Christians in Science &
The American Scientific Affiliation

New Frontiers in Science and Faith

Pollock Halls, University of Edinburgh,
Thurs 2nd – Sun 5th August 2007

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Welcome

Here it is at last! The joint meeting of *Christians in Science* and the *American Scientific Affiliation*. It is thus my great pleasure to welcome you to the beautiful city of Edinburgh – and not just a beautiful city, but a city with a proud history and steeped in excellent science – and to this exciting conference.

We have a very stimulating programme over the next few days with an array of excellent speakers from both sides of the Atlantic. We have tried to plan a programme with something for everyone across a range of Science-Faith issues, together with opportunities for presenting shorter papers and for discussion and networking. It is my hope and prayer that the objectives we had in our planning will be met in the meeting itself. So, in the next few days, I hope that we will all learn something new, that we will be encouraged in our faith, that we will deepen old friendships and make new ones.

As well as attending the conference sessions, I hope that you will have time to take advantage of all that Edinburgh offers, whether that be exercising in the swimming pool or on the hills, visiting galleries and museums, viewing the architecture or even shopping. Several of us here know Edinburgh and can advise you on what to see and how to get around. Finally then, in the context of both the conference and the city I hope that by the time your visit ends you will be truly glad that you came.

John Bryant,
Chair of Christians in Science

General information

Book stall
Wesley Owen has kindly provided an extensive selection of titles, many of which are written by our speakers and CiS/ASA members. Additional titles will be available on a separate CiS bookstall. Credit cards will be accepted, but neither Wesley Owen nor CiS cannot accept American Express.

The book stall be open during both coffee breaks and lunch time, Fri – Sun outside the Kirkland Room. CiS books may be purchased during break times. The Wesley Owen bookstall will be open between breaks, should you want extra browsing time.

Emergency phone numbers
For accommodation problems call the Edinburgh First reception on 0131 651 2001 or 2002 (manned from 7 am to 11 pm BST).
CiS Emergency contact: Ruth Bancewicz, 0781 687 3515

Useful Numbers
City Cabs: 0131 228 6876
Lothian Buses info: 0131 555 6363
First Edinburgh bus info: 08708 72 72 71
Rail enquiries: 08457 48 49 50
Edinburgh Airport: 0131 333 1000

Social events in South Hall
Thursday, 7.30 Cheese & wine reception
Friday, 9.00 Drinks at the bar and posters. Students/young professionals social.
Saturday, 8.00 -11.30 Ceilidh
Sunday, 7.30 Videos and posters

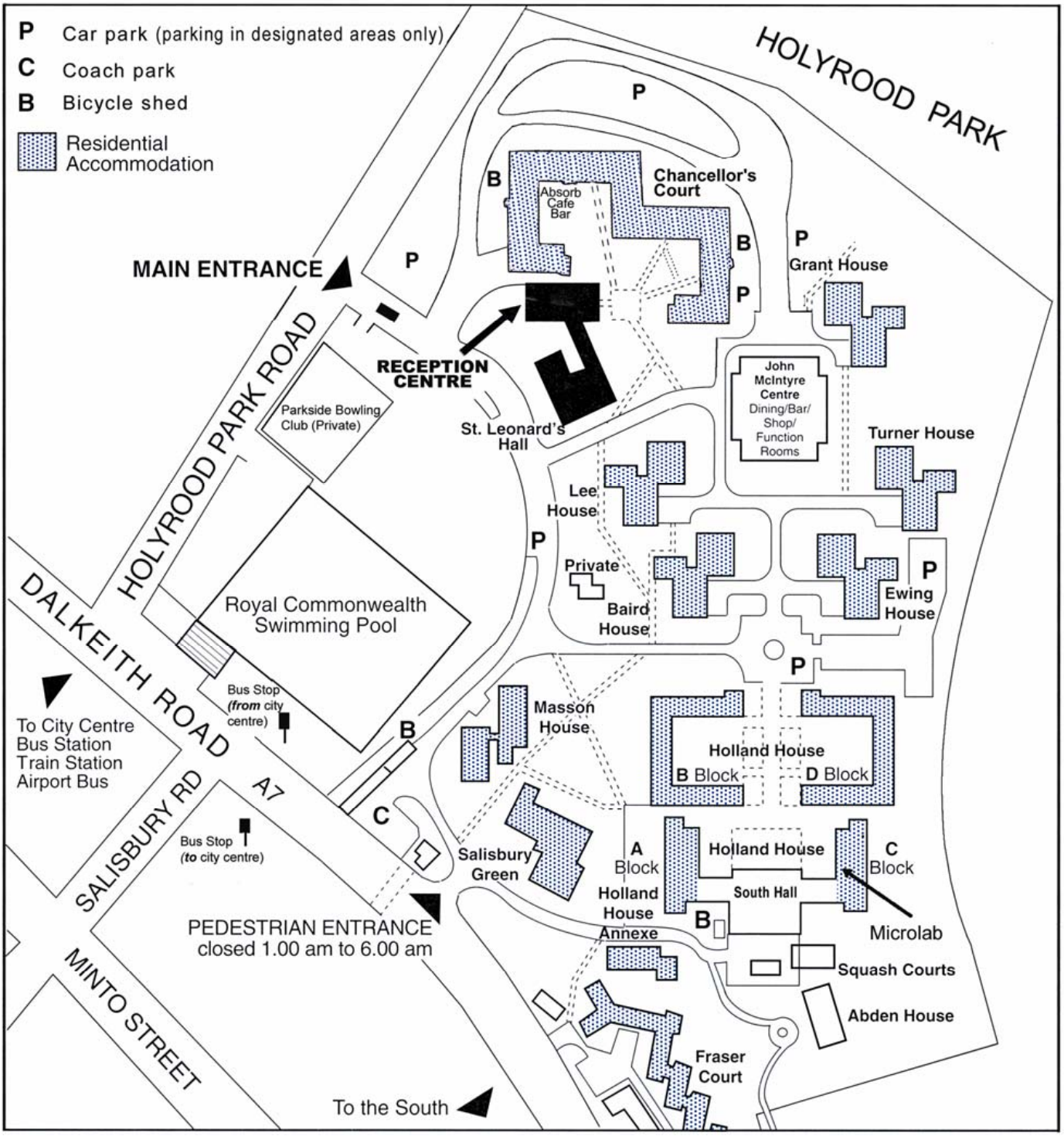
Local information
- Pay phones, internet access, a cash machine (ATM) and other facilities are available in the Pollock Halls reception centre (where you checked in)
- A shop for essential items, food etc is located in the John Mackintyre Centre
- Leisure/fitness facilities: The Commonwealth Pool & gym is on Dalkeith Road, about 200 yards from the Pollock Halls pedestrian entrance.
- The bar in the John Mackintyre Centre is open until 11.00 every night.

Check out
When you are checking out, please vacate your rooms by 10.00 am.

Luggage storage
If you arrive before check in opens at 2pm or are attending conference sessions after checking out, luggage may be stored at the reception centre.

Talk recording
The plenary sessions will be recorded (audio only), and will be available free online in mp3 format following the conference.

Map


P Car park (parking in designated areas only)
C Coach park
B Bicycle shed
Residential Accommodation
HOLYROOD PARK
MAIN ENTRANCE
HOLYROOD PARK ROAD
RECEPTION CENTRE
Parkside Bowling Club (Private)
St. Leonard's Hall
Absorb Cafe Bar
Chancellor's Court
Grant House
John McIntyre Centre Dining/Bar/ Shop/ Function Rooms
Turner House
Lee House
Private
Baird House
Ewing House
Royal Commonwealth Swimming Pool
DALKEITH ROAD
Bus Stop (from city centre)
To City Centre
Bus Station
Train Station
Airport Bus
SALISBURY RD
A7
Bus Stop (to city centre)
PEDESTRIAN ENTRANCE closed 1.00 am to 6.00 am
MINTO STREET
To the South
Masson House
Holland House B Block
D Block
Salisbury Green
A Block
Holland House
C Block
Holland House Annexe
South Hall
Microlab
Squash Courts
Abden House
Fraser Court

About the hosts

Christians in Science

www.cis.org.uk

CiS is an international network of those concerned with the relationship between science and Christian faith, open to scientists, teachers, students and all those with an interest in this dialogue. Although CiS is primarily a professional group, aimed at those working in science, a significant proportion of our members are not scientists, and we are happy to welcome into membership anyone with an interest in science and faith.

Among our 650+ members are scientists engaged in research & development, science lecturers, teachers, administrators in university, school or industry, science writers, philosophers, theologians and others who share our aims.

CiS started life in the early 1940s as a small group within the Graduates' Fellowship of the IVF (which is now called UCCF: the Christian Unions), and we are still one of UCCF's recognised Professional Groups.

Our Aims:

To develop and promote Biblical Christian views on the nature, scope and limitations of science, and on the changing interactions between science and faith.

To bring Biblical Christian thought on scientific issues into the public arena.

To encourage Christians who are engaged in scientific work to maintain an active faith and to apply it in their professional lives.

To communicate the Christian gospel within the scientific community.

To stimulate responsible Christian attitudes and action towards care for the environment.

To help Christians who are science students to integrate their religious beliefs and their scientific studies.

The American Scientific Affiliation

www.asa3.org

The American Scientific Affiliation (ASA) is a fellowship of men and women of science and disciplines that can relate to science who share a common fidelity to the Word of God and a commitment to integrity in the practice of science. ASA was founded in 1941 and has grown significantly since that time. The stated purpose of the ASA is "to investigate any area relating Christian faith and science" and "to make known the results of such investigations for comment and criticism by the Christian community and by the scientific community."

Science has brought about enormous changes in our world. Christians have often reacted as though science threatened the very foundations of Christian faith. ASA's unique mission is to integrate, communicate, and facilitate properly researched science and biblical theology in service to the Church and the scientific community.

ASA members have confidence that such integration is not only possible but necessary to an adequate understanding of God and His creation. Our total allegiance is to our Creator. We acknowledge our debt to Him for the whole natural order and for the development of science as a way of knowing that order in detail. We also acknowledge our debt to Him for the Scriptures, which give us "the wisdom that leads to salvation through faith in Jesus Christ."

We believe that honest and open study of God's dual revelation, in nature and in the Bible, must eventually lead to understanding of its inherent harmony.

The ASA is also committed to the equally important task of providing advice and direction to the Church and society in how best to use the results of science and technology while preserving the integrity of God's creation.

Science and Religion in Schools Project

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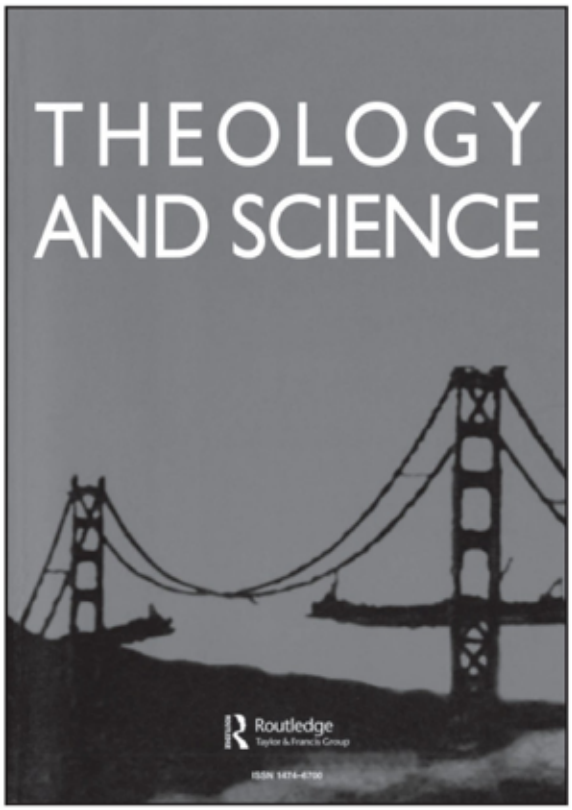
Science & Religion in Schools

THEOLOGY AND SCIENCE

The Journal of The Center for Theology and the Natural Sciences

Editors: Ted Peters, *Pacific Lutheran Theological Seminary* and the *Graduate Theological Union, USA*
Robert John Russell, *Graduate Theological Union, USA* and *Executive Director, Center for Theology and the Natural Sciences*



The primary editorial goal of ***Theology and Science*** is to publish critically reviewed articles that promote the creative mutual interaction between the natural sciences and theology. While the journal assumes the integrity of each domain, its primary aim is to explore this interaction in terms of the implications of the natural sciences for constructive research in philosophical and systematic theology, the philosophical and theological elements within and underlying theoretical research in the natural sciences, and the relations and interactions between theological and scientific methodologies.

The secondary editorial goal is to monitor and critically assess debates and controversies arising in the broader field of science and religion. Thus, ***Theology and Science*** will investigate, analyze, and report on issues as they arise with the intention of prompting further academic discussion of them.

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For more information and to subscribe visit: www.informaworld.com/tas

CTNS The Center for Theology and the Natural Sciences

Members of CTNS receive *Theology and Science* as part of their subscription. Visit **www.ctns.org**

Routledge Taylor & Francis Group

Programme

Wednesday 1st August	
2.00 pm onwards	Early check-in at main reception

Thursday 2nd August	
10.00 am onwards	Check in at main reception (rooms ready from 2pm)
12.00 noon onwards	LUNCH, *John McIntyre refectory*
1.00 pm	Field trips depart from conference registration desk
6.00 - 7.30 pm	DINNER, *John McIntyre refectory*
7.30 pm	Cheese & Wine reception, *Kirkland Room*

Friday 3rd August			
7.45 - 8.45 am	BREAKFAST, *John McIntyre refectory*		
8.45 - 9.05 am	Worship, *South Hall.* John Bryant (leader) and Wilson Poon (speaker)		
Plenary Session I: New Frontiers in Planet Care, South Hall Chair, Dr Donald Bruce			
9.10 - 10.00 am	John Houghton: The Challenge of Global Warming		
10.00 - 10.50 am	Ghillean Prance: Why Should a Christian Care About Biodiversity?		
10.50 - 11.20 am	TEA & COFFEE, *Kirkland Room*		
11.20 - 12.10 pm	Bob White: A Biblical Basis for Care for the Environment		
12.10 - 1.00 pm	Calvin deWitt: Our Personal Response		
1.00 - 2.00 pm	LUNCH		
Parallel Session I, 2.00 - 3.30 pm			
Religion and the Rise of Modern Science Chair: Jason Rampelt	***Bioethics I Chair: Judith Toronchuk***	***Theology and Modern Science Chair: Donald Petcher***	***Appropriate Technology I: Water, Energy and Bridges Chair: Walter Bradley***
Lydia Jaeger, "The Creation of Matter and the Modern Sciences"	Mark Shelhamer, "Continuing Creation in Neuroscience: Implications for Understanding the Creator"	John Templeton Baldwin, "Category Translation and Langdon B. Gilkey: A Systematic Theological Hermeneutical Method"	Kenell J. Touryan, "Water – The Defining Crisis for the Developing World"
Joseph Spradley, "Christian Roots of the Scientific Revolution"	David A. Booth, "Biological and Cultural Inheritance of the Image of God and of Original Sin"	Arie Leegwater, "'Giving and Receiving': Charles A. Coulson's Witness as a Christian Scientist"	Paul M. Means and Noelle Means Allison, "Bioenergy: The Fuel for All Seasons"
Harry Poe, "The Reformation and the Rise of Modern Science"	William Polk Cheshire, "With All Your Mind: Implications of Functional Neuroimaging for Ethics"	George L. Murphy, "Science-Theology Dialogue and Atonement"	Harmon Parker and William Jordan, "Building Pedestrian Bridges to a Better Future: Bridging the Gap—Africa"
3.30 - 4.00 pm	TEA & COFFEE, *Kirkland Room*		

<table>
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<tr><td colspan="4">Parallel session II, 4.00 - 6.00 pm</td></tr>
<tr><td>Creation, Fall, and Sabbath
Chair: Edwin Yamauchi</td><td>Science and Religion in the Seventeenth Century
Chair: Ted Davis</td><td>Environmental Stewardship
Chair: Calvin deWitt</td><td>Appropriate Technology II: Feeding the Poor
Chair: David Vader</td></tr>
<tr><td>Craig A. Boyd, “Biblical Goodness and the Perfection Myth: The Importance of the Genesis Narrative in Light of Scientific and Philosophical Perspectives”</td><td>Larissa Kate Johnson, “Redeeming Natural Theology: Science and Religion in the Seventeenth Century”</td><td>Les Batty, “Nature Conservation in a Changing Environment: Can Creation-care Theology Help us Adapt?”</td><td>David Unander, “Science and Technology for the Developing World: Science Aiding Agriculture—What Approach Works?”</td></tr>
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<tr><td rowspan="2">Hedrick J. Edwards, “Biblical Sabbath–Original Paradigm of Bio-History: A Model Critique of Humanistic Naturalism”</td><td>Prophecy & Geography
Chair: N/A</td><td rowspan="2">Uko Zylstra, “Agriculture, Nature, Ecology, and Ethics: Being Accountable in God’s Creation”</td><td>Philosophy of Science
Chair: N/A</td></tr>
<tr><td>Edwin M. Yamauchi, “Africa, India, and Russia: Biblical Misrepresentations”</td><td>Donald N. Petcher, “Mere Science: Taking the Demarcation Problem Seriously”</td></tr>
<tr><td>6.15 -7.30 pm</td><td colspan="3">DINNER, John McIntyre refectory</td></tr>
<tr><td>7.30 pm</td><td colspan="3">Keynote speaker, Alister McGrath: New Frontiers in Science and Faith, South Hall. Chair, Keith Fox</td></tr>
<tr><td>9.00 pm</td><td colspan="3">Drinks at the bar and posters, Kirkland Room.
Students/young professionals social.</td></tr>
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Saturday 4th August			
7.45 - 8.45 am	BREAKFAST, *John McIntyre refectory*		
8.45 - 9.05 am	Worship, *South Hall*. Randy Isaac (leader) and George Murphy (speaker)		
Plenary Session II: New Frontiers with Genes and Evolution, South Hall Chair: Andrew Miller			
9.10 -10.00 am	Simon Conway Morris: Does Evolution Have a Deep Structure, and If So What are the Theological Implications?		
10.00 - 10.50 am	Jeff Schloss: Evolutionary Accounts of Religion and Altruism - Explaining vs. Explaining Away		
10.50 - 11.20 am	TEA & COFFEE, *Kirkland Room*		
11.20 - 12.10 pm	Ernest Lucas: Interpreting Genesis 1-3		
12.10 - 1.00 pm	Denis Alexander: Darwinian Evolution; the Really Hard Questions		
1.00 - 2.00 pm	LUNCH		
Plenary session III: New Frontiers in Neuroscience, South Hall Chair: Malcolm Jeeves			
2.00 - 2.40 pm	Peter Clarke: Free-will and Determinism		
2.40 - 3.20 pm	Bill Newsome: Recent Developments in Brain and Mind		
3.20 - 4.00 pm	Nancey Murphy: Cognitive Science and the Evolution of Religion. A Philosophical and Theological Appraisal		
4.00 - 4.30 pm	TEA & COFFEE, *Kirkland Room*		
Parallel session III, 5.00 - 6.30 pm			
Darwin, Evolution, and God ***Chair: Denis Lamoureux***	***Bioethics II*** ***Chair: Nigel M de S Cameron***	***Designer Genes? Evolution, Genetics, and Intelligent Design*** ***Chair: Jeff Schloss***	***Appropriate Technology III: Involving Science and Engineering Students in Service to the Poor*** ***Chair: Ken Touryan***
James R. Hofmann, "The Law of Higgledy-piggledy Revisited: Contingency and Supernatural Design"	Alun Morinan, "Engineering Behavior Through Drugs and Genomics"	Stephen L. Reinbold, "Evolution: Do the Eyes Have It?"	David Vader, "Service for Today … Servant-Leaders for Tomorrow: Practical Strategies for Christian Stewardship in Academic Engagement"
Mark A. Kalthoff, "Optimistic Evolutionists: The Progressive Science and Religion of Joseph LeConte, Henry Ward Beecher, and Lyman Abbott"	Dennis M. Sullivan, "Embryonic Stem Cells from Non-Destructive Sources: A Way Out of the Ethical Quagmire?"	William E. Hamilton, Jr., and Chuck Stevenson, "Evolution and Engineering Design: Insights from Genetic Algorithms"	William Oakes, "Learning Engineering and Science While Serving the Poor"
Daniel K. Brannan, "Darwinism and Original Sin: Frederick R. Tennant's Integration of Evolution into Christian Thought in Britain in the Early 1900s"	Judith A. Toronchuk and George F.R. Ellis, "Morality, Disgust, and Emotional Systems"	Craig Rusbult, "Appropriate Humility About Evolution"	Walter Bradley, "A Global Poverty Center—Integrating Appropriate Technology, Social Entrepreneurship, and Missions at Baylor University"
6.30 - 7.00 pm	CiS AGM (room tbc)		
6.30 - 7.00 pm	ASA AGM (room tbc)		
7.00 - 8.00 pm	DINNER, *John McIntyre refectory*		
8.00 - 11.30 pm	Ceilidh, *South Hall*		

Sunday 5th August	
8.00 - 9.00 am	BREAKFAST, *John McIntyre refectory*
9.00 - 10.00 am	Worship, *South Hall*. Paul Wraight (leader), and Rev. Colin Sinclair (speaker).
10.00 - 10.30 am	TEA & COFFEE, *Kirkland Room*
Plenary session IV: New Frontiers in Cosmology, South Hall Chair: tbc	
10.30 - 11.20 am	John Polkinghorne: Space, Time and Eternity
11.20 - 12.10 am	Christine Done: Dark matter, Dark Energy and the Light of the World
12.10 - 1.00 pm	Joan Centrella: Binary Black Holes and Gravitational Waves: Opening New Windows onto the Universe
1.00 - 2.00 pm	LUNCH
Plenary session V: New Frontiers in Bio-ethics, South Hall Chair: John Bryant	
2.00 - 2.45 pm	Nigel Cameron: Emerging Technologies and Human Dignity
2.45 - 3.30 pm	Gareth Jones: Designers of the Future
3.30 - 4.15 pm	Joe Perry: Bio-tech. Crops. Where are the Frontiers?
4.15 - 4.30 pm	Closing comments and thanks
4.30 - 5.00 pm	TEA & COFFEE, *Kirkland Room*
5.00 - 6.00 pm	Posters and chat, *Kirkland Room*
6.00 - 7.30 pm	DINNER, *John McIntyre refectory*
7.30 pm	Videos and posters, *South Hall.& Kirkland Room*

Monday 6th August	
8.00 – 9.00 am	BREAKFAST, *John McIntyre refectory*
Depart. Check out by 10.00 am.	

CiS/ASA Keynote Lecture: New Frontiers in Science and Faith

Alister McGrath, Professor of Historical Theology, Oxford University

Alister McGrath is Professor of Historical Historical Theology at Oxford University. He is a prolific writer and debater, his most recent books being 'Dawkins' God: Genes, Memes and the Meaning of Life' and (with Joanna Collicutt McGrath) 'The Dawkins Delusion?'

This lecture will survey some of the emerging fields in science and faith, assess their significance, and consider how they can be pursued appropriately. The main developments that will be considered are the following.
1. The growing interest in "anthropic" phenomena, and their importance for the dialogue between science and religion. Although these phenomena are often associated with "fine-tuning" or "emergence" issues in cosmology, there is a growing realization that they are encountered throughout the physical and biological sciences.
2. The recent forceful emergence of a very aggressive "scientific atheism", especially evident in the writings of Richard Dawkins and Daniel Dennett. The lecture will consider how the scientific method has been exploited for the purposes of this atheistic agenda, and what might be said and done in response.
3. The increasing importance of the cognitive science of religion, and its implications for the science-religion dialogue. Particular attention will be paid to the work of Justin Barrett as illustrative of the significance of this field.
4. Attempts to use the natural sciences as a dialogue partner in scientific theology. The lecture will acknowledge the contributions of Thomas F. Torrance, for many years Professor of Christian Dogmatics at Edinburgh University, as well as noting more recent contributions to the field.
5. Increasing interest in retrieving the discipline of "natural theology", both as a discipline of interest in its own right, and as a significant platform for the exploration of the interactions of Christian theology and the natural sciences.
6. Finally, the lecture will note a significant need within the field of science and faith: How to encourage a new generation of scientists and theologians to develop interests in the field, and especially to pursue interdisciplinary interests when professional academic pressures often make this difficult.

Sunday Worship

We will be holding an ecumenical worship service in South Hall on Sunday morning. The preacher will be **Rev Colin A M Sinclair**, who is minister of Palmerston Place Church, a Church of Scotland congregation with an evangelical ministry based in the West End of the centre of Edinburgh. Minister of Palmerston Place Church of Scotland in Edinburgh since 1996 (and earlier at Newton-On-Ayr in the 1980s), Colin Sinclair is also widely known in Scottish Christian circles as the former General Director of Scripture Union (Scotland) from 1988 to 1996. Married with four children, Colin is also currently Chairman of the Spring Harvest Council of Management, Vice-Chairman of Mission Scotland and Chairman of the Mission and Evangelism Resources Committee of the Board of National Mission (Church of Scotland).

Plenary lectures

New Frontiers in Planet Care

Global Warming: the Challenge to Scientists and Christians, John Houghton

Sir John Houghton is a Fellow of the Royal Society, a former Chairman of the Scientific Panel of the Intergovernmental Committee on Climate Change and one of the world leaders in climate change research. In 2006 he was awarded the Japan prize for 'pioneering research on atmospheric structure and composition based on his satellite observation technology and for promotion of international assessments of climate change'. He has written several books including 'Global Warming. The Complete Briefing' and 'The Search for God; Can Science Help?'

As Christians, made in God's image, we have a God-given task to be good stewards of the whole of creation[1]. A modern word describing stewardship is 'sustainability' - often simply defined as 'not cheating on our children'. To that should be added, 'not cheating on our neighbours' and 'not cheating on the rest of creation'.

Many things in our world are just not sustainable; we are all guilty of cheating as we over-consume the Earth's resources and cause damage through pollution, waste, deforestation and climate change[2]. Climate change particularly presents challenges of care for people, especially the world's poorest, and care for species, large numbers of which are threatened with total loss.

Hundreds of scientists from many countries have thoroughly studied, through the Intergovernmental Panel on Climate Change (IPCC)[3] the likely impacts of climate change during the 21st century.

Because of burning of coal, oil and gas, the amount of carbon dioxide in the atmosphere is rapidly increasing, causing 'global warming' and climate change on a scale to which it will be difficult for many humans and ecosystems to adapt. The main adverse impacts will be due to sea level rise, extreme heat waves, changes in water availability and to greater frequency and intensity of floods, droughts and storms – already the most damaging of the world's disasters. More of them is bad news especially for many poorer countries and is likely to lead to hundreds of millions of environmental refugees.

To halt climate change during the 21st century, global emissions of carbon dioxide, currently over 20 billion tonnes per annum, need to be urgently reduced through major changes in the way we obtain and use energy.

The great disparity in emissions per capita between rich nations compared with poorer ones points up the enormous challenge of fairly sharing emissions reductions and energy resources between nations. Developed countries have grown wealthy over many generations through cheap fossil fuel energy without recognizing the damage it caused – damage that falls disproportionately on poorer nations. For rich countries the moral imperative to share wealth, resources and skills with poorer countries is inescapable.

Progress towards sustainability requires new attitudes and approaches at all levels of society, international, national and individual. A vital new attitude is that of *sharing* - an important Christian principle mentioned many times in the gospels and epistles[4]. The opposite of sharing - greed and covetousness - is condemned throughout scripture. At the individual and local level, a lot of sharing often occurs. At the international level it occurs much less as is illustrated by the fact that the average flow of wealth in the world is from the poor to the rich.

We may feel daunted by this seemingly impossible challenge. But we do not carry the responsibility alone. Our partner is no other than God Himself. The Genesis stories of creation describe God 'walking in the garden' with Adam and Eve. Also Jesus said to his disciples - calling them friends not servants, 'Without Me you can do nothing' (John 15. 5,15). We are not given precise prescriptions for action but are called to use our gifts humbly in a genuine partnership.

Caring for the whole of creation provides an important and exciting Christian mission opportunity to demonstrate love for God, and love for our neighbours wherever they may be – remembering the words of Jesus, 'From everyone who has been given much, much will be demanded' (Luke 12 48).

Why Should a Christian Care About Biodiversity? Ghillean T. Prance

Sir Ghillean Prance is a Fellow of the Royal Society, and the President of Christians in Science. He was previously Director of the Royal Botanic Gardens in Kew and before that Vice-President of the New York Botanic Garden. He is currently scientific director of the Eden Project. He has a special concern for and expertise in the Brazilian rainforest. Among his numerous awards is the Royal Horticultural Society's Victoria Medal of Honour.

Biodiversity is the supreme demonstration of God's creation on Earth. At present it is undergoing a massive extinction caused by one organism, *Homo sapiens.* We have no right to eliminate these demonstrations of God's bounty too us. Creation was given to us to enjoy but not destroy. "And out of the ground the Lord God caused to grow every tree that is pleasing to the sight and good for food" Genesis 2: 9a. The aesthetic and enjoyment before the utilitarian. This lecture will outline what we are doing to biodiversity and analyse some of the biblical reasons for taking better care of it.

The Biblical Basis of Care for the Environment, Robert (Bob) White

Robert (Bob) White, is Associate Director of the Faraday Institute, Professor of Geophysics at Cambridge University, and a Fellow of the Royal Society. His new book, 'Christianity, Climate Change and Sustainable Living' co-authored with Nick Spencer is published by SPCK (August 2007).

The Christian perspective on care for the environment should be underpinned by the twin realities that God created a world that he pronounced to be 'very good', and that he has promised in the fullness of time to make a new creation where he will dwell with his people. In between those two cosmic events, we live in a world where both the human and non-human creation is 'out of kilter' due to the effects of the Fall, but where Christ has already inaugurated the new kingdom. The Christian's calling in this world is to live out the reality of the new kingdom in the light of the distinctive Christian hope for the future of all creation.

As far as our care for the environment is concerned, this means that though God is involved in his creation in an ongoing sense (he is immanent in it), he also exists separately outside it (he is transcendent), so we should never worship creation rather than the creator. The Bible asserts that humans are created 'in God's image', and that our chief task is to glorify and worship God. Part of that worship in obedience to God's first commandment given to humankind is to care for (to 'steward' and to 'rule') the world in which we live. Because of human sinfulness, that task of stewarding the earth is hard work and is sometimes a struggle – but we are to use our God-given abilities, our scientific and technological insights in fulfilling this commandment.

Further Resources

Spencer, Nick & White, Robert (2007). *Christianity, Climate Change and Sustainable Living*, SPCK.

White, Robert (2006) A burning issue: Christian care for the environment, Cambridge Paper vol. 15, no. 4, 4pp. Available free from www.jubilee-centre.org/cambridge_papers

The John Ray Institute (www.jri.org.uk) has a good set of briefing papers and presentations on environmental issues available free online.

New Frontiers in Environmental Stewardship: Our Personal Response, Calvin deWitt

Calvin deWitt is Professor of Environmental Science at the University of Wisconsin Madison and President Emeritus of the Au Sable Institute where he prepared hundreds of students for environmental careers, helping them to probe their environmental beliefs, and inspiring them to reach out to help people incorporate environmental integrity into their worldviews. His numerous books, papers and lectures have made him a pioneer in raising environmental concern in the USA.

Our personal response to what we are being taught by the Creation, by biblical ethics, and by the dramatic consequences of human actions in the world brings us to break through to new frontiers in environmental stewardship. It brings us to realize as never before that we are, and must be, (1) citizens of this planet who are committed to integrity and a flourishing earth, (2) scientists who are inspired by the beauty of the earth and concerned with human actions that degrade this beauty, and (3) people of biblical faith who are dedicated to right living and spreading right living on earth. Our response is fruitful reflection and visible and effective action directed toward the preservation and restoration of integrity in personal lives, scientific endeavor, and Christian belief—and in the whole Creation. Our personal response—our mission and vocation—is to bring healing and wholeness to the biosphere and the whole of Creation.

At this critical time of Creation's degradation—with climate change and declining bio-diversity most prominent—we now move ahead to embrace and develop with vigor and resolve the means for engaging in a renewed and dynamic stewardship of the Creation through continuous and fearless personal action. And, recognizing that no one person or group can "save the biosphere," we are diligently and persistently enlisting and engaging others—as many as possible—to restore awe and wonder for Creation, integrate research and understanding across the disciplines, and produce and sustain concerted action at our new and challenging frontiers. We are poised—as people and scientists of faith committed to doing God's will on earth—to inspire and lead in living rightly and helping others live rightly on earth at the new frontiers of environmental stewardship.

New Frontiers with Genes and Evolution

Does Evolution Have a Deep Structure and If So What are the Theological Implications? Simon Conway Morris

Simon Conway Morris, is Professor of Evolutionary Paleobiolgy in the University of Cambridge and a Fellow of the Royal Society. He is scientifically well known for his re-interpretation of Stephen J Gould's understanding of early fossils. He has given the Royal Institution Christmas Lectures and earlier this year gave the Edinburgh Gifford lectures entitled 'Darwin's Compass: How Evolution Discovers the Song of Creation'. His book 'Life's Solution: Inevitable Humans in a Lonely Universe' raised wide interest.

Received wisdom amongst evolutionary biologists is that the outcomes of the process are effectively indeterminate, and that subject to only the broadest of constraints (stones fall, water is wet) there is no predictability in evolution. Such a view has much force, and appeals to the randomness of nature, be it genetic mutations or mass extinctions. If correct, and as repeatedly emphasized, this indicates that humans are just another species, an evolutionary fluke. Recent work on evolutionary convergence would, however, seriously question this view, not only because of the parallel emergence of very similar cognitive landscapes in different groups, but also because many of the principal building blocks needed for the emergence of intelligence evolved billions of years before the first brain.

If, therefore, evolution has inherent directionalities and outcomes then this may indicate a deep structure across which evolution is compelled to navigate. If, moreover, sentience is an inevitability then given our failure to understand consciousness on a naturalistic basis ("all panpsychists, please put your hands up") then it may transpire that evolution is merely the Universe's way of bringing us to the edge of the natural world, and so beyond.

Evolutionary Accounts of Religion and Altruism: Explaining vs. Explaining Away, Jeffrey Schloss

Jeffrey Schloss is Director of the Centre for Faith, Ethics & the Life Sciences, at Westmont College, Santa Barbara and former Director of Biological Programs for the Christian Environmental Association. His book, 'Evolution and Ethics', edited with Philip Clayton, was chosen as a 2005 Templeton Science and Religion book of distinction.

For over a century, the existence of sacrificial altruism and the virtual universality of religious faith across human culture have constituted under-attended if not unresolved quandaries for Darwinian theory. During the last several decades however, the sociobiological revolution and the development of evolutionary game theory have generated dramatic advances in theories of altruism, and most recently, similar approaches have begun provocatively to be applied to religion itself. On the one hand, many such accounts hold exciting potential to both extend scientific understanding of these phenomena and enrich theological appreciation of their natural place in the created order. On the other hand, by conflating descriptions of proximal function with explanations of ultimate origin, and by deconstructing both altruism and religion to fit reductive theoretical precommitments, the most prominent accounts nihilistically characterize religion and ostensible altruism as delusions, driven by the differential transmission of purposeless, informational replicators. This talk will examine the merits, limitations, and unstated assumptions of attempts to explain religion "naturalistically"; will survey and assess major competing proposals emphasizing cognitive spandrels, group selection, and memetic viruses; and will outline an emerging integrative proposal linking religion and altruism in ways that are consonant with, though not scientific apologies for, Christian theology.

Interpreting Genesis 1-3, Ernest Lucas

Ernest Lucas is Vice-Principal of Bristol Baptist College. He has a PhD in Chemistry and did post-doctoral research at the universities of Oxford and North Carolina before changing to theological study at Oxford. He also has a PhD in Oriental Studies from the University of Liverpool. He is the author of 'Can We Believe Genesis Today?'

This presentation argues that the application of sound hermeneutic principles rooted in a Christian understanding of the Bible as God's revealed word leads to an understanding of the early chapters of Genesis as a theological text expressed in symbolic stories addressed to ancient Hebrews, and not as a quasi-scientific text. When read in this way Genesis, far from being incompatible with the findings of modern science, provides us with a

theological and moral framework within which science and technology can be pursued to the positive benefit of humankind and the rest of creation.

Darwinian Evolution – The Really Hard Questions, Denis Alexander

Denis Alexander is Director of the Faraday Institute for Science and Religion, St. Edmund's College, Cambridge, and Editor of Science and Christian Belief. He was previously Chairman of the Molecular Immunology Programme at The Babraham Institute, Cambridge. He is author of several books including 'Rebuilding the Matrix - Science and Faith in the 21st Century'.

Ever since the publication of Darwin's *Origin of Species* it has been commonplace for Christians to view the evolutionary process as God's chosen method for bringing biological diversity into the world, including humankind. Yet there are both theists and atheists who draw attention to two difficult questions for those who take such a view. The first is that God repeatedly states in Genesis Chapter 1 that the created order that he brings into being is 'good' whereas, it is suggested, the bringing into being of biological diversity by a prolonged and wasteful evolutionary process, involving pain, death and the extinction of countless species on a huge scale, is incompatible with such a statement. The second question often raised relates to the evolutionary origins of anatomically modern humans in relation to the Adam and Eve account given in Genesis, particularly in relation to the Fall. Both these questions are closely linked and require theologically and scientifically integrated answers. This talk will survey the range of answers that have been suggested, highlighting models that are faithful both to our current understanding of human evolution as well as to the Biblical text.

New Frontiers in Neuroscience

Determinism and Free Will, Peter G.H. Clarke

Peter Clarke is Associate Professor in the Department of Cell Biology and Morphology, University of Lausanne, Switzerland. He did his PhD under the supervision of Donald MacKay the philosopher-neurobiologist who pioneered the integration of these areas with Christian belief. He has been awarded two international prizes and lectures widely on science and religion, mainly on the topic of religion and the brain.

There are many types of determinism (social, psychoanalytic, genetic etc.), but this lecture will focus on physical determinism applied to the brain. The age-old problem to be addressed is that if our brains work mechanistically, then our behaviour must be predetermined, so how can we be free?

Responses to this problem fall mostly into one of the following three categories. 1. Hard determinism: the past completely determines the future, including that of our brains, so free will is an illusion. 2. Compatibilism: determinism is compatible with free will and human responsibility. 3. Libertarianism: we do have free will, and this is incompatible with determinism.

My lecture will focus on the latter two positions, both of which are held by many Christians. The choice of a compatibilistic or libertarian philosophy depends to a great extent on whether one's approach to the mind-brain relationship is monistic or dualistic. Although substance dualism, linked to a neoplatonic view of the soul, was adopted by most Christian thinkers throughout history, many (most?) present day theologians consider that biblical anthropology is monistic: man does not have a soul, he is a soul.

A problem with libertarianism and dualism is that an influence of the soul or mind on the brain would be incompatible with physical conservation laws (energy, momentum etc.). The latter part of my lecture will criticize quantum libertarianism, which attempts to solve the conservation problem by invoking a covert mind-brain interaction occurring within the limits of Heisenbergian uncertainty. I shall argue that such brain events are too small to affect brain events such as synaptic exocytosis. Minimal uncertainties in brain events have been postulated to be amplified by chaos, but this raises the difficult question of quantum chaos; even if one accepts quantum chaos and its application to the brain, I shall argue that the decisional aspects of brain function are insensitive to it.

Recent Developments in Brain and Mind, Bill Newsome

Bill Newsome is Professor of Neurobiology at Stanford University, California and has won several awards for his research which focuses on the neural mechanisms underlying visual perception. He gave a stimulating paper on the implications of current work in neurobiology at the last CiS London conference.

I am a practicing Christian and a practicing scientist - occupations that are antithetical in the minds of many. In a common caricature, the practice of science is portrayed as objective, comprehensive and intellectual, in contrast to religious practice which is perceived as superstitious and parochial. My personal experience, however, is that both science and faith contribute critically to a meaningful, fully-lived human life. In this talk I will lay out some of the central issues in the faith/science dialogue from my personal point of view, keeping an eye particularly attuned to developments in the neurosciences that have implications for Christian faith.

Cognitive Science and the Evolution of Religion: A Philosophical and Theological Appraisal, Nancey Murphy

Nancey Murphy is Professor of Christian Philosophy at Fuller Theological Seminary. She is a member of the Board of Directors of the Center for Theology and the Natural Sciences and an ordained minister in the Church of the Brethren. She has written and lectured widely on the subject of mental causation and was a plenary speaker at the 1998 joint ASA/CiS conference.

This paper presents a sketch of current research in the cognitive study of religion and reflects on its philosophical and theological significance. This new approach to the study of religion seeks, generally, to explain the origin of religious beliefs as by-products of cognitive modules that evolved to solve adaptive problems of our hunter-gatherer ancestors, and to trace their spread according to epidemiological patterns. While these theories need to be criticized for their reductionism, they also need to be taken seriously by Christian philosophers and theologians. I shall argue that Arthur Peacocke's conception of a non-reducible hierarchy of sciences, with theology at the top, provides a model for appropriating the cognitive science of religion; I will show, further, that Catholic modernist theologian George Tyrrell, a century ago, had already incorporated much of what contemporary cognitive study of religion has to teach into his theological account of the origin and development of religion.

New Frontiers in Cosmology

Space Time and Eternity, John Polkinghorne

Sir John Polkinghorne is a Fellow of the Royal Society and former President of Queens' College Cambridge. In 1979 he resigned his position as Professor of Mathematical Physics at the University of Cambridge to pursue theological studies, being ordained as an Anglican minister in 1982. Since then, his extensive writings and lectures have consistently applied scientific thinking to Christianity, resulting in a modern and compelling new exploration of the faith. His 1994 Gifford lectures are published as 'The Faith of a Physicist' (and as 'Science and Christian Belief' in the USA). In 2002 he was awarded the prestigious Templeton Prize for 'progress towards research or discoveries about spiritual realities'.

The lecture will seek to discuss the three questions:
Does time flow or is the block universe the true reality?
How seriously should we take speculative theories of a multiverse?
What should theology make of the prediction of ultimate cosmic futility?
Throughout it will be emphasised that physics constrains metaphysics, but does not determine it.

Dark Matter, Dark Energy and the Light of the World, Chris Done

Christine Done is Professor in the Department of Physics in the University of Durham. Her special interests include 'anything with a decent gravitational field, especially black holes formed from stellar evolution in our Galaxy and the supermassive black holes in the centres of other galaxies which are thought to power the Quasars and Active Galactic Nuclei'. She has previously shared her enthusiasm and faith at the CiS northern conference

A Universe without a creator is ultimately also without hope for life. Conditions now allow life on (at least) one planet, and though individual lives are short, life itself has survived here for billions of years. Yet the Earth had a beginning and will have an end as the Sun's fuel is finite. Moving to another planetary system could be possible for an advanced technological civilization, but the lifetime of these other stars is also finite. New stars are made, but at an ever decreasing rate as galaxies are finite so use up the supply of gas and dust out of which they are formed. What happens next depends on the evolution of the Universe as a whole. If it continues expanding forever then eventually all the stars die out, and the Universe eventually becomes cold, empty and utterly inimical to life of any form. This depends on whether there is enough mass to halt the initial expansion, reversing it into a Big Crunch, perhaps seeding another Big Bang, forming an endless cycle of Universes in which an atheist could take some (stoic!) comfort. However, observations show that there is not enough gravity to halt the expansion, but that this gravity is dominated by a type of matter which is unlike the protons and neutrons which make normal matter (dark matter). Worse still, they also show that the current expansion is accelerating!! This implies that there is an additional energy source (dark energy) which is more powerful than the gravity of the entire Universe put together! We have no real idea what either of these dark components are, but since the expansion is accelerating then there is no cyclic rebirth of the Universe. Echoing the teacher of Ecclesiastes, God has put eternity in the heart of Man, but without Him life, even on a level of replication of DNA, is meaningless.

Binary Black Holes and Gravitational Waves: Opening New Windows onto the Universe, Joan Centrella

Joan Centrella is Chief of the Gravitational Astrophysics Laboratory, at the NASA Goddard Space Flight Center. She has recently been awarded the prestigious NASA Exceptional Scientific Achievement Medal for her work on modelling the gravitational effects of interacting black holes.

The final merger of two black holes releases a tremendous amount of energy and is one of the brightest sources in the gravitational wave sky. Observing these sources with gravitational wave detectors requires that we know the radiation waveforms they emit. Since these mergers take place in regions of very strong gravitational fields, we need to solve Einstein's equations of general relativity on a computer in order to calculate these waveforms.

For more than 30 years, scientists have tried to compute these waveforms using the methods of numerical relativity. The resulting computer codes have been plagued by instabilities, causing them to crash well before the black holes in the binary could complete even a single orbit. Recently this situation has changed dramatically, with a series of amazing breakthroughs. This talk will take you on this quest for the holy grail of numerical relativity, showing how a spacetime is constructed on a computer to build a simulation laboratory for binary black hole mergers.

We will focus on the recent advances that are revealing these waveforms, and the dramatic new potential for discoveries that arises when these sources will be observed by LIGO and LISA.

New Frontiers in Bioethics

Emerging Technologies and Human Dignity, Nigel M. de S. Cameron

Nigel M. de S. Cameron is Director of the Center on Nanotechnology and Society at the Illinois Institute of Technology (IIT). He also Chairs the London based Centre for Bioethics and Public Policy. He has written widely on bioethics his most recent books being 'Human Dignity in the Biotech Century', co-edited by Charles W. Colson, and 'How to be a Christian in a Brave New World', Co-authored by Joni Eareckson Tada.

While questions of ethics and technology have for a generation largely clustered around biology - focussed especially on genetics, cloning, and the research (ab)use of the embryo - it is becoming increasingly evident that the human future will be shaped for good or ill by a wide array of emerging technologies. These have been summed up as the so-called "converging technologies" of nanotechnology, biotechnology, information technology and cognitive science. Under the impress of transhumanist ideology these technologies are increasingly being presented as means for human "enhancement" and the radical transformation of human capacities rather than the flourishing of human nature. The prospect of artificial intelligence applied to enhance human intelligence, the development of virtual reality worlds, and the vast threats to privacy and security that could flow form these technologies suggest that those cocerned with the integrity of the human condition should take a lead role in policy development to ensure that the future holds neither a Luddite reaction nor a victory for the Brave New World. The watchword for the 21st century will be "pro-human."

Designers of the Future, Gareth Jones

Gareth Jones is Professor of Anatomy and Structural Biology in the University of Otago, New Zealand. He has written on bioethical issues over many years, his latest contribution to the debate being 'Designers of the Future'.

The world of 'designer babies' is far removed from that of impoverished populations 160 or so years ago in large European cities or today in many parts of Africa. Although these two worlds are rarely viewed together in bioethical thinking, they are united by responses that aim to avoid early/premature death. An analysis of these responses may throw light on a number of issues in current bioethical debate.

The idea that we are capable of designing future individuals is a peculiarly modern notion, presupposing as it does the power to make people radically different from what they would otherwise have been. Based on the postulated genetic and regenerative abilities of modern medicine, vistas of delaying death present challenges to a host of worldviews, including Christian ones. Design of this ilk gives the impression of interfering with the natural order, and possibly with God's creative intentions. Hence, procedures like preimplantation genetic diagnosis (PGD) come in for considerable criticism in some quarters under the rubric of producing designer babies.

I shall argue that we have been designing people for many years, even though the idea of design was far from anyone's thinking. I shall do this by reference to efforts made in nineteenth century Europe to alleviate the living conditions of those in large cities when the life expectancy at birth was as low as 30-40 years, mainly the result of inadequate water quality and sanitary conditions, and uncontrolled infectious diseases. The environmental intervention and biological manipulation required to raise life expectancy raised theological questions.

Premature death is invariably a result of a combination of external (environmental) and internal (genetic) factors, the contribution of the two varying under different circumstances. If Christians have a role in ameliorating debilitating environmental conditions, they may also have a role in tackling genetic conditions. Some of the theological repercussions will be addressed.

Biotech Crops; Where are the Frontiers? Joe N. Perry

Joe Perry is a quantitative ecologist in the Plant and Ecology division of Rothamsted Research (the long established agricultural research institute) where he has worked for many years at the cutting edge of bio-technology applied to agriculture. He is currently president of the British and Irish Region of the International Biometric Society.

The risks of GM crops are assessed within the broad categories of: food safety, effects of gene flow, environmental harm, and socio-economic issues. The supporter of biotechnology may point to the facts that (i) food from GM crops has been widely consumed for over ten years in North America, with no apparent ill-effects on health; (ii) aspects of GM technology are being developed, without public opposition, for medical purposes; (iii) the importation of alien weeds such as Japanese knotweed, often through garden centres, has had a far greater ecological impact than the release of any GM crops. So why is it that the European public remains highly dubious of the technology, with suspicions encouraged by a plethora of non-governmental organisations and fuelled by media campaigns bordering on the hysterical? At countless public meetings, folk with no particular preconceived views express disquiet that inserting a gene from one species into another is at best unnatural and at worst reckless. This view was expressed in explicitly ethical terms by Prince Charles: "there is a sacred trust between mankind and our Creator, under which we accept a duty of stewardship for the earth, [but] this guiding principle has become smothered by … scientific rationalism. If literally nothing is held sacred anymore …what is there to prevent us treating our world as some "great laboratory of life" with potentially disastrous long term consequences?". Hence, for the bioethicist there remain challenges within the heartlands, let alone at the frontiers. And yet biotechnology will present new challenges: GM crops for non-food/feed purposes, GM animals, hybrids between existing GM crops, each presenting new possible ethical as well as scientific questions.

In a previous paper (Perry, J.N. (2003) Genetically-Modified Crops. *Science & Christian Belief*, 15, 141-163) I stated my belief that: (i) there appears no explicit biblical restriction on the manufacture of GM crops; (ii) the growing of GM crops does not have consequences that must *of necessity* be outside God's will; (iii) the manufacture of GM crops is not immediately debarred as an unwarranted usurping of God's function as Creator of life. In this talk I will try to focus on some of these issues, as well as giving some background to my own journey of faith as a scientist.

Parallel sessions

Religion and the Rise of Modern Science

The Creation of Matter and the Modern Sciences, Lydia Jaeger

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The Christian doctrine of creation *ex nihilo* led the Church fathers to reject the Greek idea of a demiurge who imparts form to pre-existing matter, in order to “create” the world. Instead, they affirmed their belief in the creation of matter. This Christian concept had the potential to revolutionize the Aristotelian matter-form scheme, which provided the framework for much ancient and medieval science. The creation of matter implied a new perspective on the contingency of our world: contingency is not the result of an imperfect formation process, but stems from the free will of the omnipotent Creator.

This paper briefly presents three consequences of this changed vision—the importance of experiments, the integration of historical processes, and the possibility of exact mathematical science—before focusing on the last aspect: as the material world is created by God, it is open to exact scientific enquiry. In particular, the role of approximations is revolutionized: they no longer express the imperfect fit of rational description to the material world which is only partly ordered by form, but they constitute an essential element of the ever-ongoing process of perfecting the theoretical description of the material world.

This paper contrasts the thinking of three scholars from very different periods:
Thomas Aquinas tried to work out a synthesis of Christian doctrine and Aristotelian philosophy, where the status of matter constitutes a zone of conflict, witnessing to the inherent tensions in his project. In particular, Thomas could not reach the concept of an exact science, as matter was still for him a principle of disorder.
Galileo argued for the exact applicability of mathematical descriptions to the material world.
Nancy Cartwright elaborates her scientific methodology in an atheistic setting, and therefore self-consciously renounces the modern concept of exact scientific law.

Christian Roots of the Scientific Revolution, Joseph L Spradley

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Some of the most important ideas of the scientific revolution in the seventeenth century emerged in the early centuries of the Christian church. These concepts made it possible for modern science to transcend its ancient Greek heritage, which was limited by its deification of the heavens, dichotomy between the heavens and the earth, and lack of empirical emphasis. Early Christian contributions include ideas related to inertia, gravity, the physical nature of the heavens, and the importance of empirical evidence, all of which influenced Galileo and others in establishing the scientific revolution. Particular emphasis will be placed on the work of John Philoponus in the sixth century and Hildegard of Bingen in the twelfth century, who were arguably the first Christian male and female scientists.

In a systematic Christian critique of Aristotle, Philoponus of Alexandria challenged Greek ideas about the perfection and divinity of the heavens, suggesting the unity of all the created order based on the deity of Christ, and offering alternatives to Aristotelian concepts of motion. Although these ideas took several centuries to reach Western Europe, they eventually became an important influence on Galileo as demonstrated in his student notebooks.

An emphasis on the humanity of Christ in the work of Hildegard of Bingen, a German nun and Benedictine abbess, contributed to a new appreciation of the reality and importance of the material world. She made important contributions to medieval botany and medicine, including treatises that were used in Europe for several centuries. Her empirical emphasis was carried on by Christian scholars in the Franciscan tradition, such as Roger Bacon in the thirteenth century, and eventually formalized by Francis Bacon in the seventeenth century.

The Reformation and the Rise of Modern Science, Harry Lee Poe

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In *Science and the Modern World*, Alfred North Whitehead suggested that the Christian worldview contributed greatly to the emergence of modern science in the West, but that Protestantism played no significant part in its emergence. This paper will argue that the theological method of the reformers in rejecting tradition in favor of an examination of the biblical text was precisely the method adapted by Francis Bacon to the examination of creation. Just as Luther, Calvin, and the other reformers within the Catholic Church going back at least as far as Wycliffe argued that Scripture needed to take precedence over tradition, Bacon argued that science could never develop as long as scientists accepted the Greek tradition of Aristotle as final. In theology, the reforming mindset concluded that truth could only be found by going to the primary data, which in their case was the Bible. For Bacon, science needed to follow this model and go to the primary data of the physical world.

A matter of continuing curiosity concerns why modern science emerged in Northern Europe instead of in a region that had a longer and more developed intellectual tradition like the Indus River valley, the Yalu River valley, the Nile River valley, or the Tigris and Euphrates basin. China, India, and the Islamic world made remarkable discoveries about the physical world and the world of mathematics when Northern Europe was still semi-barbaric, yet Northern Europe made sudden and dramatic gains in scientific knowledge beginning in the sixteenth century. While the other cultures had the intellect for science, they lacked one ingredient that came from an unlikely source as the modern world would count likely sources for scientific discovery. They never experienced anything comparable to the Reformation which rejected tradition.

Bioethics I

Continuing Creation in Neuroscience: Implications for Understanding the Creator, Mark Shelhamer

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Creation is an ongoing process. While the earth is still undergoing changes (reshaping by geologic forces), we might tend to think of the heavens as being set in place for all eternity. But this is overly simplified, since the constellations have changed over millennia, and stars and galaxies are still being formed. The heavens, a seemingly immutable reflection of the permanence of God's creation, are being continuously created. Thus our understanding of creation as a singular event is subject to re-examination.

Similar reasoning can be applied to the area of creation in a neuroscience context. The body and brain change over time. Aging and learning are two examples, but there is a more fundamental process of change after birth. An example comes from experiments where a cat, raised in an environment without horizontal contours, has greatly impaired vision for horizontal objects. There are also cases in which the brain areas devoted to processing information on limb movements are taken over by other functions if that limb is rendered unusable. The brain undergoes constant creation, in response to changing conditions. This calls into question our understanding of what it means to be created by God, in his image.

One approach to these issues is to note that these observations are consistent with the view that the Creator has created the processes by which development takes place. This in turn raises other questions. Since experience shapes our development, are we somehow partners in creation? What does this say about being made in the image of God? Is God then still being created? If we are perfect creatures, His highest creations, then why do we need further refining? Further resolution to these issues might be found in a modified understanding of time, what it is and how we perceive it.

Biological and Cultural Inheritance of the Image of God and of Original Sin, David A Booth

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Developmental biosocial psychology is one of the fastest growing frontiers between science and faith. On the basis of field observations and domestic experiments with children and chimpanzees, Michael Tomasello (2005, 2006) proposes a fundamental cognitive mechanism distinguishing our species from the great apes–taking any of the complementing roles required to perform a collaborative task.

Love at the limit is unilateral sharing of another's concerns. From the Sabbath and Eden accounts in Genesis of the initial creation of humanity, we can see that the divine tri-unity of Lovers upholds a likeness in mortal male and female child-rearing lovers, though we become pervasively corrupted by failure to love God in return. The cerebral connections that provide the capacity for love in action could come from mutation(s) unique to contemporary *Homo sapiens.* Genetic assimilation in the maternal and paternal germlines may however be more likely. For example, increased numbers of neurons and random synapses in frontal and parietal areas could suffice, if the multiway connections needed specifically for joint intention are selected by infant-adult interactions during the first year. Then the *Imago Dei* would be a behavioural phenotype of our species. Even if so, Original Sin could be a behavioural stereotype that is inherited only via culture. In that case, individual evil-doing as well as goodness would have spread intragenerationally through the group(s) in which humanity was first created. Then also a genetic or cellular factor in some forms of deficit in prosociality could have come from another species of *Homo* now extinct (as may be hinted in Genesis 6:1–4). This approach is consistent with increasing consensus that, if religiosity (including devout atheism) and criminality are in part inherited opposites, this intergenerational transmission is ineluctably biosocial, generating some causal autonomy from both genes and environment.

With All Your Mind: Implications of Functional Neuroimaging for Ethics, William Polk Cheshire

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Reason is indispensable to ethical analysis and public bioethical discourse. The proper role of the additional contributions of emotion, intuition, and faith to bioethics have been debated. Functional MRI studies of the brain are now mapping the physical substrates underlying moral judgments and are bringing into objective view neural patterns corresponding to intimate thoughts that were once the exclusive domain of subjective reflection. Functional imaging studies have located, for example, where the neural pathways of reason and emotion converge in the dorsalateral prefrontal and anterior cingulate cortices. There exists within the brain what C. S. Lewis termed a liaison between "cerebral man and visceral man."

Neuroscience, therefore, is ushering in a new paradigm for bridging disparate systems of ethical theory and is providing new reasons to consider the relevance of deeply discerned intuitions and religious sensibilities to the broad discussion of bioethics. Intuition and prayer, too, are partly cerebral processes. The parietal lobe can no longer say to the cingulate gyrus, "I have no need of you." Rather, neuroscience is finding that complementary brain regions converse with one another in the search for truth.

In our finitude, however, not all our thoughts achieve complete expression in universally accessible language. Just as Scripture teaches that we are to love the Lord our God with all our mind, wisdom in bioethics requires that we make use of all the cognitive faculties that God has given us in wrestling with bioethical dilemmas. Neither reason, intuition, compassion, nor belief alone is complete. Each is more fallible if isolated from other valid ways of knowing.

A fully human neuroethics engages the full range of cerebral capacities. One may wonder whether fMRI could ever trace out and analyze the sense of awe one feels when pondering how God's thoughts immeasurably surpass our own.

Theology and Modern Science

Category Translation and Langdon B. Gilkey: A Systematic Theological Hermeneutical Method in Response to the Natural Sciences, John Templeton Baldwin

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The focus of Langdon Gilkey's theological career has largely been to articulate and apply a hermeneutical method of theological reflection upon biblical narratives by which to respond to the implications of the discoveries made by the modern natural sciences. Because Gilkey's hermeneutical method remains without a name, it can appropriately be called, "category translation," by which it is named, for the first time, in this presentation.

Briefly, Gilkey's method of category translation is a hermeneutical process of theological reflection upon biblical language, by which the meanings of selected biblical narratives are translated from their originally intended categories of history and fact into new categories, such as symbol and myth used analogically. After surveying

preparatory concepts in Augustine, Johann Semler, nineteenth-century natural sciences, and Krister Stendaahl, the essay examines Gilkey's idea of category translation in detail. It then assesses category translation, and notes its place in new directions in eschatology and science articulated by Robert John Russell and John Polkinghorne.

Standing as a method widely assumed throughout the current theological academic community, category translation remains one of Gilkey's most influential systematic theological legacies. Even theologians who may wave some aspects of category translation in eschatology, such as Russell and Polkinghorne, vigorously continue to apply it in protology. No wonder Gilkey's career premise is that "the most important change in the understanding of religious truth in the last centuries—a change that still dominates our thought today—has been caused more by the work of science than by any other factor, religious or cultural" (Gilkey, *Religion and the Scientific Future*, p. 4). The truth of his thesis can find no stronger confirmation than the existence and wide application of category translation.

Giving and Receiving: Charles A. Coulson's Witness as a Christian Scientist, Arie Leegwater

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Charles A Coulson, FRS, [1910–1974] was a very remarkable person. He was equally at home in a small Methodist village chapel delivering a sermon as in the company of theoretical quantum chemists. He held academic positions in theoretical physics (King's College, London, 1947–1952), mathematics (Rouse Ball Professor, Oxford, 1952–1972) and theoretical chemistry (Oxford, 1972–1974) during his career. If there is a single theme that characterized Charles Coulson's view of life, it is captured by the phrase giving and receiving: "It is that which holds our lives together and makes sense of all [our] separate experiences." For Coulson this theme marked the path of holiness and the sacrificial giving of the one who said: "If a man shall try to save his life, he shall lose it. But if he loses his life for my sake, he shall find it."

Coulson was committed to "come down" from himself to the "world of others." I will illustrate this by highlighting some episodes in Coulson's life. I will use his address to the 1951 BAAS meeting at Edinburgh, "The Place of Science in the Christian Faith" as a point of departure. This paper was "almost acceptable to the people who invited me"—The Research Scientists' Christian Fellowship (now Christians in Science).

As a consequence of living for others, there was a sense of urgency in Coulson's life. Coulson had a real mission to the "underdeveloped" world. He thought that the "overdeveloped" West bore special responsibilities, because it had the scientific know-how to help eradicate the immense problems of shortages of food, healthcare, and energy in the world. Coulson was Chairman of OXFAM (1965–1971) and a member of the Central Committee of the WCC (1962–1968). During 1959–1960 he was Vice President of the British Methodist Conference.

Science-Theology Dialogue and Atonement, George L Murphy

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Science-theology dialogue has focused on creation—the origins of the universe and humanity, and divine action. Little attention has been given to how God saves humanity and the world in Christ. This seems more remote from science than creation, but there are at least two reasons why it should be discussed.

First, creation and salvation are related, for the God who saves must be the God who created (Athanasius). The second reason is less abstract. Traditional views of atonement have come under heavy criticism recently. Not only have specific theories (e.g., that Christ paid the penalty for sin) been criticized, but some writers reject the very idea of atonement.

Thus it seems helpful to ask if atonement can be illumined by closer contact with our understanding of creation as it has been informed by dialogue with science. This paper does so as part of a research project (set out in my book *The Cosmos in the Light of the Cross*) in which science and technology are viewed in the context of a theology of the cross, which was developed by Luther to deal with issues of sin and salvation.

In particular, we will discuss atonement in terms of the New Testament concept of "new creation." After reviewing relationships between the cross and creation, we will discuss sin, the alienation from God that requires reconciliation, in connection with evolutionary processes. Christ's life, death and resurrection are seen as a

re-orientation of the world, and humanity in particular, toward God's intended goal. Parallels between the cross-resurrection event and *creatio ex nihilo,* the means by which salvation is communicated to people, the doctrine of justification, and connections between our approach and other models of atonement (such as *Christus Victor*) will then be considered.

Appropriate Technology I: Water, Energy and Bridges

Water: The Defining Crisis for the Developing World, Kenell J Touryan

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We have heard by now that water will be the oil of the 21st century, especially for most developing countries. Unlike fossil fuels that can be replaced by renewable technologies, water has no substitute.[1] Fresh water constitutes only about 2.5% of the total volume of water on Earth, and two-thirds of this fresh water is locked in glaciers and icecaps. Just 0.77% of all water is held in aquifers, lakes, rivers, etc.[2] Irrigation accounts for the lion's share (70%) of the world's consumption.

Today, 26 countries are considered water-scarce and by 2050 this number could reach 55 countries. As major rivers dwindle to a trickle farmers (and cities) pump water from underground aquifers, seriously over tapping these resources.

In this presentation, we will take a brief look at the global crisis and then turn our attention to the Middle East, a region where water shortage has become critical: Israel, Jordan and the West Bank. Brackish water is seeping into aquifers in these three countries. In 1999, USAID and USDOE funded a collaborative effort among engineers in the region to install mobile desalination units in several villages in Jordan and the West Bank using US and Israeli technologies adapted to village requirements.[3] The project was managed by the author.

Small scale reverse osmosis (RO) desalination units were assembled and installed in two villages to provide fresh water from existing wells that had become brackish (over 3000 ppm solids content). The small village of Qatar (100 families) 40km north of Aqaba in Jordan was the first location to see the installation of a small RO unit. Locals were trained to operate and maintain the mobile RO desalination unit.[4]

Two other objectives were met in this project: (1) It helped Jordanians and West Bankers learn to reverse engineer such units and manufacture them in their respective countries, and (2) It helped develop cooperation and goodwill among traditionally antagonistic parties. One could not help but experience first hand our Lord's exhortation in Matt. 5:9: "Blessed are the peace makers …" The author's hope is that more such projects be funded in conflict-torn areas of the world to address the critical need for both fresh water and reconciliation among traditional adversaries.

[1]Sandra L. Postel, *Science* 313 (25 August 2006): 1046–7; and Peter H. Gleick, *Science* 302 (28 November 2003): 1524–7.
[2]I. A. Shiklomanov in *Water in Crisis: A Guide to the World's Freshwater Resources* (New York: Oxford University Press, 1993), 13–24.
[3]K. J. Touryan and Allan Hoffman, "Small Scale Desalination of Brackish Water," presented at AAAS Annual Meeting, 16 February 2005.
[4]K. J. Touryan, Malek Kabariti, Rafi Semiat, Fadle Kawash, "Solar Powered Desalination and Pumping Unit for Brackish Water," Final Report to USAID/USDOE, August 2006.

Bioenergy: A Fuel for All Seasons, Paul M Means & Noelle Means Allison

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Global warming is a significant and sometimes daunting problem that faces our generation. We are challenged to both reduce our energy usage and find new, non-fossil, renewable sources for that energy. While conservation is an important element of the solution, major changes in the sources we use for energy are also necessary. As scientists and engineers, we are uniquely equipped to investigate, design, and implement measures to ameliorate the impact that the human population has on the Earth's climate. As Christians, we are called to be

active stewards of God's creation rather than passive passengers in time and space. It is while wearing these two "hats," that we examine the supply aspect of the energy/conservation relationship.

Options abound for alternative energy forms: solar, wind, hydro, tidal power, wave power, biofuels. New solutions appear in the popular press with, at times, bewildering frequency. Although each of these technologies has its place, this paper will focus on the possibilities presented by bioenergy. Bioenergy (sometimes termed biomass energy) is derived from sources such as wood, corn, sugarcane, rapeseed, switchgrass and sorghum. Bioenergy is a transportable, storable, and renewable fuel. A wide range of conversion technologies can be used with biomass energy. There are many attractive applications for its use in both developed and developing economies. Bioenergy is highly versatile; different forms of bioenergy can be used for heating, generating electricity, and as transportation fuel. As Christians, we see an additional benefit to the use of bioenergy in that its generation and use tends to promote the distribution of wealth (in the form of jobs and income), in particular to rural areas. Finally, in many cases bioenergy can be implemented and utilized with a low outlay of financial capital. For these reasons, we believe bioenergy is an essential part of the solution to global warming.

Building Bridges to a Better Future: "Bridging the Gap—Africa", William Jordan

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In 1869 a 475-foot suspension bridge was built across the Brazos River in Waco, Texas. It was the longest bridge west of the Mississippi at the time. This first major bridge across the Brazos River allowed ranchers south of the Brazos River to be able to get their cattle to market in
Ft. Worth, Texas, dramatically improving the economic opportunities in a large region of Texas. In the developed world, bridges are ubiquitous today and largely taken for granted. However, in the developing world, bridges are few and far between, leaving people who live far from a bridge disenfranchised from markets, schools, and medical care.

BridgingTheGapAfrica (BTG) was founded by Harmon Parker in 1996. Bridging the Gap, Inc. is dedicated to saving lives and improving the quality of life for marginalized communities across sub-Saharan Africa by constructing pedestrian footbridges to overcome the dangers posed by impassable rivers and ravines that threaten their safety, limit their access to education and healthcare, and restrict economic opportunity.

In 2005, BTG invited the engineering program at Baylor University to partner with BTG Africa to provide engineering services, analyzing the suspended pedestrian bridge design that is currently being used for rivers up to 180 feet wide and to help design a new pedestrian suspension bridge that can be built economically and safely across rivers that are up to 500 feet wide.

Today BTG Africa gets many more requests for bridges than it can supply. In this presentation, we will highlight the process of selection, the involvement of villagers in planning, financing and constructing the bridge, and how this can be done as part of a holistic Christian ministry to people in great need. We will also share the new pedestrian suspension bridge design that has been developed at Baylor to facilitate safety, ease of construction in remote locations without the benefit of heavy equipment and using building materials available in the country, and at the lowest possible cost. Finally, we will quantify for several villages the tangible benefits of their pedestrian bridge and provide a cost/benefit analysis to show how a small investment in such infrastructure can pay huge dividends to the people who use the bridge.

Creation, Fall, and Sabbath

Biblical Goodness and the Perfection Myth: The Importance of the Genesis Narrative in Light of Scientific and Philosophical Perspectives, Craig A Boyd

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My topic concerns the issue—the myth in the common sense of term—of the perfection of creation. I argue that this myth is detrimental as it causes both Christians and atheists to have unreasonable expectations about the created order. Christians inevitably see the creation narratives in ways that distort the scriptures and lead to incoherent theological positions while atheists tend to believe these unbelievable ideas are actually central to

the faith. This is an important issue that, as biblical scholar James Barr has observed, “is one that our religious traditions have not adequately faced.”

My work attempts to uncover the origins of the myth in the late work of Augustine’s *Unfinished Letter to Julian* and briefly to trace its influence through to the present century. I will juxtapose biblical hermeneutics with scientific and philosophical concerns regarding the incoherence of the traditional view of “The Fall” and the scientific data that suggest the implausibility of a cosmos without death. The approach is intentionally interdisciplinary and will appeal to a decidedly Irenean theodicy. The upshot of my work should be twofold. First, the idea of a creation that is “good” and not “perfect” implies certain ethical imperatives about creation. The creation itself is in need of human care and tending while a perfect creation needs none and a fallen creation would be impossible to restore. A second implication concerns traditional theodicy. Although my intent is not to rehash traditional process arguments here, I believe that an understanding of creation as good and not perfect helps to soften the traditional problem of evil as presented by certain atheists such as Richard Dawkins, who also unwittingly, buy into the “perfection myth.”

The Fall and Natural Evil: Revisiting the Hermeneutics and Historicity of Genesis 3, Denis O Lamoureux

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Christians throughout history have held that the events in the Garden of Eden led to the origin of natural evil. This notion is often termed “the doctrine of the cosmic fall.” Powerful biblical evidence supporting this traditional view comes from the apostle Paul. Looking back to Genesis 3 and Adam’s transgression, he states that “sin entered the world through one man, and death through sin, and in this way death came to all men, because all sinned” (Rom. 5:12). Paul also asserts that the creation “was subjected to frustration” and since then “has been groaning as in the pains of childbirth” and continues to be in “bondage to decay” (Rom. 8:20–22). However, evolutionary science falsifies the belief in a cosmic fall. Suffering and death predate the appearance of humans by hundreds of millions of years. In order to mitigate this conflict between Scripture and science, attempts have been made to interpret Paul’s reference to the entrance of death into world as “spiritual death.”

I contend that these approaches are eisegetical and ultimately derive from an underlying concordist hermeneutic. The Divine judgment to Adam, “for dust you are and to dust you shall return” (Gen. 3:19), can only refer to physical death. I will propose a two-fold solution to this apparent conflict. First, the opening chapters of Genesis are built on ancient Near Eastern motifs–*de novo* creation and the lost idyllic age–which the Hebrews inherited and sanctified under the guidance of the Holy Spirit. Though these are logical retrojections of physical phenomena from an ancient mindset, they lack historicity. Second, the redaction of sources leading to the composition of these chapters requires modern readers to respect the authorial intentionality of each. Traditionally categorized as “Priestly” and “Jahwist,” reference to the cosmos in the former reveals an ontological status, while statements about nature in the latter reflect an incidental ancient phenomenological perspective. In this way, Christians today can acknowledge that the creation is both ontologically “very good” (Gen. 1:31) and phenomenologically “subjected to frustration, groaning and bonded to decay.”

Absolute and Mediate ‘Divine Creation’ in Cosmological Discussion, David C Watts

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Controversies in science-theology are fueled by ambiguous terminology. This is so with the key terms ‘Create / Creation’ used by stakeholders from communities of physical cosmologists and biblical, systematic, philosophical and scientist-theologians. The history of interpretation recognizes a vital distinction between two referents of ‘divine creation,’ namely; ‘absolute (or primary) creation’ and ‘mediate (or secondary) creation.’ *Absolute creation* is *ex nihilo*. *Mediate creation/causation* denotes divine agency transforming pre-existing matter/energy. Thus God *created* Adam “from the dust of the ground.” Pre-existing matter/energy is only available as a consequence of *ex nihilo* creation. All that exists (including space and time) does so contingently because of the will of God and the agency of Jesus Christ, the divine *Logos*.

Classic Trinitarian theism, from at least Augustine onwards, has affirmed that God *transcends* the world of space and time and is *thereby* able also to be fully *immanent* within it. Since absolute creation is thus bringing the universe into being *from a wholly external standpoint* it is a metaphysical reality, not a ‘scientific’ or ‘historical’ event. Clarity is imperative to distinguish this from physical ‘big-bang’ singularities or ‘no-boundary’ models of space time. Quantum vacuum models referring to ‘nothing’ can be ambiguous. Scripture often uses the language

of ‘creation’ to characterize *recurring* phenomena—ranging from hailstorms to the birth of animals. Focally, these are references to *mediate* creation, but with tacit knowledge that *absolute* creation underpins all existence. Thus Scripture also uses ‘create’ (*bara*’) to denote things traditionally labeled ‘providence’ in some historic Confessions of Faith. All instances of ‘mediate creation’ back to t = 0 (excepting certain miracles such as the resurrection) are susceptible to scientific analysis because they involve divine concurrence with a network of secondary causal agencies. Regarding biological species-origins, diverse views can be equally consistent with firm belief in *absolute* creation by God.

Biblical Sabbath—Original Paradigm of Bio-history: A Model Critique of Humanistic Naturalism, Hedrick J Edwards

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Having creation as its thesis, the biblical Sabbath embodies both prologue and epilogue of Earth’s history. Its establishment constitutes a priceless metaphor of creation in three critical time dimensions, making it a model critique of humanistic naturalism.

1. Affirming creation past, the Sabbath reminds us where we came from. Its observance is implicit denial that the natural world is self-created, and explicit confession that nature’s first cause transcends nature itself (Exodus 20).
2. Affirming creation present, the Sabbath explains why we are here. It informs of the Creator’s collaborative intervention in defense of the world against oppression, violence, and whatever principle or practice now distort creation (Isaiah 58; Ezekiel 20).
3. Affirming creation future, the Sabbath envisions where we are going. It is a harbinger of hope, pointing to a God-ordained destiny in which the whole creation, once “travailing in pain,” is rescued from its bondage to decay and restored to pristine integrity (Romans 8; Isaiah 66).

The historical Christ established these three markers in the landscape of creation history as the basis for intelligent faith by declaring himself “Lord also of the Sabbath.” Clearly, then, “the Sabbath was made for man,” not against humankind. The holistic themes it embodies justify the invitation to cease all anxious labor pertaining to life’s meaning by entering, even now, into Sabbath rest (Hebrews 4). To dismiss the Sabbath as a relic of Jewish culture and as impediment to faith is to miss its significance—putting at risk the verities it encompasses and opening floodgates of speculative rationalization, which Darwinian naturalism epitomizes. Christians in science, theology, and philosophy may profit by taking another look at how this original paradigm of bio-history’s trajectory broadens the conceptual focus and mitigates anxiety.

Science and Religion in the Seventeenth Century

Redeeming Natural Theology: Science and Religion in the Seventeenth Century, Larissa Kate Johnson

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Christians, particularly those in the Reformed tradition, are skeptical of natural theology, and with good reasons. The idea that we can find out about God from nature using our own capabilities seems to contradict the belief that we can only know God through his gracious revelation, and the rise of natural religion during the Enlightenment led many to reject Scripture entirely.

While most historical scholarship has viewed natural theology as something distinct from opposed to revelation, this paper will present a model designed to take into account the complexity of natural theological discourse. This model aims to redeem the tradition of natural theology by pointing to its diversity and range of applications. Taking seventeenth-century England as an example, it will be argued that natural theology was primarily an apologetic demonstration of doctrines already known for revelation.

Rather than replacing the Bible, natural theology was seen as a way to encourage people to accept the authority of Scripture as the Word of God. By incorporating theological ideas as well as new discoveries in natural knowledge, natural theology allowed for theology and natural philosophy to be combined in a single discourse. Using two famous examples as case studies—John Wilkins’ *Of the Principles and Duties of Natural Religion* (1674) and John Ray’s *The Wisdom of God Demonstrated in the Works of Creation* (1691)—this approach will illuminate the complexities of the relations between science and religion, and the varied attempts to negotiate the boundaries between these two disciplines. In addition, this will enable an appreciation of the efforts of seventeenth-century natural philosophers to combine their pursuit of natural knowledge with their faith.

Reading God's Two Books, David J Tyler

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All Christians recognize that God has revealed himself in the natural world as well as in Christ and the Bible. Of great significance is the relationship between these two forms of revelation. Many significant controversies have resulted by people taking different positions on this relationship: geocentrism, the age of the Earth and the global flood, natural theology, evolutionary biology, human evolution, etc. More recently, differences on abortion, human embryo research and neuroscience have emerged. This paper is concerned with understanding the controversies by examining how they have emerged from different stances taken on the "two books."

The historical survey will take in the concept of complementarity and draw parallels with Gould's "non overlapping magisteria" and some of the writings of Ruse. Moving back to pre-Darwinian history, the "two books" position represented by advocates of Natural Theology reveals significant continuity with the complementarity approach and this is traced back to Galileo, the pioneers of science, and the influence of Francis Bacon. Whilst Bacon was concerned to put an end to the dominance of Aristotelianism, this does not explain the view he held on the two books. For this, it is necessary to go back to Thomas Aquinas. He saw Aristotle as the greatest of human philosophers and proposed a way of incorporating the essence of Aristotle into the Christian intellectual tradition. He did it by arguing that the world of nature could be known separately from the world of the spirit. The sacred could be distinguished from the secular. Using more contemporary terminology, Aquinas compartmentalised knowledge. The issues facing us today involve assessing whether secularism entered Christian theology via Aquinas and Bacon, or whether these men led the way in understanding the relationship between science and Scripture.

Mediating Conflicts in Science and Theology: The Example of John Wallis (1616–1703), Jason M Rampelt

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John Wallis (1616–1703) was the Savilian Professor of Geometry in Oxford from 1649 until his death and played a significant role in developing and promoting the newest mathematics and science of his time. He served in this office during a time of tremendous political and religious upheaval in Britain. Wallis's career was marked by an ability to fully participate in academic and public life without instigating or suffering from partisan acrimony. He succeeded by mediating opposing sides both in the sciences and in theology. Though a member of the Royal Society from its earliest beginnings, on the cutting edge of the experimental method and mechanical view of the world, he nevertheless still lectured on the older Aristotelian philosophy in the university. And even though he was a participant in the Westminster Assembly and a convinced Presbyterian, he was able in good conscience to conform to the episcopalian Church of England.

This paper will explain how his skill in mediating these competing positions was central to winning acceptance of the new science within the universities. In this light, Wallis will be considered as a model for how a Christian ought to behave in the face of current conflicts *between* some of the sciences and certain theological doctrines.

Prophecy and Geography

Africa, India and Russia: Biblical Misinterpretations, Edwin M Yamauchi

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Some geographical terms in the Bible are still obscure, others have been misinterpreted, sometimes with serious consequences.

Moses' wife (Num. 12:1) has been identified by some with Zipporah from Midian (Exod. 2:21), but she is a second wife from Cush (the Sudan).

The source of Solomon's gold was Ophir (1 Kings 9:28; 10:11). The identification of Ophir as a site in India led Columbus in his epochal journey westward. Ethiopian Christians and Afro-Centrists claim that the Queen of Sheba, who visited Solomon, came from Africa, whereas she came from Arabia.

Persian Christians claim that the Christian Magi came from Persia; some church fathers believed that they came from Arabia. They were most probably astrologers from Mesopotamia.

Even otherwise well-informed scholars have assumed that the Ethiopian eunuch of Acts 8 came from the modern country of Ethiopia, whereas we can be certain that he came from the kingdom of Meroe in the Sudan.

Dispensationalists like Hal Lindsey and John Walvoord have misinterpreted the prophecy of Ezek. 38:2 as a reference to Russia, a belief which seems to have influenced President Reagan.

Jerusalem is revered by Jews as the ancient capital captured by David, and as the site of their temple. Christians honor Jerusalem and launched the Crusades to recapture it. Different Christian groups, however, disagree as to the exact site of the trial, crucifixion and burial of Christ. The current Middle East crisis is fueled by the claim, founded on a later interpretation of the Qur'an that Jerusalem is also the site visited by Muhammad on his "Night Voyage" on a winged horse from Arabia.

Environmental Stewardship

Nature Conservation in a Changing Environment: Can Creation Care Theology Help Us Adapt? Les Batty

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Nature conservation philosophy and practice in Britain are the result of a complex relationship between historical principles, traditional practices and reactive management. The dominant paradigm assumes environmental stability, and particular emphasis has been placed on maintaining certain charismatic species and cherished landscapes.

A system of conservation has developed that is characterized by specific objectives, targets and measurable outcomes; and success is measured by the response of target species to a particular management prescription. Any undesired changes in the status of the species or habitat produce a "crisis management" response. However, this approach is inadequate to deal with the challenges posed by dynamic environments and changes caused by global warming. Some examples of the resulting dilemmas faced by conservation practitioners are demonstrated forcefully at one of my study sites on the Suffolk coast, in eastern England. This site is, by nature, a barrier-built estuary, but it has been considerably changed by centuries of coastal engineering and hydrological control so that it now consists of a shingle barrier backed by extensive freshwater marshes. Both the shingle barrier and its vegetation, and the marshes and the bird species they support, are designated under European Union and international conservation legislation. However, management prescriptions that favour the natural functioning of the shingle barrier are incompatible with maintaining the freshwater habitats, and vice-versa. Moreover, in recent years the marshes and their designated species have become increasingly "threatened" by tidal inundation as a result of natural coastal processes. A practical solution to this crisis is being sought, but the choices are difficult.

In this presentation I will explore the application of creation care theology to such practical conservation dilemmas, and the extent to which it can contribute to a new approach for resolving current and future conservation problems.

Creation Care—Integrating Missions and Environmental Stewardship: A Spirit-Centered Perspective, Michelle A Haynes

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As the movement to care for creation spreads within our churches and congregations, it is important to see how effectively the message is shared overseas. While some groups have made significant progress in earthkeeping missions, others completely lack the concept. What strategies can we implement to bridge the gap for those groups who have not yet formed the foundation for environmental stewardship?

A practical theology for earthkeeping from Romans 8:15–28 speaks of three groanings, that of creation, believers, and the Holy Spirit. It speaks of hope intermingled with suffering. Christians hope for the day when

God will give us our full rights as his adopted children, including release from sin and suffering. Creation hopes for the day when it will join God's children in glorious freedom from death and decay. We join with creation in eager hope and expectation.

Missionaries who understand this will be armed with greater relevancy in reaching out across the world. The message is rooted in the earth, and just as it brings hope through suffering, the Holy Spirit is within us as a foretaste and confirmation. This message develops the framework for a Pentecostal missiology that incorporates stewardship of the earth by linking theology to ethics to practice on the field. These elements should supplement pre-field training and inform the missionary about how the choices they make will impact not only the people they reach but the environment they go to as well.

Though Pentecostalism has spread quickly in developing nations, as hope amid suffering meets felt needs, it has neglected earthkeeping principles. Pentecostal missionaries need a broader perspective that empowers them to teach about care for the earth and stewardship of resources to growing local churches. These churches can then act as agents of change as their countries develop, supporting sustainable, creation-friendly choices.

Pearls Mean Tears: The Plight of the Mollusca, David Campbell

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Although popular accounts of endangered species emphasize mammals and other vertebrates, many invertebrate groups have significant rates of imperilment. Among the highest rates are found in non-marine Mollusca, with about two-thirds of the roughly 35,000 species considered at risk. Contributing factors include characters of the mollusks, such as low dispersal ability, high endemism, and complex ecological requirements, and human actions, such as major impacts on freshwater habitats, neglect of less conspicuous species, species introductions, climate change, and overharvest. New data, especially molecular sequencing, show that diversity and endemism are often underestimated.

Conversely, several species pose significant problems for humans. Their prominent role as intermediate hosts of trematodes has the greatest impact, but they also pose problems such as fouling, feeding on crops, or affecting species of importance. Many of these problems stem from introduced species. Ill-advised control measures often bring additional problems.

Good stewardship of these underappreciated parts of creation requires understanding of their biology and consideration of impacts of human activity.

Agriculture, Nature, Ecology and Ethics: Being Accountable in God's Creation, Uko Zylstra

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Agriculture is at the interphase of nature and culture. In so far as all human activity (culture) is subject to norms, it is important to discern the norms for agriculture as a particular form of human activity. Furthermore, the rapid rise in the human population, the decline in agro-ecosystems and resources to support food production, and the development of technologies that enable humans to have an excessive impact on the earthly environment call for a renewed vision of agriculture as fundamentally a form of stewardship.

Given that food is a basic form of interrelationship among creatures in a dynamic, unfolding creation, how are human beings to be stewards of the unfolding of the creation, in particular, of the agro-ecosystems? How do we understand the concepts of preservation, conservation, and restoration as norms for human stewardship of this unfolding? Is "improvement" an appropriate norm? If so, how do we judge what is "improvement"; or what is degradation? For example, is the development of genetically modified crops, such as Bt corn, an improvement of creation or a degradation of creation? Does the development and use of Bt corn fall within the creational norms for the unfolding of creation?

To deal with these fundamental questions requires tremendous wisdom and knowledge of the inter-relationships embedded in the creation. They require some basic guidelines if we are to live responsibly in God's creation. Furthermore, grappling with these questions demands a deep sense of humility rather than the arrogance that is so typical of the human relationship to the creation and understanding of the creation. A key consideration in articulating norms for sustainability of agro-ecosystems is that human beings are created to be accountable and

that global stewardship requires democratization of stewardship potentials. This entails increasing local control and accountability in agriculture.

Science and Appropriate Technology for the Developing World: Science Aiding Agriculture: What Approach Works?

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I teach principles of sustainable agriculture in many settings, and will review, with examples, recent successful approaches that use science to increase food yields.

One facet of the "image of God" in humanity is creativity, freshly expressed in each culture and time. Since we are finite, sinful and easily fooled, these creative ideas also need careful testing.
(1) Agricultural archeology can suggest forgotten or neglected approaches from extinct cultures. Two examples attracting attention are tierra prieta in the Amazon Basin and rainwater harvesting from the ancient Middle East.
(2) Pre-agrichemical Western agriculture is rich in accumulated knowledge overlooked in recent generations. Extensive published research on optimizing crop rotations is one example.
(3) All globalized crops and techniques originated in one place and culture, and diffused, often having the greatest impact far from their origin. Recent experience suggests others await promotion: Andean root crops and Moringa will be used as examples.
(4) Contemporary ecological research teaches us how living things typically function in a given place: "sustainability" is working with and not against the normal ecosystem functioning. Examples of mutualism in healthy soil and Nutrient Quality Access in the humid tropics will be presented.
(5) Promoting and testing innovation and collaboration among both "insiders" and "outsiders" is the exciting challenge. Examples will be discussed, time permitting.

Use and Misuse of Science to Feed and Empower the Poor, John Hodges

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Much of the earth's biodiversity was specifically given by God as food: plants and trees bearing seeds and fruit, green plants for humanity and animals, and later animals for food. The Genesis mandate to humanity to care for the earth and to facilitate ongoing reproduction of bio-resources clearly indicates that ensuring food supply is a God-given task.

In recent centuries, science has contributed successfully to Western food production so avoiding Malthus' prediction. Today the exploding population of the poor in developing countries poses a new challenge on how to use science to provision the whole world. Development experience shows that the only equitable, long-term solution is to "empower the poor"—enabling them to care for and use their bio-resources for food and better quality of life. This is a biblical model. In support, science is needed at the grass roots level—from the "bottom-up." The opposite is happening. Scientific capital is being used to seek "top-down" magic bullets within the paradigm of biotechnology on a large-scale and global free trade. Cutting-edge research for agriculture and food is largely directed by commercial interests. There is little evidence to date that this simplistic model for feeding the world is actually empowering the poor; and it is likely to prove counter-productive. Fundamental genetic changes in food species by gene-transfer technology are linked with the global use of patents. This duet, driven only by economic values and legal enforcement, is contrary to the mandate to care for the divine gift of biodiversity to all humanity. Lacking biblical values, the model is an affront to the Giver.

This paper reviews alternative, biblically-based ways of harnessing science to empower the poor.

Tsunami Relief and Coastal Fishing Communities: The Science and Appropriate Technology Supporting the Sustainable Use of Tropical Marine Resources, Robert D Sluka

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The December 26, 2004 tsunami significantly affected coastal fishing communities in South and Southeast Asia. Much of the coastline impacted by the tsunami was bordered by coral reefs or mangrove ecosystems. Prior to the tsunami, most of these coastal areas were significantly impacted by anthropogenic factors. This decreases the amount of food available for local fishing communities and reduces economic potential. Thus, long-term

relief and development for these fishing communities must not only take into account the tsunami-impact, but the ecology of these habitats and the environmental impact by coastal communities throughout this region. How well do relief and development agencies understand the scientific and environmental issues which affect the tsunami-impacted coastal fishing communities? Is long-term development considering how to best manage marine resources so that fishing communities can continue to fish into the future? What did we learn about doing relief and development in these coastal communities that we should apply to future disasters among coastal fishing villages? What appropriate technology is available for restoration of these marine habitats?

This talk will address these issues by evaluating tsunami relief and development projects in light of known biblical stewardship and marine conservation science principles in order to determine the lessons that need to be applied to the next disaster. Case studies from the literature will illustrate the important principles, including an examination of the author's tsunami-related work in India and his research on tropical marine conservation in the Caribbean Sea and Indian Ocean.

Philosophy of Science

Mere Science: Taking the Demarcation Problem Seriously, Donald N Petcher

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The demarcation problem of science leads most philosophers to believe that there is no definition of science that would be fairly widely agreed upon. That being said, arguments related to intelligent design (ID) for example, often hinge on the assumption that ID is or is not science. If one accepts the demarcation problem as insoluble, these are not appropriate claims to make. How are we to proceed?

In this talk I will explore what it would mean if the demarcation problem were to be taken seriously. I will first review the problem, and suggest that taking it seriously also sheds critical light on some other topics such as whether methodological naturalism is necessary for science. Then I will go on to suggest an alternative way to view the situation, which I refer to as "Mere Science." Finally I will discuss implications and recommendations of Mere Science for such dialogs as the one concerning intelligent design.

Darwin, Evolution, and God

The Law of Higgledy-piggledy Revisited: Contingency and Supernatural Design, James R Hofmann

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Ever since Darwin's *On the Origin of Species* in 1859, one source of philosophical and theological concern has been the role of "chance" in his analysis of the causes of descent with modification. Darwin himself was dismayed to learn that John Herschel's initial reaction to the idea of natural selection was to dismissively refer to it as the "law of higgledy-piggledy." The concern expressed in Herschel's quaint phrase has resurfaced with particular stridency during recent anti-evolutionary episodes in the United States.

In 2005, documents prepared by proponents of revisions to Kansas science standards included the assertion that evolutionary theory "postulates an unguided natural process that has no discernable direction or goal." The perception that evolutionary biology rules out the possibility of supernatural providence has been a major motivation for the "intelligent design" movement in the United States, primarily funded by the Discovery Institute. Legal concerns reached something of a climax during 2005 when a high profile case in Dover, Pennsylvania, was decided against the intelligent design movement.

Ironically, while assertions about the incompatibility of evolutionary biology and "design" dominate popular press coverage of school board debates, theologians have advanced quite sophisticated analyses of how the contingent nature of genetic variation can be reconciled with supernatural direction. "Human Persons Created in the Image of God" is a particularly pertinent essay by Catholic theologians. Because less formal statements by other Catholic spokesmen, such as Cardinal Christoph Schönborn, have received undue press coverage, it is worthwhile to consider how more nuanced discussions of contingency and design address the issue initially raised by Herschel in 1859.

Optimistic Evolutionists: The Progressive Science and Religion of Joseph LeConte, Henry Ward Beecher, and Lyman Abbott, by Mark A Kalthoff

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Historians of science are well acquainted with post-Darwinian efforts by American Protestants to accommodate evolutionary theory. Moore (1979) and Roberts (1988) stand among well-known recent studies. This paper extends a small portion of their investigations, focusing upon the lives and works of three prominent "optimistic evolutionists" who published on evolution and Christianity during the 1880s and 1890s: Joseph LeConte (1823–1901), Henry Ward Beecher (1813–1887), and Lyman Abbott (1835–1922). Of the three, only LeConte, who taught geology and natural history at the University of California, was a prominent scientist. Yet Beecher and Abbott (who served in succession Brooklyn's Plymouth Church) exercised considerable influence through their lectures and published writings upon American thinking about evolution and religion. Although each man has been the subject of a biographical study (Stephens on LeConte, 1982; Brown on Abbott, 1953; Applegate on Beecher, 2006), there is little scholarship looking at the three together. This is unfortunate given their personal relations and mutual influences.

A recent study of concordism and American evangelicals concludes, "four main patterns govern most religious responses to evolution" (Davis, 2003). Among these is the reformulation of traditional Christian doctrine in response to evolution. The cases of LeConte, Beecher, and Abbott exemplify this mode. Importantly, their theological accommodations of evolution include treatments of two fundamental issues: the problem of evil and the concept of design. Matters of theodicy still vex theologians and philosophers—cf., N. T. Wright, *Evil and the Justice of God* (2006)—and scientists still acknowledge the implications of evolution for the doctrine of original sin—cf., Collins "Evolution and Original Sin" (2003). The emergence of "intelligent design" theories in recent years establishes the chronic vitality of this issue. Hence century-old writings on these topics offer valuable perspective, even if only as cautionary voices that explicate theological difficulties awaiting Christians who submit traditional doctrines to service of new and fashionable scientific orthodoxies.

Darwinism and Original Sin: Frederick R. Tennant's Integration of Evolution into Christian Thought in Britain in the Early 1900s, Daniel K Brannan

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Interdisciplinary research that integrates science into Christian thought requires a historical survey of past theological attempts when the science was emerging. Darwinian explanations seem to negate traditional views of original sin. A relatively little known Anglican theologian, Frederick R. Tennant, was one of the first to integrate Darwinism into a thoroughly revised yet orthodox form of original sin.

In his Hulsean Lectures, *The Origin and Propagation of Sin* (1902), Tennant explained original sin in light of Darwinism without diminishing the need for salvation. He did so by positioning original sin as inherited propensities for self-survival, not as inherited guilt. His bold theological anthropology had three arguments that rebutted original sin as inherited original guilt: (1) there was no literal, historical Fall, (2) there is no human bias toward sin until consciousness develops, and (3) "inheritance" of sin should be located in the material of sin, not in sin itself.

Tennant saw evolution as enabling us to recover an Irenaen sense of original sin. We have inherited only those biases for behaviors that existed before the emergence of conscience and knowledge of moral law. Those behaviors once led to survival and reproduction, but they became sinful after acquisition of a consciousness that allowed recognition of moral law. Tennant emphasized the connection of his ideas to Saint Paul's insistence that without law, sin is dead.

This paper will detail the life of Frederick R. Tennant, his integration of Darwinian thought into Christian theology, and the reception of his ideas, both positive and negative. An attempt to explain why his ideas never caught on will also be made in light of Fundamentalism's rise in the 1920s.

Bioethics II

Engineering Behaviour through Drugs and Genomics, Alun Morinan

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Reliable evidence of human beings using chemicals obtained from plants to enhance their happiness dates back some 6,000 years, however, it is only comparatively recently that synthetic therapeutic drugs have been used for this purpose. In "Listening to Prozac" published in 1994, the psychiatrist Peter Kramer coined the term 'cosmetic psychopharmacology' to describe the use of the antidepressant fluoxetine (PROZAC) to improve your personality and make you better than well. Fluoxetine, together with bupropion (smoking cessation) and rimonabant (weight loss), are just three examples of centrally-acting drugs that may be considered 'lifestyle drugs.'

An exact definition of what is meant by a lifestyle drug is still a matter of debate and in the widest sense would include the 'historical' recreational drugs like alcohol, cannabis and the opioids and the more recent synthetic amphetamines and hallucinogens. However, it is generally agreed that this term describes therapeutic drugs used for non-clinical conditions or those on the border of health and illness or for problems that would be more suitably addressed by a change in lifestyle; e.g., taking lovastatin to lower blood cholesterol rather than adjustment of the diet. Over the last decade, the global lifestyle drug market has experienced a huge growth and this year is expected to be worth $29 billion.

Recent developments in pharmacogenomics may also provide a method of behavioural modification. Polymorphisms in the DNA coding for three key psycho tropic drug targets in the brain have been linked to a number of behaviours. Thus, particular variants of the 5-HTT (5-hydroxytryptamine transporter), MAO-A (monoamine oxidase A) and DRD4 (dopamine receptor D4 subtype) genes have been associated with predispositions to high anxiety and low affect, increased aggression, and hedonistic behaviour, respectively.

In a statement suggesting the use of a dual approach of a lifestyle drug and genetic engineering, philosopher Nicholas Agar (2004) in *Liberal Eugenics* writes: "The widespread use of 5-HTTLPR therapy and Prozac would 'renorm' happiness." The questions to be addressed here are: (1) Should individuals who are less intelligent, less happy or more introverted accept the psychological make-up they have received from their genes and environment or should we correct genetic and social injustices with a drug or DNA manipulation? (2) Will the widespread use of these technologies lead to a homogenization of human traits, or because it is only likely to be affordable by the rich, lead to an even greater polarization within society? (3) What implications does this have for our understanding of being created in the image of God?

Embryonic Stem Cells from Non-Destructive Sources: A Way Out of the Ethical Quagmire? Dennis M Sullivan

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Despite a divisive public debate, there appears to be no end to the desire among researchers for unfettered access to human embryos for experimentation. Currently, there are two possible sources of such embryos: excess frozen embryos from *in-vitro* fertilization procedures and embryos derived from human cloning. The harvesting of stem cells destroys the embryos, and therein lies the ethical dilemma. Are there other alternatives? Is it possible to produce pluripotent stem cells without destroying human embryos?

Three possibilities have arisen in recent months. One proposal involves the same technology as used in somatic cell nuclear transfer, or cloning. This technique inserts a diploid somatic cell nucleus into an ooplast (enucleated oocyte), which then becomes a zygote capable of cell division and embryogenesis. In contrast, the proposed new idea would epigenetically alter the state of the transferred nucleus so that the resulting entity would never have the self-organizing capability of a zygote. The procedure, called "Altered Nuclear Transfer-Oocyte Assisted Reprogramming," would theoretically be a source of "embryonic" stem cells without starting with an embryo. This idea has received the cautious endorsement of a number of prominent pro-life bioethicists.

Another proposal relies on a recognized procedure from reproductive technology, but used in a different way than usual. In preimplantation genetic diagnosis (PGD), a single blastomere is removed from a three day-old (eight-cell) embryo. After a genetic analysis, the embryo can be discarded if defects are found. However, if there are no genetic defects, the remaining seven-cell embryo can be implanted. Removing a single blastomere does not seem to affect the viability of the embryo. Could PGD techniques be used create a line of stem cells from a

single blastomere? Such an idea might produce the desired stem cells while preserving embryos.

A third recent proposal suggests that “non-viable” embryos, that is, embryos that have stopped dividing, may be a source of embryonic stem cells. The idea here is that such embryos are “already dead” in some sense, but disaggregated stem cells might be stimulated to divide in cell culture. This presentation will not focus on the scientific details of these proposals, but on the ethical pros and cons of each. If the scientific community is to proceed in these contentious areas of research, then it should be with the widest possible ethical consensus.

Morality, Disgust and Emotional Systems, Judith A Toronchuk & George F R Ellis

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Numerous authors have stressed the role of emotion, especially disgust, in moral behavior. It is possible that the evolution of morality may have involved co-opting, at least in part, of the neural mechanisms involved in disgust. The insula plays an important role in interoceptive functions and self-awareness including a necessary role in both the experience of human disgust and taste-aversion learning in mammals. In addition the anterior insula and adjacent orbito-frontal areas are activated during embarrassment, guilt and moral decision making and the right anterior insula has been suggested to be the final instantiator of subjective feeling states. In humans the fronto-insular cortex contains a recently evolved cellular type, the von Economo neuron (VEN) concentrated on the right side. VENs have been variously hypothesized as involved in expectancy of reward and punishment, human social intuition and formation of a theory of mind.

We have argued elsewhere that disgust is a basic emotional operating program evolved in lower vertebrates as a protective mechanism to prevent contact with or ingestion of disease-producing material. This paper hypothesizes that human moral intuition has a long phylogenetic history, originating as a secondary emotional system arising out of the rejection response of organisms to potentially dangerous substances, continuing through vertebrate distaste responses, conditioned taste aversions, and the human emotional response of disgust to repulsive objects and behaviors. Additional influences were provided by the ancient emotional systems including those governing fear, social ranking and territorial imperative. The emergence in humans of VENs allows the development of morality. A key point is that the moral system is secondary rather than primary, and hence is deeply influenced by interaction with others in the social and religious community.
Evolution by itself cannot underlie the development of genuine morality, entailing the power to label various practices as “good” or “evil” in a culturally independent way, but does provide an important aspect of its development.

Designer Genes? Evolution, Genetics, and Intelligent Design

Evolution: Do the Eyes Have It? Stephen L Reinbold

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Darwin pondered that if the eye could not be explained by evolution by natural selection, then his theory would be declared false. Since then much has been written on evolution of the eye, and the eye has come up again in debates on Intelligent Design. Two views have been held in regard to eye evolution: (1) a single origin of eye-forming genes with subsequent divergence to form camera-type and compound eyes, or (2) multiple origins from many genes providing a framework that allowed convergence on a few basic eye types.

A wide spectrum of animals has opsin-coding genes and genes capable of forming rudimentary eyes. The sea urchin has hundreds of genes expressed in its tube feet homologous to those expressed in vertebrate eyes. Lens proteins appear to have other uses. Genes that do not ordinarily build eyes could be recruited for that purpose.

To the Intelligent Design proponent, even conceding that anatomical eye evolution can be accounted for, and that the proteins in eyes could evolve from other sensory-related proteins, the origin of the first sensory metabolic pathway, involving complex membrane ion channels, still needs to be explained. The question is then: do the “eyes” have it on the proposition of evolution by natural selection? Surely on the anatomical level, Darwin

has been vindicated, but on the cellular level many questions remain and proponents of Intelligent Design can still be expected to say nay.

Evolution and Engineering Design: Insights from Genetic Algorithms, William E Hamilton Jr & Charles N Stevenson

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It has been argued that genetic mechanisms behind life are “blind,” a reductionist view that suggests lack of capability. Yet genetic algorithms, loosely based on biological concepts, are commonly used to solve engineering problems by discovering new design solutions. Genetic processes, and their analogous algorithms, find much of their creativity in the parallelism inherent in testing and then selecting a subset from a population of diverse individuals.

The selection and permutation of genetic building blocks that occurs in reproduction constitutes an elegant solution to the problem of optimally configuring a population for survival. Successful implementation of a genetic algorithm requires careful construction of genomes and optimality criteria to ensure that it converges on a solution, which undercuts the notion that genetic mechanisms are “blind.” The programmer implementing these algorithms must view the required solution as emerging from an evolving population. During the search process, mutation preserves genetic diversity, and crossover passes partial solutions to successive generations, combining them in new ways. Using these operations to ensure a good final design implies that genes are a population wide resource, contradicting the idea that competition is purely at a genetic level.

We consider a population under environment stress to demonstrate the importance of adaptation to the survival of a population. For our example, we modeled a population that resembles the large cactus finch in the Galapagos. We show how the GA can track conditions of drought and rain by changing the birds’ beak dimensions. The modeling of a species under stress demonstrates that the species is the unit that evolves over time, and that a diverse collection of alleles is a resource kit for preserving the species. Genetic processes, rather than being random searches, are actually intelligent processes for modifying engineering designs, which can preserve the information essential to future adaptations.

Appropriate Humility about Evolution, Craig Rusbult

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In science and theology, our humility should be appropriate—not too little and not too much. We can make some claims, but not others, with confidence. Abundant scientific evidence shows the universe is old, and sound theological interpretations of Genesis are age-neutral, so the “when” of creation seems clear. But what about the “how”?

Our universe is fine-tuned to allow life, but is this due to design and/or a multiverse? Is nature 100% self-assembling, or—if nature cannot have both self-assembly and optimal operation, and God wants optimal operation—was miraculous-appearing divine action occasionally required? Currently we cannot know, with confidence, which possibility is true, but either would bring glory to God.

Scientifically, some aspects of evolution (astronomical-E, geological-E, plus biological micro-E, fossil-E, and common descent) are more strongly supported than other aspects, such as a natural evolution of all biocomplexity, or the origin of life. What questions are justifiable when we carefully study genes and evolution? What should scientists conclude when the evidence is not conclusive? Or should they automatically say “of course, it happened by natural process” for every question about nature’s history, independent of evidence?

Theologically, what can a Christian believe about evolution? Is theistic evolution theologically acceptable? Does “natural” mean “it happened without God”? Why isn’t God more obvious? What can “God of the gaps” mean, and why should this one multi-meaning term be replaced by several single-meaning terms? Although each of us can argue, based on science and theology, for our favorite view of creation, would it be appropriate to humbly acknowledge that “however God created, he is worthy of our praise”? These questions, and others, are examined in a web-page, www.asa3.org/ASA/education/asa2007.htm, so more than half the talk will be

discussion led by listeners.

Appropriate Technology III: Involving Science and Engineering Students in Service to the Poor

Service for Today … Servant-leaders for Tomorrow: Practical Strategies for Christian Stewardship in Academic Engagement, David Vader

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God's call to stewardship challenges the Christian scholar to generosity in sharing the resources of our academic disciplines, particularly with those most marginalized by the weight of sin in the world. Resistance to such generosity continues in practice, however, from higher education's long commitment to scientific rationalism. For more than a decade, educators and students in the Collaboratory for Strategic Partnerships and Applied Research at Messiah College have developed strategies that enable stewardship. We bring scholars from the liberal and applied disciplines together and, in partnership with off-campus organizations and communities, seek deep understanding and sustainable solutions to pressing needs through applications in the mathematical and information sciences, engineering, and business. Our goal is to fulfill biblical mandates to foster justice, empower the poor, reconcile adversaries, and care for the earth, in the context of academic engagement.

Learning in the Collaboratory supports and builds on quality classroom instruction. Projects enable students to engage classroom fundamentals in an authentic client-provider environment, and the Collaboratory is run by student leaders and the educators who mentor them. We serve others today, while discipling women and men to live lives of service, leadership and reconciliation.

This talk will cover the operational structure and strategies of the Collaboratory; modes of collaboration with organizations like World Vision and SIM; Christian discipleship in the Collaboratory; funding streams and strategies; an Integrated Projects Curriculum (IPC) to incorporate Collaboratory programming within the Bachelor of Science in Engineering curriculum at Messiah College; and technology projects in energy, water access, transportation, communications, and disability services.

Learning Engineering and Science While Serving the Poor, William C Oakes

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Service-Learning is a pedagogy that integrates academic learning with service to the undeserved people of our society. It has been shown to enhance learning and motivation within the classroom as well as broadening students' views of themselves, their profession and their connection with societal needs. In the United States, there has been an explosion of service-learning activities within colleges and universities and also the pre-college levels. While service-learning follows biblical values and has the potential to show students how to integrate their faith and their future profession, the secular community has been in front leading the service-learning movement.

Engineering, technology and science have enormous potential to reduce suffering and improve the quality of life in our local and global communities, yet these fields have lagged behind others in integrating service-learning into their curricula. For Christian faculty, service-learning provides an opportunity to integrate biblical values into our classrooms whether we teach at Christian or state/secular institutions.

This paper will examine how students can learn and be transformed in a locally-based long-term service-learning program. The EPICS Program founded at Purdue University in 1995 will be used as an illustration. EPICS is a design program where multi disciplinary teams work with local not for profit organizations to design, develop and build solutions to the needs of the local community. This paper will present the experience at Purdue: how the EPICS model has been disseminated to other institutions and how the broader implications and opportunities for this type of learning experience can transform students, faculty and communities.

A Global Poverty Center—Integrating Appropriate Technology, Social Entrepreneurship, and Missions at Baylor University, Walter L Bradley

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Jesus commands us to serve the poor in his name (Matthew 25) and indicates that more will be expected in this regard of those to whom much has been given (Luke 12). The response of the Church to this command in the 20th century has often been one of charity rather than empowerment. A new Center has been proposed at Baylor (hopefully to be approved by March 2007) that will address the needs of the poor, especially in developing parts of the world, with appropriate technology and social entrepreneurship as an integral part of a more holistic approach to missions.

The goal is to identify abundant, renewable resources in developing parts of the world that can be processed into value-added products in the rural villages to create jobs and provide basic resources often not currently available in these villages such as electricity, clean water, medical care, decent housing and jobs. Small, bottom-up approaches facilitated in partnership with Christians in these rural villages will provide sustainable economic development that will significantly enhance their quality of life and bless the community with a gospel that seeks to meet the spiritual and physical needs of the community.

The Engineering School, the Business School, and Truett Seminary at Baylor University will be equal partners in this Global Poverty Center. This presentation will outline the overall strategy and illustrate what it might look like using coconuts as the abundant renewable resource.

Posters

Science: From Mystical to Mathematical Beauty, Paul H Carr

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Historical examples will be given of beauty in science and in spirit.[1] The awesome beauty of nature lured ancient people to explain the world with myths. The mathematical beauty of modern science emerged from the mystical beauty of these spiritual stories over many millennia. The emergence of astronomy from astrology and mythology is an example. The ancient Greeks explained the motion of the sun with the following myth. The sun god Helios drove his chariot pulled by four beautiful white winged horses across the sky each day. The sun's brilliant light emanated from the fiery crown that adorned his head.

Pythagoras, 590 BC, discovered the harmonious musical ratios: the octave 1:2, fifth 2:3, and fourth 3:4. The planets rotating around the earth made the "Music of the Spheres," because he believed the intervals between the planetary radii had similar ratios. In 1543 Copernicus proposed his new theory of the "sun at the center of the most beautiful temple."

In the 17th century, Newton discovered the mathematical laws of gravity and dynamics. He concluded his *Principia* with, "The most beautiful system of the sun, planets, and comets could only proceed from the counsel and dominion of an intelligent and powerful being." The mathematical beauty of Einstein's general relativity frames the whispering cosmos, the "cool" remnant radiation from the hot big bang. Even though our concepts of the universe have changed, we perceive of it as awesome and beautiful. In this sense, beauty points to an eternal, ultimate, and spiritual reality. The concept of beauty as a manifestation of a transcendent and immanent creator contributed to the emergence of science in the West rather than the East.

[1]Paul H. Carr, *Beauty in Science and Spirit* (Center Ossipee, NH: Beech River Books, 2006), www.BeechRiverBooks.com.

Wood burning Stoves in Darfur, Hugh Burnham-Slipper & Mike Clifford

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Half the world cooks using wood, often on open fires or on inefficient stoves. Collecting firewood is often left to women and children. As well as reducing the time available for education and other activities, there are many cases of women being raped while trying to collect firewood outside of refugee camps in the Darfur region. The aim of this research is to produce optimised wood stoves, reducing the amount of wood required, hence reducing carbon emissions, and improving the quality of
life, particularly for women and children.

Our approach is to use computational fluid dynamics and genetic algorithms to improve the combustion conditions in wood-burning cook-stoves. In the initial experimental phase, open wood fires were characterised in terms of burn-rate, and gas temperature and velocity. Several stove designs were also assessed, including the three-stone fire (3-5% efficient), the Eritrean mogogo (5-10% efficient) and the rocket
elbow (20-30% efficient).

The experimental results were replicated in a computer simulation which was validated for a range of fires. This model was embedded in a CFD package which correctly predicted the flame height, velocity and temperature.

The validated CFD model is being used with a genetic algorithm to The validated CFD model is being used with a genetic algorithm to optimise the stove design: each stove is defined by a genome describing its dimensions; the various designs are allowed to “mate”, each one vying for the attention of the “fittest” or most efficient stove; the offspring inherit a mixture of their parents’ features, until an optimum design emerges. Finally the optimised design is to be built and physically tested before being modified to make it suitable for field trials and dissemination to rural communities.

In conclusion, this research aims to improve the quality of life for women and children by developing an improved cook-stove using computer-aided design tools. Novel aspects of the work are the application of CFD to wood combustion in stoves and the use of genetic algorithms to improve combustion chamber design.

From the anti-mythology of Israel’s prophets to the rise of modern Western science, Pablo de Felipe

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Since the discovery of the Mesopotamian creation accounts, at the end of the 19th century, many have assumed that the similarities with the Bible accounts mean that biblical authors were just borrowing. However, some 20th century theologians have argued that, behind superficial similarities, lays a sharply different message centred in the separation between Creator and creation, leading to a de-sacralisation of the world. In addition, texts like Genesis 1 and 2 show a high regard for human beings unknown in their cultural context. These ideas have paramount importance for science, allowing and encouraging the human study of a de-divinised nature. Why, then, was a positive effect on the history of science not achieved in the Biblical cultural context?

Some historians of science (Duhem, Jaki, Hooykaas) have pointed out that it was necessary for the intellectual reflection on the Biblical world-view during the Middle Ages and the early Modern era to realise the full implications of these ideas. This process started in the 6th century with the Christian philosopher and scientist Philoponus, who did not hesitate to criticize the divine nature of the heavens in the Greek cosmology, in particular in Aristotle. Criticisms of this sort reappeared among Christians towards the close of the Middle Ages. In the end, the unification of the earthly and celestial physics led to the demise of Aristotelism, and the rise of modern science. Contrary to popular perception, it is a well-known historical fact that Christians largely led this process. However, in spite of that optimistic reading of science and faith historical relations, it is impossible to deny that conflicts have indeed arisen at some points, why?

I will focus in two different episodes regarding cosmology and separated by one millennium. In the Alexandrian context of the 6th century, Cosmas Indicopleustes (recently identified by Wanda Wolska as Constantine of Antiochia) published the final effort in a long tradition of Antiochian theology. His *Christian Topography* defended a flat earth and a chest-shaped sky together with hatred-filled attacks on Christians that supported the spherical earth. In the 16th century, a new literalistic understanding of the biblical references to nature precipitated some Christians into conflict with those who proposed a moving earth. In spite of the differences of time, place and cultural contexts,

I suggest that there are underlying similarities between both conflicts, mainly due to a literalistic interpretation of the biblical references to nature and the desire to find scientific information in the Bible. Is there an alternative to those views?

Interestingly, most of the scientists supporting the heliocentric theory in the 16th and 17th centuries were Christians and many of them devoted time and energy to propose solutions to science and faith problems. Although they were not frequently heard in their own times, their models have had a more favourable reception in recent times with several authors studying them in detail (Hooykaas, Howell). It would be interesting to reflect on the extent to which these “old” solutions can help us today to make sense of both, “old” and “new” conflicts.

The Falsity of Macroevolution from the Standpoint of Medicine, Microbiology, Molecular Biology and Mathematics, Edmund T Dombrowski

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Context: A legitimate scientific argument exists between the concepts of neo-Darwinian evolution and intelligent design as the causation of the variable forms of life encountered on this planet and the place of humankind in the cosmos.

Objectives: To determine whether complex biological interactions such as basal ganglia modulation of cortical stimuli, or primordial cellular self-generation and reproduction, can be produced on a stepwise basis within the realm of reasonable medical/scientific probability.

Design: We review and apply the empirically derived laws of science in general, and molecular biology and bacteriology, in particular, that prohibit self-generation and the reproduction of primordial cells, to determine if the interconnections between the pre-motor cortex, the motor cortex, the basal ganglia, the cerebellum and the final common pathways controlling fine motor movements could have been produced in a stepwise manner.

Outcome: The literature reveals that no one has ever demonstrated the de novo production of functional protein under normative conditions. In the absence of protein enzymes such as DNA and RNA polymerases, or the protein transfer mechanisms of the cell membrane, a primordial cell could never have self-generated. In the absence of the protein enzymes helicase and topoisomerases I and II, primordial binary cell division could not have occurred. Experience with cell culture and bacteriology prohibits primordial cell growth.

Chance origin of a primordial cell, a genetic mechanism to increase the genome chromatin of populations sufficient to produce an integration of the basal ganglia, motor cortex, and musculoskeletal system lies far outside the bound of probability.

Conclusion: Microevolution is a fact. Macroeveolution is a scientific hypothesis. Gaps in Darwinian macroeveolution contradict its ability to either explain or predict biologic phenomena. Public-policy such as the extremes of eugenics in the USA and Nazi Germany should never be formulated by demeaning the significance of humans, morality or Christian ethics. The Christian concept of a just God, the concept of absolute right and wrong, and the creation of mankind and womankind by intelligent design are superior concepts for the guidance of public policy.

The Appearance of Age in Recent Creation: Reimagining Philip Gosse’s Omphalos, Joshua Klose

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Few published works on the question of origins have provoked such widespread disdain as Philip Gosse’s Omphalos. Yet Gosse’s notorious central idea of creation with the appearance of age, or ‘prochronism’, may still contribute to a careful analysis of recent Genesis creation. This presentation first examines Gosse’s own view, arguing that his insistence on the necessity of prochronism is not justified by his system of cycles, but rather by the causal nature of the universe. A new theory of prochronism is formulated on this latter understanding, challenging claims of divine deception and models of ‘functioning completeness’, and is considered with respect to popular recent creation scenarios of the fall and prefall world.

Do Justice, Love Kindness: Strong Reciprocation is the Heart of Human Cooperation, Selena Malortje

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Although the differences between human beings and other animals are often trivialised, the collaborative interactions maintained by human societies far outstrip those of non-human animals, in a feat of cooperation that cannot be accounted for by kin selection and reciprocal altruism alone.

Across numerous different cultures, human beings persistently flout the canonical model, rewarding altruistically and punishing others who do not do the same, irrespective of personal gain. The importance of this paradoxical behaviour in establishing and sustaining cooperation is widely attested.

Yet cultural explanations cannot account for its ubiquity or strength; inter-group selection is complicated by the challenge of maintaining group integrity; and the economic solution 'inequity aversion' explains only the stability of such behaviour, not its origin.

The possibility of gene-culture coevolution by the internalization of sociocultural norms has recently generated research showing that culturally distinct groups may compete not only for resources, but also for members; an important discovery which may be a step towards explaining ultimately the evolution of altruistic cooperation.

Why human beings should be the only species to exhibit this singular kind of collaboration is a question that may or may not lie within the realm of Natural Science. Wary of the arrogant assumption that human beings can ever approach the depth of knowledge so intensely desired, we remember that it is only in humility before the One who knows *a priori* all there is for humans to discover *a posteriori*, that we can come to a greater understanding of all that He delights in laying open to our minds.

The AIDS Challenge in Africa: Some Ethical and Theological Complexities, Lincoln J Michell

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The Sub-Saharan Africa is the area most severely affected by the AIDS pandemic—bearing over 70% of the global burden of HIV/AIDS. To understand the African context of this crisis, certain complexities need to be borne in mind. These include the problems of poverty (particularly from the perspective of globalization), denial and the politicization of HIV/AIDS, behaviour change against the backdrop of deprivation and illiteracy, women's vulnerability and the dehumanization of sexuality. An ethical response needs to engage with each of these component challenges and an expanded concept of bioethics, appropriate to the context, needs to be devised. My theology of AIDS is presented on three fronts. Firstly, there is the implicit theological problem posed by the very existence of AIDS: that of human suffering in the world of the kind of God Christians believe in. Secondly, there is a need for what I term a "theological audit," partly in response to the former problem, but essentially within the potentially apocalyptic context of the pandemic. Such an audit involves the radical revision of some of our key theological concepts and the introduction of new elements of critique, notably from the feminist perspective. Finally, the prospect of a global renaissance—as precipitated by spiritual and moral renewal within the Church—is briefly explored.

Immunohistochemistry Shows No Difference in E-cadherin Expression Pattern Between Early and Late Onset Gastric Cancer, Clare Parkinson

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Early-onset gastric cancer (GC) has a different array comparative genomic hybridisation (CGH) profile compared to late-onset GC. The expression and distribution of E-cadherin (CDH1) are often abnormal in GC.

We investigated CDH1 expression by immunohistochemistry on tissue microarrays constructed from sporadic GC of 77 patients younger than 50 years and 163 older patients. Staining pattern was classified as normal, abnormal or negative and correlated with patient age, clinicopathological data, survival data and CDH1 copy

number from array CGH data.

CDH1 expression pattern was markedly heterogeneous even within the same TMA core. 18% of the cases showed normal expression, 70% abnormal expression and 12% were negative. Higher number of lymph node metastases and higher stage were both related to a higher frequency of tumour cells with abnormal CDH1 expression. Abnormal CDH1 expression was also associated with a high grade of differentiation and diffuse type GC. No association was found between CDH1 expression pattern and patient age, survival, CGH copy number or any other clinicopathological parameter.

Our study confirms the relationship between CDH1 expression, tumour progression and tumour differentiation in GC, but does not support a relationship between CDH1 expression pattern, patient prognosis or age of diagnosis. Furthermore, our array CGH data indicate that a mechanism other than CDH1 copy number change could be responsible for abnormal CDH1 staining pattern in GC.

My desire to be involved in medical research stems from my fascination with God's created world and my aspiration to be like Jesus by helping those who are ill.

A Scientific Study of Character Development, Kevin S Seybold, Joseph J Horton & Gary L Welton

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According to the Commission on Children at Risk, we are currently experiencing a crisis in American childhood. Children today lack two kinds of connectedness—close connections to other people and deep connections to moral and spiritual meaning. This lack of connectedness can be conceptualized as being a weak moral framework for the development of character. This poster will present the results of the first year of a three-year study examining character development in adolescents. A cohort sequential design combining a cross-sectional design with a longitudinal design allowing an exploration of the moral framework and religious factors that impact character for each age group of children was used. This design enables the examination of both age-related differences across each wave of data collection as well as developmental changes within each individual participant. Previous studies investigated some of the predictor variables we consider (e.g., parenting style and attachment quality). These studies have not, however, provided an integration of these factors, nor have they considered the common sense suggestion that religion is an important factor in character development. In the first year of the study, approximately 300 students (public, private, home school) from the 7th and 10th grades (and their parents or guardians) were assessed on the quality of parental romantic relationships, the nature of the adolescent's relationships, the level of the adolescent's religiosity and that of his/her family, the social level of the adolescent, and various measures of the adolescent's character. This poster will report on various correlates of character development, gender differences, and the initial age-related differences. These same students and parents will be reassessed in two years to reveal any individual developmental changes in these variables. (This research is funded by the John Templeton Foundation, grant # 11321)

Implications of Human Uniqueness: From *Imago Dei* to Neuroscience, William M Struthers

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As developmental biology has provided a detailed story of how human life begins at conception and continues on into adulthood, there has been a shift towards the view of human uniqueness and personhood from being defined by a theological framework towards a neurobiological standard. This movement towards individual and human identity as defined by the presence of the neural architecture for cognitive capacities, such as consciousness or intelligence, may be collapsed into a neuroessentialist view and has considerable implications for biomedical ethics.

While neurobiology begins with asserting that humanity's uniqueness lies primarily in our genetics, phenotype, and neurological development, it follows that human identity and uniqueness become fully manifest in our cognitive functioning. Advances in the neurosciences have been able to shed considerable light on the similarities and differences between the nervous systems of humans and nonhuman mammals and this has been aided by brain imaging research on humans as well as progress in developmental neuroscience.

This neuroscientific approach to understanding human uniqueness is quite different than that used by theologians who rely on the principle of *imago Dei* to mark humanity's uniqueness. The *imago Dei* has long been of interest to theologians, and it is a vital element of the Christian faith. Positions have ranged from a different substance (an immortal soul), a relational nature, our functioning as stewards, to an intellectual capacity (i.e. rationality); many which rely heavily on substance dualism. The potential problems that arise with a dualist view of the *imago Dei* are generally contrasted with and presented as evidence for a neuroessentialist view.

Another view of the *imago Dei*, however, that respects both Christian tradition as well as the neurobiological evidence will be offered. A review of Christian theological anthropology with respect to the *imago Dei* will be provided in conjunction with a discussion of recent findings in the uniqueness of the human brain paralleling the historical views of *imago Dei*. Implications for a variety of neuroethical issues will also be offered.

Voice-Based Information Systems in Developing-World Languages: A Technology for the Poor, Roger Tucker

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"If I speak in the languages of men and of angels, yet have not love, I am only a resounding gong or a clanging cymbal" 1 Cor. 13:1.

Is it possible to run a successful project requiring state-of-the-art technology development and new linguistic knowledge, where the only beneficiaries of the technology would be the poorest people in the world?

In the developing world, mobile phone usage is growing at a phenomenal rate, especially among the poor. Many of these users would value timely information on jobs, health issues, local market prices, etc. but have little access to computers, may not be very literate and know only their local or national language. Voice-based information services for mobiles would address this need, but to operate in any scalable way they need text to speech (TTS) technology in these local languages, which are difficult and expensive to develop.

The Local Language Speech Technology Initiative (LLSTI) was started in 2003 as a global partnership (India, Kenya, Nigeria, South Africa, UK and Germany) to address this technology gap. LLSTI provides the tools, support and expertise required for a non-expert to produce a good quality TTS system in their own language, with the resulting system going open source so that others can build on it. With just one year's funding from the UK DfID and Canadian IDRC to start it, it successfully produced prototype TTS systems in Kiswahili, Hindi and isiZulu, with a valiant but not altogether successful attempt in Ibibio, a small Nigerian language.

The many scientific and technical challenges involved in these developments have been reported on elsewhere.[1] All of the LLSTI partners are continuing their work, the most forward being the Meraka Institute in South Africa, who are now developing voice services in all 11 official languages.

Although motivated by the biblical call to heed the poor, LLSTI is a purely technological initiative. Despite good links into organizations like SIL and World Vision, it has no Christian bias. Yet it was and is a venture of faith, both in God to bring it into being, and in people to share meager resources and support each other. As well as describing LLSTI itself, this poster reflects on some of the lessons about how faith works, that have been learnt along the way.

References

[1]R.Tucker and K.Shalonova, "Supporting the Creation of TTS for Local Language Voice Information Systems," *Interspeech* 2005, Portugal (Sept. 2005); K. Shalonova and R. Tucker, "Issues in Porting TTS to Minority Languages," SALTMIL workshop on Minority Languages, LREC, Lisbon, May 2004; and R.Tucker and K.Shalonova, "The Local Language Speech Technology Initiative—Localisation of TTS for Voice Access to Information," SCALLA 2004: Crossing the Digital Divide: Shaping Technologies to Meet Human Needs, Nepal, January 2004.

Endnotes

I Gen 1 v26,28 & 2 v15.

II Some of the websites that provide information on science, environment and Christianity are the John Ray Initiative www.jri.org.uk, A Rocha www.arocha.org, and the Au Sable Institute www.ausable.org.

III The policymakers' summary of the 4th IPCC assessment report was published in February 2007. The 3rd report *Climate Change 2001* in four volumes, published for the IPCC by Cambridge University Press, 2001. All are available on

the IPCC web site www.ipcc.ch. My book, John Houghton, *Global Warming: the complete briefing*, 3rd edition, Cambridge University Press, 2004 is a comprehensive summary, strongly based on the IPCC reports. For a concise summary of the science see John Houghton, *Reports Progress in Physics*, **68** (2005) 1343-1403. For an important statement on the integrity of the science of climate change from the Academies of Science from the world's 11 largest countries see, www.royalsoc.ac.uk/document.asp?id=3222

IV John the Baptist preached about it (Luke 3 v11), Jesus talked about it (Luke 12 v33), the early church practised it (Acts 4 v32) and Paul advocated it (2 Cor 8 v13-15)