (2008): Mutations: evolution's engine becomes evolution's end! *Journal of Creation* 22, 60–66.
- Woetzel D (2009): Evolutionists retreating from the arena of science. <http://www.creation.com/evolutionists-retreat-from-science>. Accessed 23 May 2013.
- Woodmorappe J (2001): Mammal-like reptiles: major trait reversals and discontinuities. *CEN Technical Journal* 15, 44–52.
- Woodmorappe J (2002): Greenland ice cores: implicit evidence for catastrophic deposition. *CEN Technical Journal* 16, 14–16.
- Woodmorappe J (2009): Evolutionary cladograms and malevolent, straw-men creationists. A review of *Evolution: What the fossils say and why it matters* by Donald R. Prothero. *Journal of Creation* 23, 39–43.
- Wright D (2012): Timeline for the Flood. <https://answersingenesis.org/bible-timeline/timeline-for-the-flood/>. Accessed 3 June 2013.
- Yahya H (2006): *Atlas of creation*, Vol. 1. Ankara: Global Publishing.
- YEC Headquarters 6 Day Creation (2011): Can theistic evolution belief make a Christian lose their salvation? <http://yechheadquarters.org/?p=852>. Accessed 26 April 2013
- Young W (1985): *Fallacies of creationism*. Calgary: Detselig Enterprises.
- Zimmerman M (2010): The danger of ignoring creationism. *Huffington Post* 15 April, 2010.

INTERNET HOMEPAGES OF SAMPLED AUTHORS, JOURNALS AND ORGANIZATIONS

- Answers in Genesis (AiG): <https://www.answersingenesis.org/>. Accessed 27 August 2013.
- Answers Magazine: <https://answersingenesis.org/answers/magazine/>. Accessed 27 August 2013.
- Creation (magazine): <http://creation.com/creation-magazine>. Accessed 27 August 2013.
- Creation Ministries International (CMI): <http://creation.com/>. Accessed 27 August 2013.
- Creation Studies Institute (CSI): <http://www.creationstudies.org/>. Accessed 28 August 2013.
- Discovery Institute: <http://www.discovery.org/>. Accessed 27 August 2013.
- Institute for Creation Research (ICR): <http://www.icr.org>. Accessed 5 October 2013.
- Intelligent Design and Evolution Awareness Center (IDEA): <http://www.ideacenter.org/>. Accessed 27 August 2013.
- Intelligent Design Network (IDN): <http://www.intelligentdesignnetwork.org/>. Accessed 27 August 2013.
- Journal of Creation: <http://creation.com/journal-of-creation>. Accessed 27 August 2013.
- Liberty University: <http://www.liberty.edu/>. Accessed 26 August 2013.
- Luominen.fi and "Luominen" magazine: <http://www.luominen.fi/lehti/>. Accessed 5 September 2013.
- Old Earth Ministries: <http://www.oldearth.org/>. Accessed 25 August 2013.
- Puolimatka T (2013): Tapio Puolimatka. <http://www.tapiopuolimatka.net/>. Accessed 28 August 2013.
- Reinikainen P (2013d): Pekka Reinikainen. <http://www.pekkareinikainen.info/fi/index.php>. Accessed 27 August 2013. Webpage removed in 2014.
- The Panda's Thumb: <http://www.pandasthumb.org/>. Accessed 27 August 2013.
- The TalkOrigins archive: <http://www.talkorigins.org/>. Accessed 27 August 2013.
- UK Apologetics: <http://www.ukapologetics.net/>. Accessed 29 August 2013.
- YEC Headquarters 6 Day Creation: <http://yecheadquarters.org/>. Accessed 28 August 2013.

LITERATURE CITED

- Aikin SF, Casey J (2011): Straw men, weak men, and hollow men. *Argumentation* 25, 87–105.
- Alters BJ, Nelson CE (2002): Perspective: teaching evolution in higher education. *Evolution* 56, 1891–1901.
- Anderson AA, Brossard D, Scheufele DA, Xenos MA, Ladwig P (2014): The “nasty effect:” Online incivility and risk perceptions of emerging technologies. *Journal of Computer-Mediated Communication* 19, 373–387.
- Andrews RC (1921): A remarkable case of external hind limbs in a humpback whale. *American Museum Novitates* No. 9, 1–6.
- Anon (2011): Luominen—tarua vai totta? 1 Moos 1–14 (Creation—myth or reality? 1 Moos 1–14). http://sley.fi/luennot/Raamattu/Vt/Vanhan_testamentin_yleisluennot/Snl1-21PH.htm. Accessed 27 August 2013. [in Finnish]
- Anon (2013): List of dinosaurs. http://en.wikipedia.org/wiki/List_of_dinosaurs. Accessed 1 June 2013.
- Artigas M, Glick TF, Martinez RA (2006): Negotiating Darwin: the Vatican confronts evolution, 1877–1902. Baltimore: Johns Hopkins University Press.
- Augustine of Hippo (≈ 415): *De genesi ad litteram libri duodecim*. http://www.augustinus.it/latino/genesi_lettera/index2.htm. Accessed 24 April 2013.
- Ávila V, Chavarriás D, Sánchez E, Manrique A, López-Fanjul C, García-Dorado A (2006): Increase of the spontaneous mutation rate in a long-term experiment with *Drosophila melanogaster*. *Genetics* 173, 267–277.
- Badger S, Tenneson M (2010): Does the spirit create through evolutionary process? Pentecostals and biological evolution. In Smith JKA, Yong A (Eds.), *Science and the spirit. A Pentecostal engagement with the sciences* (pp. 92–116): Bloomington: Indiana University Press.
- Baer CF, Phillips N, Ostrow D, Avalos A, Blanton D, Boggs A, Keller L, Levy L, Mezerhane E (2006): Cumulative effects of spontaneous mutations for fitness in *Caenorhabditis*: role of genotype, environment and stress. *Genetics* 174, 1387–1395.
- Bakewell MA, Shi P, Zhang J (2007): More genes underwent positive selection in chimpanzee evolution than in human evolution. *Proceedings of the National Academy of Sciences* 104, 7489–7494.
- Bakker R (1986): *The dinosaur heresies*. London: Penguin Books.
- Benedict XVI (2007): Meeting of the Holy Father Benedict XVI with the clergy of the dioceses of Belluno-Feltre and Treviso, Church of St Justin Martyr, Auronzo di Cadore, Tuesday, 24 July 2007. http://vatican.va/holy_father/benedict_xvi_speeches/2007/july/documents/hf_ben_xvi_sp_e_20070724_clero-cadore_en.html. Accessed 31 July 2013.
- Blancke S, De Smedt J (2013): Evolved to be irrational? Evolutionary and cognitive foundation of pseudosciences. In Pigliucci M, Boudry M (Eds.), *The philosophy of pseudoscience* (pp. 361–379): Chicago: University of Chicago Press.
- Blancke S, De Smedt J, De Cruz H, Boudry M, Braeckman J (2012): The implications of the cognitive sciences for the relation between religion and science education: the case of evolutionary theory. *Science & Education* 21, 1167–1184.
- Blancke S, Hjerimitslev HH, Braeckman J, Kjærgaard PC (2013): Creationism in Europe: facts, gaps, and prospects. *Journal of the American Academy of Religion* 81, 996–1028.

- Blount ZD, Borland CZ, Lenski RE (2008): Historical contingency and the evolution of a key innovation in an experimental population of *Escherichia coli*. *Proceedings of the National Academy of Sciences* 105, 7899–7890.
- Boudry M, Leuridan B (2011): Where the design argument goes wrong: auxiliary assumptions and unification. *Philosophy of Science* 78, 558–578.
- Boudry M, Blancke S, Braeckman J (2010): How not to attack intelligent design creationism: philosophical misconceptions about methodological naturalism. *Foundations of Science* 15, 227–244.
- Bowler PJ (2003): *Evolution: The history of an idea*. 3rd ed. Berkeley: University of California Press.
- Boxhorn J (1995): Observed instances of speciation. <http://www.talkorigins.org/faqs/faq-speciation.html>. Accessed 31 July 2013.
- Brink DO (2007): The autonomy of ethics. In Martin M (Ed.), *The Cambridge companion to atheism* (pp. 149–165). Cambridge: Cambridge University Press.
- Burrows AM, Waller BM, Parr LA, Bonar CJ (2006): Muscles of facial expression in the chimpanzee (*Pan troglodytes*): descriptive, comparative and phylogenetic contexts. *Journal of Anatomy* 208, 153–167.
- Callaway E (2013): Deal done over HeLa cell line. Family of Henrietta Lacks agrees to release of genomic data. *Nature* 500, 132–133.
- Campbell A, Otrell-Cass K (2011): Teaching evolution in New Zealand’s schools—reviewing changes in the New Zealand science curriculum. *Research in Science Education* 41, 441–451.
- Campione NE, Evans DC (2011): Cranial growth and variation in edmontosaurs (Dinosauria: Hadrosauridae): implications for latest Cretaceous megaherbivore diversity in North America. *PLoS ONE* 6, e25186.
- Carlsson B, Kindberg E, Buesa J, Rydell GE, Fos Lidón M, Montava R, Abu Mallouh R, Grahn A, Rodríguez-Díaz J, Bellido J, Arnedo A, Larson G, Svensson L (2009): The G428A nonsense mutation in FUT2 provides strong but not absolute protection against symptomatic GII.4 norovirus infection. *PLoS ONE* 4, e5993.
- Carrier R (2004a): The argument from biogenesis: probabilities against a natural origin of life. *Biology and Philosophy* 19, 739–764.
- Carrier R (2004b): Antony Flew considers God... Sort of. <http://www.infidels.org/kiosk/article369.html>. Accessed 17 February 2013.
- Carrier R (2006): Science and medieval Christianity. <http://richardcarrier.blogspot.fi/2006/11/science-and-medieval-christianity.html>. Accessed 28 August 2013.
- Cavanaugh MA (1985): Scientific creationism and rationality. *Nature* 315, 185–189.
- Charity Navigator (2013a): Answers in Genesis. <http://www.charitynavigator.org/index.cfm?bay=search.summary&orgid=5214>. Accessed 31 August 2013.
- Charity Navigator (2013b): Discovery Institute. <http://www.charitynavigator.org/index.cfm?bay=search.summary&orgid=9757>. Accessed 31 August 2013.
- Chiappe LM (2009): Downsized dinosaurs: the evolutionary transition to modern birds. *Evolution: Education and Outreach* 2, 248–256.
- Church of Sweden (2005): Hör evolution ihop med kristen tro? (Is evolution compatible with Christian faith?). Church of Sweden. <http://www.svenskakyrkan.se/default.aspx?id=679678>. Accessed 6 June 2013. [in Swedish]

- Conway Morris S (1998): *The crucible of creation. The Burgess shale and the rise of animals.* Oxford: Oxford University Press.
- Conway Morris S (2005): The Boyle lecture. Darwin's compass: how evolution discovers the song of creation. <http://www.faith.org.uk/Publications/Magazines/Nov05/Nov05DarwinsCompass.html>. Accessed 5 January 2010.
- Corcoran J (1989): Argumentations and logic. *Argumentation* 3, 17–43.
- Crouch RA, Miller RB, Sideris LH (2006): *Intelligent design, science, education and public reason.* Bloomington: Indiana University, The Poynter Center for the Study of Ethics and American Institutions.
- Crow JF (1997): The high spontaneous mutation rate: is it a health risk. *Proceedings of the National Academy of Sciences* 94, 8380–8386.
- Curtis GN (2001): Fallacy files. <http://www.fallacyfiles.org/aboutgnc.html>. Accessed 10 December 2012.
- Darwin C (1839): *Voyage of the Beagle.* London: Penguin Books.
- Darwin C (1859): *On the origin of species by means of natural selection, or the preservation of favoured races in the struggle for life.* London: John Murray.
- Darwin C (1861): Letter to Asa Gray. In Darwin C, Burkhardt F, Smith S (Eds.), *The correspondence of Charles Darwin: Vol. 9.* Cambridge: Cambridge University Press.
- Data360.org (2006): Belief in Evolution - % of Population. Data360. http://www.data360.org/dsg.aspx?Data_Set_Group_Id=507. Accessed 17 February 2013.
- Dawkins R (1986): *The blind watchmaker.* New York: W. W. Norton & Company.
- Deming D (2008): Design, science and naturalism. *Earth-Science Reviews* 90, 49–70.
- Denes-Raj V, Epstein S (1994): Conflict between intuitive and rational processing: when people behave against their better judgment. *Journal of Personality and Social Psychology* 66, 819–829.
- Diogo R, Wood B (2011): Soft-tissue anatomy of the primates: phylogenetic analyses based on the muscles of the head, neck, pectoral region and upper limb, with notes on the evolution of these muscles. *Journal of Anatomy* 219, 273–359.
- Diogo R, Wood BA, Aziz MA, Burrows A (2009): On the origin, homologies and evolution of primate facial muscles, with a particular focus on hominoids and a suggested unifying nomenclature for the facial muscles of the Mammalia. *Journal of Anatomy* 215, 300–319.
- Doherty ME, Mynatt CR, Tweney RD, Schiavo MD (1981): Pseudodiagnosticity. In Tweney RD, Doherty ME, Mynatt CR (Eds.), *On scientific thinking* (pp. 158–169): New York: Columbia University Press.
- Douay-Rheims Catholic Bible (2001): <http://www.drbo.org/chapter/20040.htm>. Accessed 17 June 2013.
- Dowden B (2010): Internet encyclopedia of philosophy. Fallacies. <http://www.iep.utm.edu/fallacy/>. Accessed 13 February 2013.
- Durrett R, Schmidt D (2008): Waiting for two mutations: with applications to regulatory sequence evolution and the limits of Darwinian evolution. *Genetics* 180, 1501–1509.
- Durrett R, Schmidt D (2009): Reply to Michael Behe. *Genetics* 181, 821–822.
- Eldredge N (1985): *Time frames: the rethinking of Darwinian evolution and the theory of punctuated equilibria.* New York: Simon & Schuster.
- Episcopal Church in the United States of America, the Committee on Science, Technology and Faith of the Executive Council (2005): *A catechism of creation: an Episcopal understanding.* Louisville: The Domestic and Foreign Missionary Society of the Protestant Episcopal Church in the United States of America.

- Epstein S (1994): Integration of the cognitive and the psychodynamic unconscious. *American Psychologist* 49, 709–724.
- Evangelical Church in Germany (2008): Evangelische Kirche zieht klare Trennlinie zu Kreationismus. http://www.ekd.de/aktuell_presse/news_2008_04_01_2_ekd_text_94.html. Accessed 15 May 2013. [in German]
- Evangelical Lutheran Church of Finland (2013): Evolution. <http://www.evli2.fi/sanasto/index/php/Evoluutio>. Accessed 6 June 2013. [in Finnish]
- Evans EM (2001): Cognitive and contextual factors in the emergence of diverse belief systems: creation versus evolution. *Cognitive Psychology* 42, 217–266.
- Faqs.org (2013): Intelligent Design Network Inc in Lake Quivira, Kansas. <http://www.faqs.org/tax-exempt/KS/Intelligent-Design-Network-Inc.html>. Accessed 31 August 2013.
- Fields H (2006): Dinosaur shocker. <http://www.smithsonianmag.com/science-nature/dinosaur.html>. Accessed 31 August 2013.
- FindTheCompany (2013): The Intelligent Design and Evolution Awareness Center in Seattle, Washington. <http://companies.findthecompany.com/l/23842336/The-Intelligent-Design-And-Evolution-Awareness-Idea-Center-in-Seattle-WA>. Accessed 31 August 2013.
- Fitelson B, Stephens C, Sober E (1999): How not to detect design. Department of Philosophy, University of Wisconsin, Madison: Copyright 2000 Branden Fitelson, Christopher Stephens, Elliott Sober.
- Fitzhugh K (2010): Evidence for evolution versus evidence for intelligent design: parallel confusions. *Evolutionary Biology* 37, 68–92.
- Fogelin RJ, Duggan TJ (1987): Fallacies. *Argumentation* 1, 255–262.
- Forbes List (2013): America's top colleges. <http://www.forbes.com/top-colleges/list/>. Accessed 27 August 2013.
- Forrest B (2007): Understanding the intelligent design creationist movement: its true nature and goals. A position paper from The Center for Inquiry Office of Public Policy. Washington DC: Center for Inquiry.
- Foth C (2012): On the identification of feather structures in stem-line representatives of birds: evidence from fossils and actupalaeontology. *Paläontologische Zeitschrift* 86, 91–102.
- Friedman M (2008): The evolutionary origin of flatfish asymmetry. *Nature* 454, 209–212.
- Gilbert W (1986): Origin of life: The RNA world. *Nature* 319, 618.
- Gingerich PD, Ul-Haq M, von Koenigswald W, Sanders WJ, Smith BH, Zalmout IS (2009): New protocetid whale from the middle Eocene of Pakistan: birth on land, precocial development, and sexual dimorphism. *PLoS ONE* 4, e4366.
- Godin B (1999): Argument from consequences and the urge to polarize. *Argumentation* 13, 347–365.
- Goodwin J (1998): Forms of authority and the real *ad verecundiam*. *Argumentation* 12, 267–280.
- Gould SJ (1980): *The panda's thumb*. New York: W. W. Norton & Co.
- Gould SJ (1989): *Wonderful life: the Burgess Shale and the nature of history*. New York: W.W. Norton & Co.
- Gould SJ (1997): Nonoverlapping magisteria. *Natural History* 106, 16–22.
- GuideStar (2013): Institute for Creation Research. http://www.guidestar.org/organizations/95-3523177/institute-creation-research.aspx#ctl00_phMainBody_divRevExp. Accessed 31 August 2013.
- Hafiz Y (2013): Evolution and God: only 21% of Americans believe humans evolved without divine guidance. *Huffington Post* 23 July, 2013.

- Hahn U, Oaksford M (2007): The burden of proof and its role in argumentation. *Argumentation* 21, 39–61.
- Hall DW, Mahmoudizad R, Hurd AW, Joseph SB (2008): Spontaneous mutations in diploid *Saccharomyces cerevisiae*: another thousand cell generations. *Genetics Research* 90, 229–241.
- Ham K (2009a): AiG at Liberty University. <http://blogs.answersingenesis.org/blogs/kenham/2009/09/23/aig-at-liberty-university/>. Accessed 31 August 2013.
- Hameed S (2014): Making sense of Islamic creationism in Europe. *Public Understanding of Science*, doi: 10.1177/0963662514555055.
- Hardt TGA (2002 [1980]): The God created Heaven and Earth. Examining the first books of the Bible. Helsinki: Suomen Luther-säätiö. [in Finnish]
- Harrison BW (2001): Early Vatican responses to evolutionary theory. *Living Tradition—Organ of the Vatican Theological Forum*, No. 93.
- Henke KR (2013): Young-earth creationist ‘dating’ of a Mt. St. Helens dacite: the failure of Austin and Swenson to recognize obviously ancient minerals. *No Answers in Genesis*. http://noanswersingenesis.org.au/mt_st_helens_dacite_kh.htm. Accessed 4 April 2013.
- Hergovich A, Schott R, Burger C (2010): Biased evaluation of abstracts depending on topic and conclusion: further evidence of a confirmation bias within scientific psychology. *Current Psychology* 29, 188–209.
- Hitler A (1936): *Mein Kampf*. 172.–173. Auflage. Munich: Zentralverlag der N.S.D.A.P. Frz Eher Nachf. [in German]
- Holy See (1993): *Catechism of the Catholic Church*. http://www.vatican.va/archive/ENG0015/_INDEX.HTM. Accessed 17 June 2013.
- Hughes JF, Skaletsky H, Pyntikova T, Graves TA, van Daalen SKM, Minx PJ, Fulton RS, McGrath SD, Locke DP, Friedman C, Trask BJ, Mardis ER, Warren WC, Repping S, Rozen S, Wilson RK, Page DC (2010): Chimpanzee and human Y chromosomes are remarkably divergent in structure and gene content. *Nature* 463, 536–539.
- Ibn Khaldun (1377): *Muqaddimah*. http://www.muslimphilosophy.com/ik/Muqaddimah/Chapter1/Toc_Ch_1.htm. Accessed 6 June 2014.
- International Faith & Science Conferences 2002-2004 Organizing Committee (2004): *Affirmation of Creation: The International Faith & Science Conferences 2002-2004 report of the Organizing Committee to the General Conference Executive Committee through the office of the General Conference President, September 10, 2004*. Silver Spring: Seventh-day Adventist World Church.
- International Theological Commission (2004): *Communion and stewardship: human persons created in the image of God*. http://www.vatican.va/roman_curia/congregations/cfaith/cti_documents/rc_con_cfaith_doc_20040723_communion-stewardship_en.html. Accessed 2 February 2013.
- Isaak M (2003): Five major misconceptions about evolution. <http://www.talkorigins.org/faqs/faq-misconceptions.html>. Accessed 27 August 2013.
- Isaak M (Ed.) (2006): *An index to creationist claims*. The TalkOrigins archive. <http://www.talkorigins.org/indexcc/list.html>. Accessed 14 February 2013.
- Järnefelt E (2007): *Älykkään suunnittelun teoria: Tutkimus kansanomaisen psykologian ja biologian yhteydestä kreationistiseen ajatteluun (Theory of intelligent design: A study on the connections of popular psychology and biology to creationist thinking)*. MA Thesis. Helsinki: University of Helsinki, Faculty of Arts, Department of Comparative Religion. [in Finnish with an English abstract]

- John Paul II (1996): Message to the Pontifical Academy of Sciences: on evolution. Vatican: The Holy See.
- Johnston IC (1999): ...And still we evolve: A handbook for the early history of modern science. <https://www.oneeyedman.net/school-archive/classes/fulltext/www.mala.bc.ca/~johnstoi/darwin/title.htm>. Accessed 6 June 2014.
- Jovičić T (2004): Authority-based argumentative strategies: a model for their evaluation. *Argumentation* 18, 1–24.
- Kelemen D, DiYanni C (2005): Intuitions about origins: purpose and intelligent design in children’s reasoning about nature. *Journal of Cognition and Development* 6, 3–31.
- Kelley DH, Milone EF (2011): Exploring ancient skies: a survey of ancient and cultural astronomy. New York: Springer.
- Kirk GS, Raven JE, Schofield M (1983): The presocratic philosophers. 2nd ed. Cambridge: Cambridge University Press.
- Kiviranta P (2011): Luominen – tarua vai totta? (Creation—myth or reality?). http://sley.fi/luennot/Raamattu/Vt/Vanhan_testamentin_yleisluennot/1Moos1-11PK.htm. Accessed 31 July 2013. [in Finnish]
- Kuraev A (transl. Chumakov A) (2001): Orthodoxy and creationism. Missionary Leaflet #E87. La Cañada: Holy Trinity Orthodox Mission.
- Lancaster S (2005): Capable of God: Evolution and new Creation. *Theology and Science* 3, 197–210.
- Langen TA (2004): What is right with ‘teaching the controversy’? *Trends in Ecology and Evolution* 19, 114–115.
- Larson EJ (2004): Evolution: The remarkable history of a scientific theory. New York: Modern Library.
- Latin Vulgate Bible (2001): <http://www.drbo.org/lvb/>. Accessed 3 October 2013.
- Liberty University (2012): Liberty University undergraduate catalog 2012–2013. Lynchburg: Liberty University.
- Lindeman M (1998): Motivation, cognition and pseudoscience. *Scandinavian Journal of Psychology* 39, 257–265.
- Lindeman M (2011): Biases in intuitive reasoning and belief in complementary and alternative medicine. *Psychology & Health* 26, 371–382.
- Linder DO (2008): State *v.* John Scopes (“The monkey trial”). Speech on the Occasion of the 75th Anniversary of the Scopes Trial, July 10, 2000. <http://law2.umkc.edu/faculty/projects/ftrials/scopes/evolut.htm>. Accessed 27 August 2013.
- Liu J, Shu D, Han J, Zhang Z, Zhan X (2006): A large xenusiid lobopod with complex appendages from the Lower Cambrian Chengjiang Lagerstätte. *Acta Palaeontologica Polonica* 51, 215–222.
- Liu J, Shu D, Han J, Zhang Z, Zhan X (2008): Origin, diversification, and relationships of Cambrian lobopods. *Gondwana Research* 14, 277–283.
- Lucey BP, Walter A, Nelson-Rees WA, Grover M, Hutchins GM (2009): Henrietta Lacks, HeLa cells, and cell culture contamination. *Archives of Pathology & Laboratory Medicine* 133, 1463–1467.
- Lucretius (59): Liber II. <http://www.thelatinlibrary.com/lucretius.html>. Accessed 6 June 2014.
- MacCoun RJ (1998): Biases in the interpretation and use of research results. *Annual Review of Psychology* 49, 259–287.
- Mackie JL (1982): The miracle of theism. Arguments for and against the existence of God. Oxford: Clarendon Press.

- Marsh B, Todd PM, Gigerenzer G (2004): Cognitive heuristics: reasoning the fast and frugal way. In Leighton JP, Sternberg RJ (Eds.), *The nature of reasoning* (pp. 273–287): New York: Cambridge University Press.
- Matzke NJ (2003): Evolution in (Brownian) space: a model for the origin of the bacterial flagellum. *TalkDesign*. <http://www.talkdesign.org/faqs/flagellum.html>. Accessed 13 June 2013.
- Mayr E (2003): *Evoluutio* (Evolution). Helsinki: WSOY. [in Finnish]
- McGrath A (2010): *A fine-tuned universe: The quest for God in science and theology*. Louisville: Westminster John Knox.
- McGrath AE (2011): *Science and religion. A new introduction*. 2nd ed. Chichester: John Wiley & Sons.
- McLaughlin PJ, Dayhoff MO (1973): Eukaryote evolution: a view based on cytochrome c sequence data. *Journal of Molecular Evolution* 2, 99–116.
- McLean v. Arkansas documentation project (2005): Contents. http://www.antievolution.org/projects/mclean/new_site/index.htm. Accessed 31 August 2013.
- Meng J, Wang Y, Li C (2011): Transitional mammalian middle ear from a new Cretaceous Jehol eutriconodont. *Nature* 472, 181–185.
- Milinkovitch MC, Orti G, Meyer A (1993): Revised phylogeny of whales suggested by mitochondrial ribosomal DNA sequences. *Nature* 361, 346–348.
- Mitchell S (transl.) (1992): *The book of Job*. New York: Harper Collins.
- Mitchell G, Skinner JD (2003): On the origin, evolution and phylogeny of giraffes, *Giraffa camelopardalis*. *Transactions of the Royal Society of South Africa* 58, 51–73.
- Mitroff II (1981): Scientists and confirmation bias. In Tweney RD, Doherty ME, Mynatt CR (Eds.), *On scientific thinking* (pp. 170–175): New York: Columbia University Press.
- Moore R (2000): The revival of creationism in the United States. *Journal of Biological Education* 35, 17–21.
- Moore A (2010): Should Christians do natural theology? *Scottish Journal of Theology* 63, 127–145.
- Moore G (2011a): Dinosaur blood? Reasons to Believe. <http://www.reasons.org/articles/dinosaur-blood>. Accessed 15 December 2012.
- Moore G (2011b): Dinosaur blood revisited, part 1 (of 2): Reasons to Believe. <http://www.reasons.org/articles/dinosaur-blood-revisited-part-1-of-2>. Accessed 15 December 2012.
- Moore G (2011c): Dinosaur blood revisited, part 2 (of 2): Reasons to Believe. <http://www.reasons.org/articles/dinosaur-blood-revisited-part-2-of-2>. Accessed 15 December 2012.
- Moritz JM (2011): The search for Adam revisited: evolution, Biblical literalism, and the question of human uniqueness. *Theology and Science* 9, 367–377.
- Moritz JM (2013): God’s creation through evolution and the language of Scripture. *Theology and Science* 11, 1–7.
- Morrison JD (2001): Thomas Torrance’s reformulation of Karl Barth’s christological rejection of natural theology. *The Evangelical Quarterly* 73, 59–75.
- Murray BG Jr. (2001): Are ecological and evolutionary theories scientific? *Biological Reviews* 76, 255–289.
- Murtorinne E (1992): *Suomen kirkon historia 3, autonomian kausi 1809–1899* (History of the church of Finland 3, era of autonomy 1809–1899). Porvoo: WSOY. [in Finnish]

- Näreaho L (2010): Tiede, uskonto ja tietoisuus: filosofista rajankäyntiä (Science, religion and consciousness: philosophical demarcation). Helsinki: Suomalainen Teologinen Kirjallisuusseura and the author. [in Finnish]
- National Center for Science Education (2008): *Kitzmiller v. Dover*: intelligent design on trial. <http://ncse.com/creationism/legal/intelligent-design-trial-kitzmiller-v-dover>. Accessed 31 August 2013.
- Nelson PA (1996): The role of theology in current evolutionary reasoning. *Biology and Philosophy* 11, 493–517.
- Nickerson RS (1998): Confirmation bias: a ubiquitous phenomenon in many guises. *Review of General Psychology* 2, 175–220.
- Nickson E (2004): Let's be intelligent about Darwin. *National Post* 6 February, 2004.
- Nicozisin G (2013): Creationism versus evolution. http://www.orthodoxresearchinstitute.org/articles/dogmatics/nicozisin_creationism.htm. Accessed 21 August 2013.
- Nieminen P (2012): Evoluutioteorian ja uskonnon suhde: luonnontieteellinen ja teologinen argumentaatio Tapio Puolimatkan teoksessa *Usko, tie ja evoluutio* (Evolutionary theory and religion: scientific and theological argumentation in the book *Faith, science and evolution* by Tapio Puolimatka). MTh Thesis. Joensuu: University of Eastern Finland. [in Finnish with an English abstract]
- NNDB (2013): Michael Behe. <http://www.nndb.com/people/637/000058463/>. Accessed 30 August 2013.
- Nonaka M, Azumi K, Ji X, Namikawa-Yamada C, Sasaki M, Saiga H, Dodds AW, Sekine H, Homma MK, Matsushita M, Endo Y, Fujita T (1999): Opsonic complement component C3 in the solitary ascidian, *Halocynthia roretzi*. *Journal of Immunology* 162, 387–391.
- Numbers RL (2006): *The creationists: from scientific creationism to intelligent design*. Cambridge: Harvard University Press.
- Öjermo M (2008): Anser svenska kyrkan att Bibeln är Guds ord? (Does the Swedish Church consider that the Bible is the Word of God?). <http://www.svenskakyrkan.se/default.aspx?di=677389>. Accessed 27 August 2013. [in Swedish]
- Ólafsson SS (2005): Menn, apar og þróunarkenning (Men, apes and evolutionary science). The Evangelical Church of Iceland. http://tru.is/svor/2005/11/menn_apar_og_throunarkenning. Accessed 31 July 2013. [in Icelandic]
- Open Charity (2013): Creation Ministries International (Canada). <http://www.opencharity.ca/charity/118878891RR0001>. Accessed 31 August 2013.
- Orthodox Church in America (2014): *Evolution & orthodoxy*. <http://oca.org/questions/contempmoral/evolution-orthodoxy>. Accessed 11 June 2014.
- Pacini R, Epstein S (1999): The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology* 76, 972–987.
- Paley W (1809): *Natural theology: or, evidences of the existence and attributes of the Deity*. http://darwin-online.org.uk/converted/Ancillary/1809_Paley_A142.html. Accessed 11 June 2014.
- Pallen MJ, Matzke NJ (2006): From *The Origin of Species* to the origin of bacterial flagella. *Nature Reviews Microbiology* 4, 784–790.
- Pannenberg W (2004a [1991]): *Systematic theology Volume 1*, trans. Bromiley GW. London: T & T Clark International.
- Pannenberg W (2004b [1991]): *Systematic theology Volume 2*, trans. Bromiley GW. London: T & T Clark International.

- Paps J, Bagaña J, Riutort M (2008): Lophotrochozoa internal phylogeny: new insights from an up-to-date analysis of nuclear ribosomal genes. *Proceedings of the Royal Society B: Biological Sciences* 276, 1245–1254.
- Paps J, Bagaña J, Riutort M (2009): Bilaterian phylogeny: a broad sampling of 13 nuclear genes provides a new Lophotrochozoa phylogeny and supports a paraphyletic basal acoelomorpha. *Molecular Biology and Evolution* 26, 2397–2406.
- Pareene A (2011): Evangelical Liberty University received half a billion dollars in federal aid money. http://www.salon.com/2011/04/05/liberty_university_federal_money/. Accessed 29 August 2013.
- Parker A (2003): *In the blink of an eye: how vision kick-started the big bang of evolution*. London: Simon & Schuster.
- Pennock RT (2003): Creationism and intelligent design. *Annual Review of Genomics and Human Genetics* 4, 143–163.
- Peters KE (2012): Human salvation in an evolutionary world: an exploration in Christian naturalism. *Zygon* 47, 843–869.
- Philippe N, Pelosi L, Lenski RE, Schneider D (2009): Evolution of penicillin-binding protein 2 concentration and cell shape during a long-term experiment with *Escherichia coli*. *Journal of Bacteriology* 191, 909–921.
- Pius XII (1950): Encyclical *humani generis* of the Holy Father Pius XII to our venerable brethren, patriarchs, primates, archbishops, bishops, and other local ordinaries enjoying peace and communion with the Holy See concerning some false opinions threatening to undermine the foundations of Catholic doctrine. Vatican: The Holy See.
- Popper K (1978): Natural selection and the emergence of mind. *Dialectica* 32, 339–355.
- Purves WK, Sadava D, Orians GH, Heller HC (2004): *Life. The science of biology*. 7th ed. Sunderland: Sinauer Associates.
- Putz R, Pasbst R (Eds.) (2009): *Sobotta. Atlas of human anatomy*. 14th ed. Munich: Urban & Fischer.
- Ranta P (2011): *Charles Darwin—elämä ja evoluutio (Charles Darwin—life and evolution)*. Helsinki: Teos. [in Finnish]
- Raoult D (2008): Creationism—remember the principle of falsifiability. *Lancet* 372, 2095–2096.
- Ratcliff WC, Denison RF, Borrello M, Travisano M (2011): Experimental evolution of multicellularity. University of Oklahoma, Conference Report, Evolution, June 17–21, 2011, Norman, USA.
- RationalWiki (2013a): Disproving evolution. http://rationalwiki.org/wiki/Disproving_Evolution. Accessed 21 August 2013.
- RationalWiki (2013b): 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. Accessed 1 June 2013.
- RationalWiki (2013c): Creationist claims. http://rationalwiki.org/wiki/Creationist_claims. Accessed 1 June 2013.
- RationalWiki (2013d): The equation of creation. http://rationalwiki.org/wiki/The_Equation_of_Creation. Accessed 17 September 2013.
- Reed DH (2005): Relationship between population size and fitness. *Conservation Biology* 19, 563–568.
- Robinson AJ, Kropatkin M, Aggeler PM (1969): Hageman factor (factor XII) deficiency in marine mammals. *Science* 166, 1420–1422.
- Sahlane A (2012): Argumentation and fallacy in the justification of the 2003 war on Iraq. *Argumentation* 26, 459–488.

- Salo S (2012): Pyhän kolminaisuuden päivänä (On Trinity Sunday). Seurakunta 3–4 2012, 10–13. [in Finnish]
- Särelä M (2012): Viides luomispäivä (The fifth day of creation). Luterilainen 6/2012, 225. [in Finnish]
- Schudel M (2006): Obituary: Henry M. Morris, father of "creation science". Seattle Times 5 March, 2006.
- Schulp AS, Al-Wosabi M, Stevens NJ (2008): First dinosaur tracks from the Arabian peninsula. PLoS ONE 3, e2243.
- Schweitzer M, Staedter T (1997): The real Jurassic park. Earth 6, 54.
- Schweitzer MH, Marshall M, Carron K, Bohle DS, Busse SC, Arnold EV, Barnard D, Horner JR, Starkey JR (1997): Heme compounds in dinosaur trabecular bone. Proceedings of the National Academy of Sciences 94, 6291–6296.
- Schweitzer MH, Wittmeyer JL, Horner JR, Toporski JK (2005): Soft-tissue vessels and cellular preservation in *Tyrannosaurus rex*. Science 307, 1952–1955.
- Scott EC (1997): Antievolution and creationism in the United States. Annual Review of Anthropology 26, 263–289.
- Scriven M (1987): Fallacies of statistical substitution. Argumentation 1, 333–349.
- Senter P (2011): Using creation science to demonstrate evolution 2: morphological continuity within Dinosauria. Journal of Evolutionary Biology 24, 2197–2216.
- Sherman SJ, Corty E (1984): Cognitive heuristics. In Wyer RS Jr, Srull TK (Eds.), Handbook of social cognition, Volume 11 (pp. 189–286): Hillsdale: Lawrence Erlbaum Associates.
- Shermer M (2002): Why people believe weird things. Pseudoscience, superstition, and other confusions of our time. New York: Henry Holt and Company.
- Shermer M (2011): What is pseudoscience? Scientific American 15 September, 2011.
- Slijper EJ (1962): Dolphins and whales. Ann Arbor: University of Michigan Press.
- Sober E (2007): What is wrong with intelligent design? Quarterly Review of Biology 82, 3–8.
- Stalin J (1907): Анархизм или Социализм? (Anarchism or socialism?). Сочинения (Collected works). – Т. 1. – М.: ОПИЗ. Moscow: Государственное Издательство Политической Литературы. [in Russian]
- Steering Committee on Science and Creationism (1999): Science and creationism. A view from the National Academy of Sciences. Washington, DC: National Academy Press.
- Steinheimer FD (2004): Charles Darwin's bird collection and ornithological knowledge during the voyage of H.M.S. "Beagle", 1831–1836. Journal of Ornithology 145, 300–320.
- Stempien R, Coleman S (1985): Processes of persuasion: the case of creation science. Review of Religious Research 27, 169–177.
- Strickberger MW (1996): Evolution. Sudbury: Jones and Bartlett.
- Sysoyev D (2009): Теистический эволюционизм как новое арианство (Theistic evolution as new arianism). <http://mission-center.com/ru/science/13488-bibl-scient-daniil-sisoev-new-arianstvo>. Accessed 21 August 2013. [in Russian]
- Takechi M, Kuratani S (2010): History of studies on mammalian middle ear evolution: a comparative morphological and developmental biology perspective. Journal of Experimental Zoology B 314, 417–433.
- TalkOrigins archive (2005): Claim CA005.1. http://www.talkorigins.org/indexcc/CA/CA005_1.html. Accessed 13 July 2013.
- Templeton Report, News from the John Templeton Foundation (2009): Evolution at the Vatican. West Conshohocken: John Templeton Foundation.

- Tenneson M, Badger S (2010): A brief overview of Pentecostal views on origins. *Enrichment journal*, Spring 2010, http://enrichmentjournal.ag.org/201002/ejonline_201002_origins.cfm. Accessed 5 September 2013.
- Theobald D (2012): 29+ evidences for macroevolution. <http://www.talkorigins.org/faqs/comdesc/section2.html> Andrews1921. Accessed 3 December 2012.
- Thewissen JGM, Bajpai S (2001): Whale origins as a poster child for macroevolution. *Bioscience* 51, 1037–1049.
- Thewissen JGM, Cooper LN, Clementz MT, Bajpai S, Tiwari BN (2007): Whales originated from aquatic artiodactyls in the Eocene epoch of India. *Nature* 450, 1190–1194.
- Thom A (1962): The megalithic unit of length. *Journal of the Royal Statistical Society, Series A (Statistics in Society)* 125, 243–251.
- Thwaites WM (1985): New proteins without God's help. *Creation/Evolution Journal* 16, 1–3.
- Tikhnenko ND, Tsvetkova NV, Voylovkov AV (2003): The effect of parental genotypes of rye lines on the development of quantitative traits in primary octoploid triticale: plant height. *Russian Journal of Genetics* 39, 52–56.
- Tishkoff SA, Reed FA, Ranciaro A, Voight BF, Babbitt CC, Silverman JS, Powell K, Mortensen HM, Hirbo JB, Osman M, Ibrahim M, Omar SA, Lema G, Nyambo TB, Ghorri J, Bumpstead S, Pritchard JK, Wray GA, Deloukas P (2006): Convergent adaptation of human lactase persistence in Africa and Europe. *Nature Genetics* 39, 31–40.
- Todd SC (1999): A view from Kansas on that evolution debate. *Nature* 401, 423.
- Tomić T (2013): False dilemma: a systematic exposition. *Argumentation* 27, 347–368.
- United Methodist Church (2008): Science and technology. <http://www.umc.org/what-we-believe/the-natural-world#science-tech>. Accessed 21 August 2013.
- University of California, Museum of Paleontology (2013): Metazoa: fossil record. Chart of first appearances of metazoans. <http://www.ucmp.berkeley.edu/phyla/metazoaf.html>. Accessed 15 December 2012.
- University of Minnesota Law Library (2013): The Scopes trial (1925). <http://darrow.law.umn.edu/trials.php?tid=7>. Accessed 31 August 2013.
- U.S. Supreme Court Center (1968): *Epperson v. Arkansas* - 393 U.S. 97 (1968). <https://supreme.justia.com/cases/federal/us/393/97/case.html>. Accessed 31 August 2013.
- U.S. Supreme Court Center (1987): *Edwards v. Aguillard* - 482 U.S. 578 (1987). <https://supreme.justia.com/cases/federal/us/482/578/case.html>. Accessed 31 August 2013.
- van Eemeren FH, Grootendorst R (1992): *Argumentation, communication, and fallacies. A pragma-dialectical perspective*. Hillsdale: Lawrence Erlbaum Associates.
- Wallace AR (1858): On the tendency of varieties to depart indefinitely from the original type. *Journal of the Proceedings of the Linnean Society of London, Zoology* 3, 53–62.
- Walton D (1999a): The appeal to ignorance, or *argumentum ad ignorantiam*. *Argumentation* 13, 367–377.
- Walton D (1999b): Rethinking the fallacy of hasty generalization. *Argumentation* 13, 161–182.
- Walton DN (1999c): The fallacy of many questions: on the notions of complexity, loadedness and unfair entrapment in interrogative theory. *Argumentation* 13, 379–383.
- Walton D (2006): Poisoning the well. *Argumentation* 20, 273–307.
- Weisberger AM (2007): The argument from evil. In Martin M (Ed.), *The Cambridge companion to atheism* (pp. 166–181): Cambridge: Cambridge University.
- Wiens RC (2002): Radiometric dating: a Christian perspective. The American Scientific Association. <http://www.asa3.org/ASA/resources/Wiens2002.pdf>. Accessed 15 December 2012.

- Wikipedia (2013): Pekka Reinikainen. http://fi.wikipedia.org/wiki/Pekka_Reinikainen. Accessed 31 August 2013. [in Finnish]
- Wilkins JS (2011): Are creationists rational? *Synthese* 178, 207–218.
- Wilson DE, Reeder DM (2005): Mammal species of the world. A taxonomic and geographic reference. Volume 1. 3rd ed. Baltimore: The Johns Hopkins University Press.
- Woods J (1998): Argumentum ad baculum. *Argumentation* 12, 493–504.
- Woods J (2000): Slippery slopes and collapsing taboos. *Argumentation* 14, 107–134.
- Xu X, Guo Y (2009): The origin and early evolution of feathers: insights from recent paleontological and neontological data. *Vertebrata Palasiatica* 47, 311–329.
- Yap A (2013): Ad hominem fallacies, bias, and testimony. *Argumentation* 27, 97–109.
- Young W (1985): Fallacies of creationism. Calgary: Detselig Enterprises.
- Zhang J, Wagh P, Guay D, Sanchez-Pulido L, Padhi BK, Korzh V, Andrade-Navarro MA, Akimenko M-A (2010): Loss of fish actinotrichia proteins and the fin-to-limb transition. *Nature* 466, 234–237.
- Zhou X, Xu S, Xu J, Chen B, Zhou K, Yang G (2012): Phylogenomic analysis resolves the interordinal relationships and rapid diversification of the Laurasiatherian mammals. *Systematic Biology* 61, 150–164.
- Zuckerman P (2009): Atheism, secularity, and well-being: how the findings of social science counter negative stereotypes and assumptions. *Sociology Compass* 36, 949–971

**PUBLICATIONS OF THE UNIVERSITY OF EASTERN FINLAND
DISSERTATIONS IN EDUCATION, HUMANITIES, AND THEOLOGY**

1. Taru Viinikainen. *Taipuuko "akrobaatti Aleksandra"? Nimikekonstruktio ja nimikkeen taipuminen lehtikielessä 1900-luvulta 2000-luvulle*. 2010.
2. Pekka Metso. *Divine Presence in the Eucharistic Theology of Nicholas Cabasilas*. 2010.
3. Pekka Kilpeläinen. *In Search of a Postcategorical Utopia. James Baldwin and the Politics of 'Race' and Sexuality*. 2010.
4. Leena Vartiainen. *Yhteisöllinen käsityö. Verkostoja, taitoja ja yhteisiä elämyksiä*. 2010.
5. Alexandra Simon-López. *Hypersurrealism. Surrealist Literary Hypertexts*. 2010.
6. Merja Sagulin. *Jälkiä ajan hiekassa. Kontekstuaalinen tutkimus Daniel Defoen Robinson Crusoen suomenkielisten adaptaatioiden aatteellisista ja kirjallisista traditioista sekä subjektikäsitteistä*. 2010.
7. Pirkko Pollari. *Vapaan sivistystyön kieltenopettajien pedagogiset ratkaisut ja käytänteet teknologiaa hyödyntävässä vieraiden kielten opetuksessa*. 2010.
8. Ulla Piela. *Kansanparannuksen kerrotut merkitykset Pohjois-Karjalassa 1800- ja 1900-luvuilla*. 2010.
9. Lea Meriläinen. *Language Transfer in the Written English of Finnish Students*. 2010.
10. Kati Aho-Mustonen. *Group Psychoeducation for Forensic Long-term Patients with Schizophrenia*. 2011.
11. Anne-Maria Nupponen. *»Savon murre» savolaiskorvin. Kansa murteen havainnoijana*. 2011.
12. Teemu Valtonen. *An Insight into Collaborative Learning with ICT: Teachers' and Students' Perspectives*. 2011.
13. Teemu Kakkuri. *Evankelinen liike kirkossa ja yhteiskunnassa 1944-1963. Aktiivinen uudistusliike ja konservatiivinen sopeutuja*. 2011.
14. Riitta Kärkkäinen. *Doing Better? Children's and Their Parents' and Teachers' Perceptions of the Malleability of the Child's Academic Competences*. 2011.
15. Jouko Kiiski. *Suomalainen avioero 2000-luvun alussa. Miksi avioliitto puretaan, miten ero koetaan ja miten siitä selviydytään*. 2011.
16. Liisa Timonen. *Kansainvälisty tai väisty? Tapaustudkimus kansainvälisyysosaamisen ja kulttuurienvälisen oppimisen merkityksenannoista oppijan, opettajan ja korkeakoulutoimijan pedagogisen suhteen rajaamisessa kohtaamisen tiloissa*. 2011.
17. Matti Vanttinen. *Oikeasti hyvä numero. Oppilaiden arvioinnin totuudet ja totuustuotanto rinnakkaiskoulusta yhtenäiskouluun*. 2011.
18. Merja Ylönen. *Aikuiset opin poluilla. Oppimistukikeskuksen asiakkaiden opiskelukokemuksista ja kouluttautumishalukkuudelle merkityksellisistä tekijöistä*. 2011.
19. Kirsi Pankarinkangas. *Leskien keski-iässä tai myöhemmällä iällä solmimat uudet avioliitot. Seurantatutkimus*. 2011.
20. Olavi Leino. *Oppisopimusopiskelijan oppimisen henkilökohtaistaminen ja oppimismahdollisuudet työpaikalla*. 2011.
21. Kristiina Abdallah. *Translators in Production Networks. Reflections on Agency, Quality and Ethics*. 2012.
22. Riina Kokkonen. *Mittarissa lapsen keho ja vanhemmuus – tervettä lasta sekä "hyvää" ja "huonoa" vanhemmuutta koskevia tulkintoja nyky-Suomessa*. 2012.
23. Ari Sivenius. *Aikuislukion eetos opettajien merkityksenantojen valossa*. 2012.
24. Kamal Sbiri. *Voices from the Margin. Rethinking History, Identity, and Belonging in the Contemporary North African Anglophone Novel*. 2012.
25. Ville Sassi. *Uudenlaisen pahan unohdettu historia. Arvohistoriallinen tutkimus 1980-luvun suomalaisen romaanin pahan tematiikasta ja "pahan koulukunta" –vuosikymmenmääritteen muodostumisesta kirjallisuusjärjestelmässä*. 2012.
26. Merja Hyytiäinen. *Integroiden, segregoiden ja osallistaen. Kolmen vaikeasti kehitysvammaisen oppilaan opiskelu yleisopetuksessa ja koulupolku esiopetuksesta toiselle asteelle*. 2012.
27. Hanna Mikkola. *"Tänään työ on kauneus on ruumis on laihus." Feministinen luenta syömishäiriöiden ja naiskupuolen kytköksistä suomalaisissa syömishäiriöromaneissa*. 2012.
28. Aino Äikäs. *Toiselta asteelta eteenpäin. Narratiivinen tutkimus vaikeavammaisen nuoren aikuisen koulutuksesta ja työllistymisestä*. 2012.

29. Maija Korhonen. *Yrittäjyyttä ja yrittäjämäisyyttä kaikille? Uusliberalistinen hallinta, koulutettavuus ja sosiaaliset erot peruskoulun yrittäjyyskasvatuksessa*. 2012.
30. Päivikki Ronkainen. *Yhteinen tehtävä. Muutoksen avaama kehittämispyrkimys opettajayhteisössä*. 2012.
31. Kalevi Paldanius. *Eläinlääkärin ammatti-identiteetti, asiakasvuorovaikutuksen jännitteiden hallinta ja kliinisen päättelyn yhteenkietoutuminen sekapraktiikassa*. 2012.
32. Kari Korolainen. *Koristelun kuvailu. Kategorisoinnin analyysi*. 2012.
33. Maija Metsämäki. *Influencing through Language. Studies in L2 Debate*. 2012.
34. Pål Lauritzen. *Conceptual and Procedural Knowledge of Mathematical Functions*. 2012.
35. Eeva Raunistola-Juutinen. *Äiti ja nanna - Kirkkojen maailmanneuvoston naisten vuosikymmenen ortodoksiset naiskuvat*. 2012.
36. Marja-Liisa Kakkonen. *Learning Entrepreneurial Competences in an International Undergraduate Degree Programme. A Follow-Up Study*. 2012.
37. Outi Sipilä. *Esiliina aikansa kehyksissä – moniaikaista tekstiilikulttuuria ja representaatioita kodista, perheestä, puhtaudesta ja käsityöstä 1900-luvun alkupuolen Suomessa*. 2012.
38. Seija Jeskanen. *Piina vai pelastus? Portfolio aineenopettajaopiskelijoiden ammatillisen kehittymisen välineenä*. 2012.
39. Reijo Virolainen. *Evankeliumin asialla - Kurt Frörin käsitys evankelisesta kasvatuksesta ja opetuksesta Saksassa 1930-luvulta 1970-luvulle*. 2013.
40. Katarzyna Szal. *Finnish Literature in Poland, Polish Literature in Finland – Comparative Reception Study from a Hermeneutic Perspective*. 2013.
41. Eeva-Liisa Ahtiainen. *Kansainvälistymisen ja laadunvarmistuksen yhteys ammatti- korkeakoulun asiakirjateksteissä. Tapaustutkimus*. 2013.
42. Jorma Pitkänen. *Fides Directa – Fides Reflexa. Jonas Laguksen käsitys vanhurskauttavasta uskosta*. 2013.
43. Riitta Rajasuu. *Kuopiossa, Oulussa ja Turussa vuosina 1725–1744 ja 1825–1844 syntyneiden kastenimet*. 2013.
44. Irina Karvonen. *Pyhän Aleksanteri Syväriläisen koulukunta – 1500-luvun luostarihistoriaa vai 1800-luvun venäläiskansallista tulkintaa?* 2013.
45. Meri Kytö. *Kotiin kuuluvaa. Yksityisen ja yhteisen kaupunkikäänneajan risteymät*. 2013.
46. Jörg Weber. *Die Idee von der Mystagogie Jesu im geistigen Menschen: Einführung in die »christliche Theosophie« des Corpus Areopagiticum*. 2013.
47. Tuija, Lukin. *Motivaatio matematiikan opiskelussa – seurantatutkimus motivaatiotekijöistä ja niiden välisistä yhteyksistä yläkoulun aikana*. 2013.
48. Virpi Kaukio. *Sateenkaari lätäkössä. Kuvitellun ja kerrotun ympäristöestetiikka*. 2013.
49. Susanna Pöntinen. *Tieto- ja viestintäteknologian opetus käytön kulttuurin diskursiivinen muotoutuminen luokanopettajaopiskelijoiden puheessa*. 2013.
50. Maria Takala-Roszczenko. *The 'Latin' within the 'Greek': The Feast of the Holy Eucharist in the Context of Ruthenian Eastern Rite Liturgical Evolution in the 16th–18th Centuries*. 2013.
51. Erkki Nieminen. *Henki vastaan alkoholi: AA-toiminnan synty ja kehitys Lahdessa 1950-1995*. 2014.
52. Jani Kaasinen. *Perinnerakentaminen käsitteenä ja osana teknologiakasvatusta - opettajaopiskelijoiden käsitykset, käsitysten jäsentyneisyys ja muutos perinnerakentamisen opintojakson aikana*. 2014.
53. Gerson Lameck Mgaya. *Spiritual gifts: A socio-rhetorical interpretation of 1 cor 12–14*. 2014.
54. Pauli Kallio. *Esimiehen muuttuvat identiteetit: Narratiivinen tutkimus keskijohdon identiteeteistä ja samastumisesta organisaatiomurroksessa*. 2014.
55. Sirpa Tokola-Kemppi. *Psykoanalyttisen psykoterapian merkityksiä kirjailijahaastattelujen valossa*. 2014.
56. Dhuana Affleck. *How does Dialogical Self Theory appear in the light of Cognitive Analytic Therapy? Two approaches to the self*. 2014.
57. Teemu Ratinen. *Torjuttu Jumalan lahja. Yksilön kamppailu häpeällistä seksuaalisuutta vastaan*. 2014.
58. Päivi Löfman. *Tapaustutkimus itseohjautuvuudesta sairaanhoitajakoulutuksen eri vaiheissa*. 2014.
59. Päivi Kujamäki. *Yhteisenä tavoitteena opetuksen eheyttäminen. Osallistava toimintatutkimus luokanopettajille*. 2014.
60. Henriikka Vartiainen. *Principles for Design-Oriented Pedagogy for Learning from and with Museum Objects*. 2014.
61. Päivi Kaakkunen. *Lukudiplomin avulla lukemaan houkutteleva yläkoulussa. Lukudiplomin kehittämistutkimus perusopetuksen vuosiluokilla 7–9*. 2014.
62. Jari Kukkonen. *Scaffolding inquiry in science education by means of computer supported collaborative learning : pupils' and teacher students' experiences*. 2015.
63. Petteri Nieminen. *A Unified Theory of Creationism – Argumentation, experiential thinking and emerging doctrine*. 2015.
64. Esa Asikainen. *"Me olemme postipaketteja". Tutkimus Helsingin vammaiskoulutuksista vuosina 2002-2007*. 2015.

PETTERI NIEMINEN

A Unified Theory of Creationism

– *Argumentation, experiential thinking
and emerging doctrine*

In this dissertation, creationist and pro-evolutionary texts were analyzed for fallacies, experiential thinking and theological aspects. The creationist texts contained several emotional fallacies, such as ad hominem and guilt by association, and experiential thinking, such as relying on confirmation bias and using testimonials for evidence. Creationism was characterized by demonization of evolutionary proponents and use of scientific data as proof for the Bible.



UNIVERSITY OF
EASTERN FINLAND

PUBLICATIONS OF THE UNIVERSITY OF EASTERN FINLAND

Dissertations in Education, Humanities, and Theology

ISBN: 978-952-61-1686-0 (nid.)

ISSNL: 1798-5625

ISSN: 1798-5625

ISBN: 978-952-61-1687-7 (PDF)

ISSN: 1798-5633 (PDF)