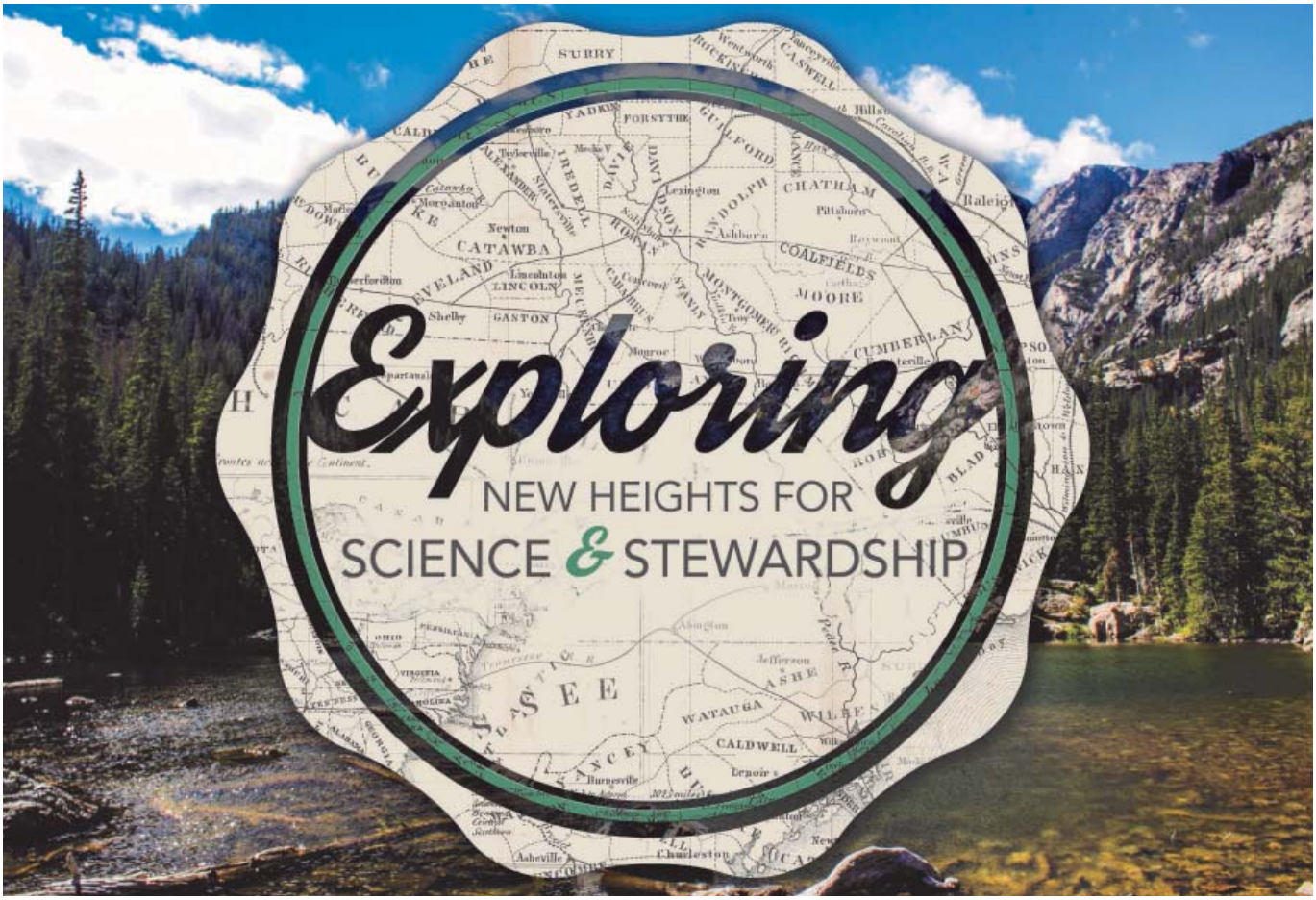


"The earth is the Lord's and everything in it,
the world and all who live in it." –Psalm 24:1

July 28–July 31, 2017

Colorado School of Mines
1500 Illinois Street
Golden, Colorado 80401

Contents

CHRISTIANITY TODAY

proudly sponsors

the Katharine Hayhoe plenary session.

General Information

Exhibit and Book Room

The exhibits and book tables featuring books of interest to attendees are located in the Student Center Ballroom DE.

Exhibit and Book Room hours:

Saturday:	9:45 AM – 5:15 PM
Sunday:	10:30 AM – 5:15 PM
Monday:	9:45 AM – 11:45 AM

Plenary Sessions

The Saturday evening plenary session will be held at the banquet in the Green Center, Friedhoff Hall. All other plenary sessions will be held in the Student Center Grand Ballroom.

Friday:	7:30 PM	**Annabelle Pratt**, "Modernizing the Electric Grid: Why and How?"
Saturday:	8:40 AM	**Katharine Hayhoe**, "Climate Change: Fact, Fiction, and Faith"
Saturday:	8:00 PM	**Philip Yancey,** "Now and Then"
Sunday:	11:00 AM	**Ian Hutchinson**, "The Technical and Spiritual Challenges of Sustainable Energy"
Monday:	8:45 AM	**James Peterson**, "CRISPR Cas9 and Changing Human Nature: The National Academy of Sciences Report and a Christian Response"

Poster Session and Viewing

will be in the Student Center Ballroom DE. Poster session is Saturday from 2:45 to 3:45 PM. Poster viewing is Saturday and Sunday.

Water Symposium

is a special session of invited papers organized by **Dorothy Boorse**. It will be held in Brown W280 on Saturday from 1:15 to 2:45 PM.

Special Events

Friday:	5:15 PM	First-Time Attendees Dinner Meetup
	8:30 PM	Fellowship Mixer
Saturday:	6:00 AM	Morning Walk
	7:00 AM	Student/Early Career Breakfast Meetup
	11:45 AM	CSCA (Canadian Scientific and Christian Affiliation) Lunch Meetup
	6:30 PM	Banquet, *business casual attire*
Sunday:	6:00 AM	Morning Walk
	7:30 AM	Engineers Breakfast Meetup
	9:30 AM	Worship Service
	12:00 PM	CWIS (Christian Women in Science) Lunch Meetup
	5:15 PM	Geologists Dinner Meetup
	6:00 PM	Volleyball Tournament
	6:30 PM	CWIS State of Women in ASA (open to all)
	8:00 PM	Ice Cream Social
	8:30 PM	State of the ASA – Last year's highlights and exciting future initiatives
	9:30 PM	InterVarsity Reception / Meet the Plenaries
Monday:	6:00 AM	Morning Walk

Campus ATM Machine

is located in the Student Center.

Campus Parking

is a pay-to-park campus. Parking lots are available throughout campus, but do not park in red lots.

Campus Wi-Fi network

is named "CSMguest." No password is required, only an email account.

Campus Safety:

303-273-3333.

Many thanks to ...

Program Chair **Lynn Billman** and Local Arrangements Chairs **Ken** and **Cheryl Touryan** for their countless hours of preparation.

We are especially thankful for the **donors** who contributed to the Students and Early Career Scientists Scholarship Fund.

The ASA Spirit

The ASA encourages thoughtful and provocative scientific presentations and discussions. Presenters and discussants are expected to maintain a humble and loving attitude toward individuals who have a different opinion.

Pre-Meeting Activities

Thursday, 27 July 2017		
3:00 PM–10:00 PM	Lodging Registration	Maple Hall Lobby
3:00 PM–10:00 PM	ASA Meeting Registration *	Maple Hall Lobby
5:00 PM–6:30 PM	Dinner	Mines Market

** ASA Meeting Registration moves Friday to Student Center Ballroom DE*

Friday, 28 July 2017		
7:00 AM–8:00 AM	Breakfast	Mines Market
8:00 AM–8:30 PM	ASA Registration Table	Student Center Grand Ballroom Lobby
8:00 AM–5:00 PM	Exhibit and Book Room Set-Up	Student Center Ballroom DE
8:00 AM–8:30 PM	Poster Set-Up	Student Center Ballroom DE
8:00 AM–10:00 PM	Lodging Registration	Maple Hall Lobby
8:00 AM–5:00 PM	Field Trip: Rocky Mountain National Park *	Parking Lot E
8:30 AM–4:00 PM	Field Trip: Denver Front Range Geology Tour *	Parking Lot E
8:30 AM–12:00 PM	Field Trip: National Renewable Energy Laboratory (NREL) Tour *	Parking Lot E
10:00 AM–4:00 PM	Field Trip: Coors Brewery Self-Tour	Sign up at the ASA Registration Table to connect with others
11:30 AM–1:30 PM	Lunch	Mines Market
1:30 PM–5:00 PM	Workshop: The Energy, Environment, and Ethics Nexus **Brent Nelson**, facilitator	Brown W210

** Please arrive 15 minutes before departure time.*

Program Schedule

Friday, 28 July 2017		
5:15 PM 6:30 PM	Dinner	Mines Market
5:15 PM 6:30 PM	First-Time Attendees Dinner Meetup	Mines Market Private Dining Room
7:00 PM 7:30 PM	Welcome, Introductions, Announcements • **Leslie Wickman**, ASA Executive Director • **Vicki Best**, ASA Director of Operations and Development • **Stephen Moshier**, Executive Council President • **Gregory Jackson**, Professor and Head of the Department of Mechanical Engineering at Colorado School of Mines • **Ken** and **Cheryl Touryan**, Local Arrangements Co-chairs • **Lynn Billman**, Program Chair	Student Center Grand Ballroom
7:30 PM 8:30 PM	**Plenary I:** **Annabelle Pratt**, "Modernizing the Electric Grid: Why and How?" Moderator: **Lynn Billman**	Student Center Grand Ballroom (8)
8:30 PM 10:00 PM	Mixer	Maple Community Room
8:30 PM	ASA Registration Table closes	Student Center Grand Ballroom Lobby
10:00 PM	Lodging Registration closes	Maple Hall Lobby

PLEASE NOTE: Abstracts are found on the page numbers within the parentheses.

SATURDAY, 29 JULY 2017

6:00 AM	Morning walk sponsored by the ASA Christian Women in Science affiliate; all are welcome — Meet in Maple Hall Lobby			
7:00 AM	Breakfast — Mines Market			
7:00 AM	Student/Early Career Breakfast Meetup — Mines Market Private Dining Room			
8:15 AM	ASA Registration Table — Student Center Grand Ballroom Lobby			
8:20 AM	**Devotions.** Devotional: **Deborah Shepherd** — Student Center Grand Ballroom Faith Worship: **Sara Sherman**, worship leader; **Keith Kemerer**, vocals; & **Cindi Birney**, piano			
8:40 AM 9:45 AM	**Plenary II.** — Student Center Grand Ballroom *Christianity Today* proudly sponsors this session, greetings from **Rebecca Randall** **Katharine Hayhoe**, "Climate Change: Fact, Fiction, and Faith" (8) Moderator: **Dorothy Boorse**			
9:45 AM 5:15 PM	Poster Viewing — Student Center Ballroom DE			
9:45 AM	Exhibit and Book Room — Student Center Ballroom DE			
9:45 AM	Beverage Break — Student Center Ballroom DE			
10:15 AM 11:45 AM	**I.A: Energy, Water, and Environment** –Brown W280 Moderator: **Terry Gray**	**I.B: Biological Sciences** –Brown W250 Moderator: **Sy Garte**	**I.C: Physical Sciences** –Brown W210 Moderator: **Deborah Shepherd**	**I.D: Student/Early Career Track 1** –SC Grand Ballroom Moderator: **Thomas Grosh IV**
10:15 AM	**Terry M. Gray** (11) "Back to the Future on the Back of an Envelope"	**Valerie C. Sikkema** (11) "Stewardship and Integrated Pest Management in a Commercial Nursery in Canada"	**David Campbell** (11) "History of Geology: Past Faith and Science Informing the Present"	**S. Joshua Swamidass** (11) "Science, Mission, and Flourishing"
10:45 AM	**John A. Turner** (12) "The Hydrogen Economy: Food and Energy"	**Robin Pals Rylaarsdam** (12) "Practical Evolution: Harnessing Variation and Selection in Rational Drug Discovery"	**Peter B. James** (12) "Planetary Science and 'Aiming for Heaven'"	**Panel** (12) "Communicating with Secular Peers about Faith and Science"
11:15 AM	**Richard Passamanek** (13) "Propellant Fracturing of Vertical and Horizontal Wells"	**Nahanni Freeman** and **Mark A. Parker** (13) "Serotonin Transporter Gene Polymorphism, Response Inhibition, Auditory Attention, and Emotional Variations"	**Dillard Faries** (13) "The Personal Struggle of Wolfgang Pauli with Modern Physics and Modern Psychology as Impetus and/or Model for Integration of Science and Faith"	**Various Mentors** (13) Speed Mentoring, Session 1
11:45 AM	Lunch — Mines Market			
11:45 AM	CSCA (Canadian Scientific and Christian Affiliation) Lunch Meetup — Mines Market Private Dining Room			
1:15 PM 2:45 PM	**II.A: Water Symposium Invited Papers** –Brown W280 Moderator: **Dorothy Boorse**	**II.B: Biological Sciences** –Brown W250 Moderator: **Patricia Fitzgerald-Bocarsly**	**II.C: Theology** –Brown W210 Moderator: **E. Janet Warren**	**II.D: Student/Early Career Track 2** –SC Grand Ballroom Moderator: **Thomas Grosh IV**
1:15 PM	**Dorothy Boorse** (14) "Water and the Sustainable Development Goals: Availability, Pollution, and Ecosystem Health as We Look toward 2030"	**Roger Wiens** (14) "Why Should We Expect to Find Life on Mars?"	**Dick Fischer** (14) "The Genesis 5 Patriarchs and the Sumerian King List: Is There a Commonality?"	**Panel** (14) "Flourishing in a Science Career"
1:45 PM	**Thomas Ackerman** (15) "Climate Change, Climate Engineering, and the Global Hydrologic Cycle"	**Sy Garte** (15) "The Teleological Biochemistry of Evolution"	**Justin Crick** (15) "The Genesis Flood: Discussing a Global Deluge from a Water Engineering Perspective"	**Panel** (15) "Communicating about Science with Christian Communities"
2:15 PM	**Steven Hall** (16) "Ethical and Stewardship Considerations in Aquaculture"	**S. Joshua Swamidass** (16) "The Recent Common Ancestry of All Humanity about 6,000 Years Ago"	**Alan Dickin** (16) "Why the Identity of Noah Is Important for the Origins Debate"	**Various Mentors** (16) Speed Mentoring, Session 2

2:45 PM 3:45 PM	Poster Session — Student Center Ballroom DE
	1. **Kenell J. Touryan**, "Perovskite Solar Cells: Fastest Advancing Solar Technology to Date" (30) 2. **Raul Botello**, "Water Quality Impacts of Arizona's Salt River Project Canal on Papago Park" (30) 3. **Amanda Burns**, "*E. coli* as an Indicator of Water Quality at Papago Park" (30) 4. **Carola Davila**, "Stewardship of Papago Park, Phoenix, AZ: Examining the Effects of Recreational Activities on Vegetation" (30) 5. **Joanna R. Klein**, "A Teaching Strategy to Relate Christian Faith and Scientific Explanations of Origins: Its Impact and Effectiveness" (31) 6. **Dina Higgins**, "Addressing the Undiscussed" (31) 7. **Samantha Russell**, "Integrating a Christian Worldview into an Introduction to Engineering Course" (31) 8. **Michael Sheller**, "Combining Engineering Fundamentals and Personality Indicators in a First-Year Retention Program" (31) 9. **Robbin Eppinga** and **Lydia Marcus**, "Developing Tools to Promote and Measure Science-Faith Integration in Emerging Young Adult Christians" (32) 10. **Richard E. Denton**, "Eradicating Bible Poverty around the Globe" (32) 11. **Ashley Rea**, "Evolution of Nutrient Resorption in Sunflower" (32) 12. **Julie Woodman**, "A Case for Cornelia de Lange Syndrome: Regulating Protein Phosphorylation to Understand Disease" (32) 13. **Daisy Savarirajan**, "Ortho Cleavage of Protocatechuate in Lignin Degradation by *Bacillus subtilis"* (33) 14. **Ramesh Velupillaimani**, "Biochemical and Spectroscopic Characterization of PSI-LHCI-LHCII Supercomplex from *Chlamydomonas reinhardtii* Cells Adapted to State 2 Conditions" (33) 15. **Christopher Buschhaus**, "Interpreting Goose Poo for Improved Orchard Establishment" (33) 16. **Arthur K. Sikora**, "Expanding Magnetic Resonance Techniques into Live Whole Cells for Membrane Protein Studies" (33) 17. **Charles Kankelborg**, "Chance, Divine Foreknowledge, and the Sovereignty of God" (34) 18. **Kathryn Belicki**, "Why Forgive? Differential Outcome Following Interpersonal Injury as a Function of Reasons for Forgiving" (34) 19. **Kathryn Belicki**, "Attachment to God versus People: Relations to Outcome Following Traumatic Events" (34) 20. **Anjali Fahnestock**, "Why Science and Faith in a Designed Universe Are Not Mutually Exclusive Using Plantinga's Arguments" (34) 21. **O. Favour Ayodele**, "Choices and Management" (35) 22. **Amy K. Blom**, "Effects of Climate Change on Crop Choices in Colombia" (35) 23. **Jim Buchholz**, "How Different Philosophies of Science Affect Your Faith and Worldview" (35)
2:45 PM	Refreshment Break — Student Center Ballroom DE

3:45 PM 5:15 PM	**III.A: Energy, Water, and Environment** –Brown W280 Moderator: **Terry Gray**	**III.B: Biological Sciences** –Brown W250 Moderator: **Patricia Fitzgerald-Bocarsly**	**III.C: Education** –Brown W210 Moderator: **Mark Parker**	**III.D: Theology and Other** –SC Grand Ballroom Moderator: **Lynn Billman**
3:45 PM	**Kevin Orner** (17) "Environmental Stewardship through Recovering Resources from Wastewater"	**Perry Marshall** (17) "Extended Evolutionary Synthesis as Replacement of Neo-Darwinism"	**Joel D. Light** (17) "Relationships among Evangelical College Students' Worldviews and Their Knowledge, Beliefs, and Acceptance of Anthropogenic Climate Change"	**Jimmy Davis** (17) "Natural and Revealed Theology's Impact on One's View of God and Nature"
4:15 PM	**Michael Whelan** (18) "Industry vs. the Planet: A Christian Perspective on Reconciling Environmental Stewardship with Industrial Advancement"	**Emily R. Herrington** (18) "A Place for Striving and 'Agency' in Evolutionary Theory?"	**Louise Ko Huang** (18) "The Relevance of Undergraduate Education and Climate Change Issues"	**Hans Weichselbaum** (18) "Does Science Lead One to Atheism?"
4:45 PM	**Ruth Douglas Miller** (19) "Why Haven't You Installed a Solar Array Yet?"	**Denis Lamoureux** (19) "An Overview of *Evolution: Scripture and Nature Say Yes!*"	**Wade A. Neiwert** (19) "Engaging Students in Science and Faith through Study Abroad"	**Jamin Hübner** (19) "Revisiting Pollution and Property Rights: A Christian Libertarian Perspective"

4:45 PM	ASA Registration Table closes — Student Center Grand Ballroom Lobby
5:15 PM	Exhibit and Book Room closes — Student Center Ballroom DE
5:15 PM	Parallel Session III ends

6:30 PM	Banquet, *business casual attire* • **Leslie Wickman** and **Vicki Best** —Welcome, Prayer, Introductions • **Faith Tucker** —Personal Testimony **Ken** and **Cheryl Touryan** proudly sponsor complimentary copies of Philip's book.	Green Center, Friedhoff Hall
8:00 PM 9:00 PM	**Plenary III.** Introduction: **Ken Touryan** **Philip Yancey,** "Now and Then"	Green Center, Friedhoff Hall (10)

Congratulations, Long-Time Member Attendees!

We appreciate your faithful commitment to the ASA.

55 years
Ronald L. Barndt
Leland H. Williams Sr.

50–54 years
Gordon E. Brown
David L. Newquist
Kenneth C. Olson

45–49 years
Richard F. Carlson
Dwight H. Klaassen
Martin L. Price
Robert E. Sundell
Kenell J. Touryan
Davis A. Young

40–44 years
Paul T. Arveson
Donald H. Bilderback
Walter L. Bradley
Dillard W. Faries
Randall D. Isaac
David H. Ives
D. Gareth Jones
Ronald T. Myers
Willard H. Roundy Jr.
Bruce W. Schweitzer
Jack C. Swearengen
John R. Wood
Kurt A. Wood
James E. Yoder

SUNDAY, 30 JULY 2017		
6:00 AM	Morning walk sponsored by the ASA Christian Women in Science affiliate; all are welcome	Meet in Maple Hall Lobby
7:00 AM	Breakfast	Mines Market
7:30 AM	Engineers Breakfast Meetup—All engineers are invited	Mines Market Private Dining Room
9:30 AM 10:30 AM	**Worship Service** Faith Worship: **Sara Sherman**, worship leader; **Rachel Shield**, vocals; **Hank Lea**, guitar; and **Jon Price**, drums Minister: **Rev. Peter Hiett**, Pastor of The Sanctuary Denver Offering supports **Issachar Center for Urban Christian Leadership**	Student Center Grand Ballroom
10:30 AM	ASA Registration Table	Student Center Grand Ballroom Lobby
10:30 AM 5:15 PM	Poster Viewing	Student Center Ballroom DE
10:30 AM	Exhibit and Book Room	Student Center Ballroom DE
10:30 AM	Beverage Break	Student Center Ballroom DE
11:00 AM 12:00 PM	**Plenary IV.** **Ian Hutchinson**, "The Technical and Spiritual Challenges of Sustainable Energy" Moderator: **Randy Isaac**	Student Center Grand Ballroom (9)
12:00 PM	Lunch	Mines Market
12:00 PM	Christian Women in Science (ASA Affiliate) Lunch Meetup—All women are invited	Mines Market Private Dining Room

1:15 PM 2:45 PM	**IV.A: Engineering** –Brown W280 Moderator: **William Jordan**	**IV.B: Medical Sciences** –Brown W250 Moderator: **S. Joshua Swamidass**	**IV.C: Education** –Brown W210 Moderator: **Mark Parker**	**IV.D: Theology** –SC Grand Ballroom Moderator: **Lynn Billman**
1:15 PM	**Jonathan Touryan** (20) "Current and Future Approaches to Brain-Computer Interface Technology"	**D. Gareth Jones** (20) "Science, Ethics, and God's Will: Approaches to Medical Technology"	**Stephen Dilley** (20) "Ideas for Fortifying Biological Education"	**John R. Wood** (20) "The Necessity of Death"
1:45 PM	**Ryan K. Osteroos** (21) "Summary of US Air Force Academy Unmanned Aviation Research"	**John Pohl** (21) "The Human Microbiome: Medical, Philosophical, and Theological Complexity"	**Michael A. Everest** (21) "Does the Second Law of Thermodynamics Contradict the Theory of Evolution?"	**Stephen Huffey** (21) "The Ultimate Purpose of Stewardship: 'The Earth Is the Lord's and Everything in It …' Psalm 24:1"
2:15 PM	**Paul H. Carr** (22) "Balancing Economics with Ethics to Save God's Creation"	**E. Janet Warren** (22) "Alternative Medicine and the Failure of Protestant Christianity"	**Michael Tenneson** (22) "Veracity Claims Assessment by Christian College Students"	**Peter Hiett** (22) "The Implications of Relativity upon Our Understanding of Genesis One and the Christian Doctrine of *Apokatastasis*"
2:45 PM	Refreshment Break			Student Center Ballroom DE and Brown
3:15 PM 5:15 PM	**V.A: Ethics, Environment, and Economics**–Brown W280 Moderator: **Peter Sawtell**	**V.B: Physical Sciences** –Brown W250 Moderator: **Deborah Shepherd**	**V.C: Science Literacy** –Brown W210 Moderator: **Se Kim**	**V.D: Theology** –SC Grand Ballroom Moderator: **Lynn Billman**
3:15 PM	**Dominic Halsmer** and **Philip Riegert** (23) "Creation as Invitation: How Nature Complements Scripture in Calling Us Back to Our Maker"	**David C. Winyard Sr.** (23) "Transhumanism-Christianity Diplomacy: To Transform Science-Religion Relations"	**Jack C. Swearengen** (23) "Science Literacy for the Church"	**Hugh Ross** (23) "Habitability for Redemption"
3:45 PM	**Raymond J. Lewis** (24) "The Promise of Theocentric Environmental Ethics"	**George L. Murphy** (24) "Cosmological Presuppositions"	**Kathryn Applegate** (24) "Bringing Light, Not Heat: New and Forthcoming BioLogos Resources"	**Walter L. Bradley** (24) "Fine Tuning of the Universe: Evidence for the Existence of God"
4:15 PM	**Paul Heintzman** (25) "The Ecological Virtues of Bill Mason"	**David S. Oakley** (25) "The End of an Era? The Data Deluge and the Scientific Method: A Case Study in Medicine"	**Dana Oleskiewicz** (25) "Linking Citizens to Science in the Interest of Faith"	**Mitchell Mallary** (25) "Dispensationalism and the Alternative Ethics of Revelation"
4:45 PM	**Johnny Wei-Bing Lin** (26) "Determining the Content of Excellent Creation Care and the Need for a Center for Environmental Stewardship and Dialogue"	**Arnold E. Sikkema** (26) "Quantum Field Theory, Personhood, and the Trinity: Echoes and Resonances"	**HanSung Hong** and **Se Kim** (26) "Perspectives of Science Among Asian Americans and Applicable Implications to Reaching the Broader Younger Generations for Christ"	**David A. Larrabee** (26) "Eschatological Visions and Climate Change Decisions"
5:15 PM 10:00 PM	Posters taken down			Student Center Ballroom DE
5:15 PM	Exhibit and Book Room closes			Student Center Ballroom DE
5:15 PM	Dinner			Mines Market
5:15 PM	Geologists Dinner Meetup—All geologists are invited			Mines Market Private Dining Room
6:00 PM	Volleyball Tournament			Volleyball Lawn Courts
6:30 PM	CWIS State of Women in ASA (open to all)			Student Center Grand Ballroom
8:00 PM	Ice Cream Social			Student Center Ballroom DE
8:30 PM	State of the ASA Presenters: **Leslie Wickman, Stephen Moshier, Vicki Best**			Student Center Grand Ballroom
9:30 PM	InterVarsity Reception / Meet the Plenaries			Student Center Ballroom DE

Monday, 31 July 2017				
6:00 AM	Morning walk sponsored by the ASA Christian Women in Science affiliate; all are welcome			Meet in Maple Hall Lobby
7:00 AM	Breakfast			Mines Market
8:15 AM	ASA Registration Table			Student Center Ballroom DE
8:20 AM	**Devotions**. Devotional: **Johnny Lin** Faith Worship: **Sara Sherman**, worship leader; **Hank Lea**, guitar; and **Jon Price**, drums			Student Center Grand Ballroom
8:45 AM 9:45 AM	**Plenary V.** **James C. Peterson**, "CRISPR Cas9 and Changing Human Nature: The National Academy of Sciences Report and a Christian Response" Moderator: **Keith Miller**			Student Center Grand Ballroom (9)
9:45 AM	Exhibit and Book Room			Student Center Ballroom DE
9:45 AM	Beverage Break			Student Center Ballroom DE
10:15 AM 11:45 AM	**VI.A: Engineering and Appropriate Technology** –Brown W280 Moderator: **William Jordan**	**VI.B: Physical Sciences and Appropriate Technology** –Brown W250 Moderator: **Deborah Shepherd**	**VI.C: Science Literacy** –Brown W125 Moderator: **Se Kim**	**VI.D: Theology** –SC Grand Ballroom Moderator: **Lynn Billman**
10:15 AM	**Leonard J. Bond** (27) "Quality, Reliability, Safety, and Economics: The Role of Nondestructive Evaluation for Energy Systems in Creation Care and Sustainability"	**Martin Price** (27) "A Quick Overview of Practical, Low-Cost Options for Helping Rural Poor in Developing Countries"	**Kate Hogan** (27) "The Nature Mentor Momentum"	**Robert C. Bishop** (27) "Scientific Explanations Are Purposefully Limited to Natural Causes"
10:45 AM	**William Jordan** (28) "A Christian Approach to Sustainable Engineering"	**Ken Wolgemuth** (28) "800 Carbon-14 Measurements in Lake Suigetsu, Japan: An Opportunity to Directly Test the Young Earth Model"	**Jeffrey K. Greenberg** (28) "Projects to Promote the Effective Bonding of Science and Christian Faith"	**Jason N. Hine** and **Richard F. Carlson** (28) "Paradox in Christian Faith: Simplicity and Complexity, With Insights from Theology and Modern Physics"
11:15 AM	**Paul Arveson** (29) "Extinguishing the Three-Stone Fire"	**John C. Munday** (29) "Salt Range, Pakistan—Still Unsolved?"	**Walter Rogero** (29) "Conducting Meaningful Conversations in Faith and Science"	**David Siegrist** (29) "Human Life: Accident or Inevitable?"
11:45 AM	Parallel Session VI ends			
11:45 AM	Exhibit and Book Room closes			Student Center Ballroom DE
11:45 AM	ASA Registration Table closes			Student Center Ballroom DE
11:45 AM	Lunch			Mines Market
1:00 PM	Lodging Check Out (luggage storage available) *			

** To avoid paying for another night's lodging, you must be checked out by 1:00 PM*

Post-Meeting Activities

Monday, 31 July 2017		
1:00 PM	Climate Change Tour Package	Bus loads at Parking Lot E

Tuesday, 1 August 2017		
8:00 AM	South Platte River Wetlands Walk	Maple Hall Entrance
8:00 AM	Mt. Galbraith Hike	Maple Hall Entrance
10:00 AM	Lodging Check Out	Maple Hall Lobby

Plenary I — **Student Center Grand Ballroom**
Friday, 28 July 2017 — **7:30 PM**

Modernizing the Electric Grid: Why and How?

Annabelle Pratt

The average American home consumes 900 kWh of electricity per month. This amount of energy is roughly equivalent to 40 cyclists biking eight hours per day, every day. This energy is drawn, conveniently and cheaply, from the world's largest machine—the electric grid—voted the twentieth century's greatest engineering achievement by the National Academy of Engineering.

This energy is also remarkably reliable, with power available over 99.9% of the time. Yet, reported power outages are rising across the entire country because of an aging infrastructure and more frequent extreme weather.

In this talk, I will discuss what is meant by grid modernization and what is driving this effort, and how the traditional model of power generation and delivery is challenged by distributed generation sources such as solar and wind energy. I will also share my thoughts on the challenges of continuing to supply reliable electric power at a reasonable cost, especially in light of the view that access to energy services is integral to overcoming poverty.

Annabelle Pratt *received her bachelor's and master's degrees in electrical and electronic engineering from the University of Stellenbosch, South Africa, and her PhD degree in electrical engineering from Oregon State University. She is currently a principal engineer with the National Renewable Energy Laboratory.*

Prior to joining NREL, she was a senior power research engineer with Intel Labs, and previously, she was with Advanced Energy Industries where she developed power supplies for the semiconductor manufacturing and architectural glass coating industries.

Her research interests include autonomous energy management of flexible loads in buildings to increase the penetration of renewable energy resources. She is a senior member of the Institute for Electrical and Electronic Engineers (IEEE) and active in providing peer reviews and in standards activities.

Plenary II — **Student Center Grand Ballroom**
Saturday, 29 July 2017 — **8:40 AM**

Climate Change: Fact, Fiction, and Faith

Katharine Hayhoe

Climate change is one of the most hotly debated and politically polarized issues in public dialogue today.

- Is the evidence solid?
- Are proposed solutions viable?
- And why should Christians care?

Join Katharine Hayhoe as she untangles the complex science behind global warming and highlights the key role our faith and values play in shaping our attitudes and actions on this crucial topic.

Named to TIME *magazine's 100 Most Influential People in the World list for 2014,* **Katharine Hayhoe** *is an atmospheric scientist who studies climate change, one of the most pressing issues facing humanity today.*

Katharine may be best known to many people because of how she's bridging the broad, deep gap between scientists and Christians. Together with her husband Andrew Farley, a professor of applied linguistics, pastor of Church without Religion, and best-selling author, Katharine wrote A Climate for Change: Global Warming Facts for Faith-Based Decisions*, a book that untangles the complex science and tackles many long-held misconceptions about global warming.*

Her work as a climate change evangelist has been featured on the Emmy award-winning documentary series "Years of Living Dangerously" and "The Secret Life of Scientists and Engineers." In 2012, she was named by Christianity Today *as one of their "50 Women to Watch"; in 2014, she was awarded the American Geophysical Union's Climate Communication Prize, and named as one of* Foreign Policy*'s 100 Leading Global Thinkers and "20 Women Making Waves in the Climate Change Debate."*

Plenary III | **Student Center Grand Ballroom**
Sunday, 30 July 2017 | **11:00 AM**

The Technical and Spiritual Challenges of Sustainable Energy

Ian Hutchinson

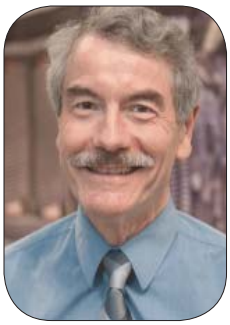
The material standard of living in the developed world is founded on the application of abundant energy to meet human needs and desires. Is this energy use sustainable?

The currently available sources of energy have various different technical characteristics which affect their sustainability and safety. Individuals and policy-makers are motivated only partly by their perception of these characteristics to favor some sources over others. Many Christians find a calling in worthy efforts to improve the technical effectiveness of energy sources.

A sober assessment of the prospects for energy sustainability, however, challenges the common presumption that there is a technical "fix" for energy. Other, nontechnical, resources are needed.

Christians have tremendous spiritual resources to motivate us to love and value all of creation, and ethics grounded unshakably in God's love toward humankind. These have enormous significance for the global challenge of sustainable energy, but need theological attention and emphasis.

Ian Hutchinson *is Professor and former Head of the Department of Nuclear Science and Engineering, at the Massachusetts Institute of Technology (MIT). His group's experimental research, on confined plasmas hotter than the center of the sun, was a major contributor to the international effort to generate practical energy from fusion reactions, the power source of the stars.*



In addition to 200 journal articles and two science text books, he has also written and spoken widely on the relationship between science and Christianity. His book Monopolizing Knowledge *explores how the error of scientism arose, and how it feeds today's culture wars and an excessive reliance on technology.*

Ian is a fellow of the American Physical Society, the (UK) Institute of Physics, and the ASA.

Plenary IV | **Student Center Grand Ballroom**
Monday, 31 July 2017 | **8:45 AM**

CRISPR Cas9 and Changing Human Nature: The National Academy of Sciences Report and a Christian Response

James C. Peterson

The possibilities and risks of recombinant DNA triggered the famous Asilomar Conference in 1975. Geneticists agreed there on safeguards for their research. A second such formative conference was held in Washington, DC, in December of 2015. This one was triggered by an even more transformative new technology called CRISPR Cas9. Instead of clumsily working proteins, CRISPR Cas9 makes possible uniquely specific deletions and additions in RNA.

The National Academy of Sciences, the National Academy of Medicine, the Chinese Academy of Sciences, and the Royal Society of the UK, called together a gathering of the founding scientists with some advisors to work through the direction of this amazingly efficient and relatively inexpensive method to edit DNA with precision. As a participant at that conference, I saw the challenge of developing ethical consensus, and the progress since, that has led to an official set of recommendations in February of 2017.

In this session, we will discuss the proposed guidelines concerning somatic, germline, curative, and enhancement uses in human beings, and consider Christian insights and purpose that might shape our response.

Formerly holding the R.A. Hope Chair at McMaster University and serving as the president of the Canadian Scientific and Christian Affiliation, **James C. Peterson** *(PhD Virginia) is now the Schumann Professor of Christian Ethics and Director of the Benne Center for Religion & Society at Roanoke College, the ethicist for Lewis Gale Hospital, and a professor at the Virginia Tech Carilion School of Medicine.*

He is an ASA Fellow and the Editor-in-Chief of our peer-reviewed journal PSCF. *He has been a clinical and research fellow in genetics funded by the National Institutes of Health, and published two books with Eerdmans on human genetic intervention:* Genetic Turning Points *and* Changing Human Nature. *Invitations to lecture have come from universities including Oxford, Queens, British Columbia, Toronto, Harvard, and Northwestern, as well as confessional colleges from Calvin to Wheaton. The International Society for Science and Religion founded at Cambridge has elected him a Fellow.*

Water Symposium — **Brown W280**
Saturday, 29 July 2017 — **1:15 PM**

Water Symposium

organized by **Dorothy Boorse**

Water issues are currently among the most pressing environmental issues. From water pollution, loss of freshwater availability, the collapse of ocean ecosystems, loss of fish, and the effects of climate change, water will continue to be a central concern in environmental stewardship.

In this symposium we will hear three talks:

1. Dorothy Boorse will talk about water issues as they relate to the Sustainable Development Goals. These are worldwide goals for human development that began in 2015 and will last until 2030. They replace the Millennial Development Goals, which organized worldwide development for fifteen years. Boorse will specifically discuss the big picture of global of water availability, water pollution, and the impacts of water trends on ecosystem health and relate them to ongoing efforts to improve human flourishing.
2. Tom Ackerman will discuss climate engineering, large scale changes to land, water, and air that are being considered to mitigate climate change and their effects on water.
3. Steve Hall will talk about aquaculture, providing a concrete example at the intersection of water, energy, food, sustainability and service.

There will be time for questions and audience discussion as we attempt to put global water issues into a context and describe the ethical considerations of various actions.

Dorothy Boorse *is interested in wetland ecology, invertebrates, vernal pools and salt marshes. She is also passionate about increasing women and minorities in science, science and faith communities, and literary science, how science is portrayed in culture, and how people relate science and faith.*

Dorothy loves being outdoors and loves wetlands more than just about anything. Her college textbook co-authored with Richard Wright, Environmental Science: Toward a Sustainable Future *(2014, Pearson) is in its 13th edition. Dorothy has been a member of ASA since 2001, was elected as an ASA Fellow in 2012, and was elected to the Executive Council in 2016.*

Banquet Speaker — **Green Center, Friedhoff Hall**
Saturday, 29 July 2017 — **8:00 PM**

Now and Then

Philip Yancey

A native of Atlanta, Georgia, **Philip Yancey** *earned graduate degrees in communications and English from Wheaton College and the University of Chicago. He joined the staff of* Campus Life Magazine *in 1971, and worked there for ten years as Editor and then Publisher.*

Then Philip became a full-time writer, initially working as a journalist for such varied publications as Reader's Digest, National Wildlife, Christian Century, *and* The Reformed Journal. *For many years he wrote a monthly column for* Christianity Today *magazine, which he still serves as Editor at Large.*

He has written over twenty-five books, including Where Is God When It Hurts, Prayer: Does It Make Any Difference?, *and* Disappointment with God. *The books have won thirteen Gold Medallion Awards from the Christian Publishers Association and have sold more than fifteen million copies in English, as well as being translated into forty languages. Christian bookstore managers selected* The Jesus I Never Knew *as the 1996 Book of the Year, and* What's So Amazing About Grace? *received the same award in 1998. Among his most recent books are* The Question That Never Goes Away *and* Vanishing Grace: What Ever Happened to the Good News?

The Yanceys lived in downtown Chicago before moving to a very different environment in Colorado. They enjoy mountain climbing, skiing, and wildlife.

Worship Minister — **Student Center Grand Ballroom**
Sunday, 30 July 2017 — **9:30 AM**

Sunday Sermon

Rev. Peter Hiett

Rev. Peter Hiett *is the pastor of The Sanctuary Denver, as well as a husband and father of four. Peter holds a bachelor's degree in geology from the University of Colorado and a Masters of Divinity from Fuller Seminary.*

He has authored four books including two recent creative commentaries on Genesis chapters one and two—The History of Time and the Genesis of You *and* God and His (Sexy) Body.

I.A: Energy, Water, and Environment

Brown W280

Back to the Future on the Back of an Envelope

Terry M. Gray
Colorado State University

Energy use on planet Earth is expected to go up three-fold by 2100. With just a handful of assumptions we can map out what our energy future will look like. Knowing that future we can then think about what it will take to get there. The assumptions are the following: (1) The human population will stabilize at 10 billion; (2) Every nation will be as developed as modern western European nations with a Human Development Index (HDI) of 0.9 and a per capita energy use of 150 GJ per person; (3) Energy will be carbon neutral; and (4) Water for domestic use and irrigation will be produced by desalination at US levels today.

From assumptions 1 and 2, we conclude the global energy use to be 1500 EJ—just under triple 2016 global energy use (550 EJ). In the US, 170 billion gallons of water per day are used for public water supply and for irrigation. On assumption 4, we conclude that producing that much fresh water via reverse osmosis will take 100 EJ of energy—a mere 6.6% increase.

1600 EJ is about 50,000 1 GW power plants (actual production not simply nameplate). Assumption 3 means that these power plants are all new. Today there are fewer than 2,000 1 GW carbon-free power plants (nuclear, hydro, wind, solar, geothermal). 580 new 1 GW carbon free power plants per year are needed by 2100 to meet the expected global energy demand.

I.B: Biological Sciences

Brown W250

Stewardship and Integrated Pest Management in a Commercial Nursery in Canada

Valerie C. Sikkema
Van Belle Nursery

When I started working at a large wholesale nursery in 2006, its approach to insect and disease control was, “If you see it, kill it.”

In the last ten years, we have worked to implement regular scouting and set pest treatment thresholds. Our preferred treatments range from sanitary pruning and irrigation control to biocontrols, including predatory insects and mites, nematodes, biopesticides, and entomopathogenic fungi. Chemical controls involve “softer” formulations more compatible with those biocontrols and strict rotation protocols to prevent the development of resistance.

We regularly invite local researchers and universities to conduct pest management trials at our nursery. We have projects researching Trichoderma for root disease, Hypoaspis for Foliar Nematode control, pre-emergent infused mulches for weed control, and the development of a robotic scouting system.

I will discuss how this fits with the desire of our company to be more stewardly with the environment and resources, and some of the important lessons that we have learned including grower, sales, and consumer training that is required to be successful.

I.C: Physical Sciences

Brown W210

History of Geology: Past Faith and Science Informing the Present

David Campbell
Gardner-Webb University

Many sources, including textbooks and popular “history,” often perpetuate the myths of science-faith warfare rather than an accurate picture of the development of geology.

Both creation science and conventional geologists often misinterpret historical views by falsely assuming that a similarity between a past position and a modern one means that the two are the same. Replacing the simplistic false dichotomy of young-earth, biblically based positions involving global flooding versus old-earth, nonbiblical positions with no global flood with a true picture of the variety of historical concepts may promote better thinking about the range of possible positions.

As demonstrated by Martin Rudwick, chronologies such as Ussher’s actually were forerunners of geology, whereas the vast timeline of deists such as Hutton was on a philosophical dead end. Neptunism and catastrophism were not compatible with modern flood geology.

Tracing the history of geology also provides a way that students can see the accumulation of evidence on the age of the earth and how it was accepted and fit into a Christian worldview. This may be easier to accept than starting with the conclusion of an old earth.

I.D: Student/Early Career, Track 1

SC Grand Ballroom

Science, Mission, and Flourishing

S. Joshua Swamidass

In this session, I will speak about taking risks to (1) engage the world as Christians in science, (2) serve the church through science professions, and (3) model missional engagement within a science career. The session will include an opportunity to ask questions.

The ESN student track is designed so that all the parts work together as a whole, but each individual segment works on its own, so please join us even if you can’t make every slot.

I.A: Energy, Water, and Environment (cont'd)

Brown W280

The Hydrogen Economy: Food and Energy

John A. Turner
National Renewable Energy Laboratory

Energy carriers are essential for powering the society we live in. Coal, oil, natural gas, gasoline and diesel all carry energy in chemical bonds, used in almost all areas of our civilization. But these carriers have a limited-use lifetime on this planet. They are finite, contribute to climate change and carry significant geopolitical issues. If humankind is to maintain and grow our societies, new energy carriers must be developed and deployed into our energy infrastructure.

Hydrogen is the simplest of all the energy carriers and when refined from water using renewable energies such as solar and wind, represents a sustainable energy carrier, viable for millennia to come. The Hydrogen Economy then is the production of hydrogen from water, its distribution and utilization as an energy carrier.

But hydrogen is not just an energy carrier, it also is a key part of the food supply. Half of the world's yearly production of hydrogen (some 25 MMT) is used in the refining industry, the other half (another 25 MMT) is used to make ammonia. This ammonia is ultimately used as fertilizer and the increased crop production from nitrogen fertilizer helps feed an additional 3 billion people on this planet. If anything, hydrogen used to make ammonia, is more valuable than hydrogen as an energy carrier for transportation.

This talk will discuss sustainable processes for the production of hydrogen and the promise of hydrogen for transportation, energy storage, ammonia, and hydrocarbon production from CO_2.

I.B: Biological Sciences (cont'd)

Brown W250

Practical Evolution: Harnessing Variation and Selection in Rational Drug Discovery

Robin Pals Rylaarsdam
Benedictine University

Nonscientists often think of evolutionary biology as mostly a description of the changes in flora and fauna over time on Earth. While phylogenetic relationships are an important part of evolutionary biology, and indeed played an essential role in the history of this field, evolutionary biology provides a powerful toolkit for investigating other fields of biology, including biomedical research.

The principles of variation and selection, protein homologies, and conservation of biochemical pathways can be harnessed to many ends. This presentation will illustrate how these three foundational principles were used in an ongoing project to develop small-molecule drug candidates for a rare genetic disease, McCune-Albright Syndrome.

I.C: Life and Environmental Sciences (cont'd)

Brown W210

Planetary Science and "Aiming for Heaven"

Peter B. James
The Lunar and Planetary Institute, Houston, Texas
Baylor University

C. S. Lewis entreated his readers to seek the kingdom of God before all else, and he noted that this kingdom-mindset can even bear fruit in a worldly sense: "Aim for heaven, and you will get Earth thrown in" (this is an argument based on Matt. 6:33).

In a similar way, scientific exploration of the planets and moons in our solar system yields secular and spiritual dividends for humanity here on Earth. Planetary endeavors in recent history have fostered international cooperation, have taught us about the mechanisms by which our own planet operates, and have given us a fuller appreciation for the grandeur of creation's creator.

Recent developments in planetary geophysics are particularly exciting, as they allow us to probe the interiors of planetary bodies in ways never before possible.

I will present data from recent spacecraft missions along with my own contributions to the geologic understanding of Venus, a planet that is similar to Earth in size and composition and yet so different in terms of crustal tectonics. Elwin Ransom (from Lewis's Space Trilogy) would be thrilled!

I.D: Student/Early Career, Track 1 (cont'd)

SC Grand Ballroom

Communicating with Secular Peers about Faith and Science

Panel members:

- **Se Kim**
  AAAS Dialogue on Science, Ethics, and Religion
- **Denis Lamoureux**
  St. Joseph's College, University of Alberta

Ever wonder how to communicate with peers who share your love for science but not your faith? Come hear strategies for building good conversations and engaging secular scientists on topics of faith and science.

The ESN student track is designed so that all the parts work together as a whole, but each individual segment works on its own, so please join us even if you can't make every slot.

I.A: Energy, Water, and Environment (cont'd)

Brown W280

Propellant Fracturing of Vertical and Horizontal Wells

Richard Passamanek
Colorado School of Mines (retired)

This presentation describes a research project whose purpose was to develop a controlled propellant burning process that would produce multiple fractures in vertical or horizontal wells.

A brief history of propellant fracturing is given to familiarize the audience with the technique. The choice of propellant is restricted by a set of criteria.

A series of tests was performed to characterize the burn rate and gas generation rate as a function of pressure after a suitable propellant was found.

The data from these tests were reduced to empirical expressions. These mathematical expressions describing the propellant burn, along with compressible flow theory and fracture mechanics of the formation were used to develop a fully coupled computer code which describes the entire fracture process as a function of time. The test results verify the computer code.

Production histories from a number of wells are discussed. This process has been applied in approximately 2,000 plus wells in about 65 countries.

Another aspect of this process is that it is friendly to the environment with which God has entrusted us. The process uses 2% KCl water. No proppant is used since the fracturing process produces its own in-place proppant.

I.B: Biological Sciences (cont'd)

Brown W250

Serotonin Transporter Gene Polymorphism, Response Inhibition, Auditory Attention, and Emotional Variations: An Investigation of the Link between Behaviors and Genotypic Polymorphism

N. Freeman, J. R. Graber, J. N. Perkins, R. L. Rudkin, and **M. A. Parker**
Colorado Christian University

In addition to impacting mood, anxiety, sleep, and sexual performance, serotonin levels appear to play a role in sensitivity to aversive outcomes, with the 5-HTTLPR polymorphic region showing a relationship to the evaluation of risk (Nomura et al., 2015), aggression in response to stress (Conway et al., 2012), and differential levels of connectivity in emotional arousal centers following exposure to an unpleasant visceral stimuli (Kilpatrick et al, 2015). Polymorphisms in the serotonin-transporter gene may relate to increased impulsivity (Bavilaqua & Goldman, 2013), aversion to delay of gratification (Sonuga-Barke et al., 2011) and altered vigilant attention (Walderhaug, Herman, Magnusson, Morgan, & Landre, 2010).

In a sample of healthy adults, we measured the inhibition of dominant responses, cognitive flexibility and sequencing, auditory attention and immediate auditory recall, and self-reported anxiety and depression. We also obtained buccal swabs for the purposes of isolating genomic DNA (Küchler et al., 2011). The DNA was then used to determine the 5-HTTLPR genotype of the study participants (McDougle et al., 1998). These data were correlated to the psychological testing data in order to examine the potential influence of the 5-HTTLPR on these specific psychological traits.

I.C: Life and Environmental Sciences (cont'd)

Brown W210

Conjunctio of Physis and Psyche: The Personal Struggle of Wolfgang Pauli with Modern Physics and Modern Psychology as Impetus and/or Model for Integration of Science and Faith

Dillard Faries
Wheaton College

Wolfgang Pauli is perhaps the best exemplar of a person who deeply understood modern physics and struggled with its meaning and interpretation in the context of philosophy, theology, the history of ideas, and especially in relation to the mind of humankind, the psyche.

Having dispensed with relativity (i.e., conquered it) at the age of twenty, he moved on to the really difficult (i.e., impossible) realm of quantum mechanics. As a school-chum and lifelong friend of Heisenberg, a disciple of Niels Bohr, and "adopted son" and "heir apparent" of the Einstein kingdom, he was at the center of the creation, the interpretation, and the controversy of quantum mechanics.

Personal crises and neuroses led him deeply into the realm of dreams, archetypes, the collective unconscious, and the psychology of Carl Gustav Jung. His contributions to the interpretation of quantum mechanics, the philosophical and theological implications, and his call for bridging the gap of Cartesian dualism will only grow in importance.

I will present brief summaries of Pauli's life, of the classical worldview of modern science, its counterpart in quantum physics, and the directions which Pauli took these ideas in the wider arena of the history of ideas.

I.D: Student/Early Career, Track 1 (cont'd)

SC Grand Ballroom

Speed Mentoring, Session 1

Various Mentors

Wondering how to put your career in science and your mission as a believer in Christ together? Curious how to flourish as a scientist? Want to process one of our tracks or a plenary session further? Not sure how to find mentors? Join us for speed mentoring!

Our ESN track speakers and others will be available to share advice and answer your questions in a small group setting. This interactive session will allow you to meet mentors and peers and learn from them.

Those who wish can proceed to lunch together for more conversation after this session.

The ESN student track is designed so that all the parts work together as a whole, but each individual segment works on its own, so please join us even if you can't make every slot.

II.A: Water Symposium

Brown W280

Water and the Sustainable Development Goals: Water Availability, Pollution, and Ecosystem Health as We Look toward 2030

Dorothy Boorse
Gordon College

In 2015, the Sustainable Development Goals (SDGs) replaced the Millennium Development Goals (MDGs) as the roadmap for world-wide development. The MDGs lasted from 2000–2015 and gave the global community a series of goals and targets by which we might meet those goals such as halving severe poverty, cutting maternal and infant mortality rates, increasing the numbers of children in primary school, and increasing the number of people with access to sanitation and clean water.

Many targets were achieved or significant progress was made at the same time that the world population rose from 6 to 7.2 billion. Unfortunately, however, the goal of protecting environmental sustainability was not achieved, and many environmental indicators declined during this time period. Fisheries globally are in collapse, oceans are acidifying, glaciers and sea ice is declining, and the SDGs then, were developed to include sustainability at every level. Several of them focus on water. Water availability, water pollution, and the health of aquatic ecosystems are three areas where we are at a critical juncture in our use and protection of water resources and aquatic systems.

Here I will discuss these three in the context of global development, ecological sustainability, human health, and the maintenance of ecosystem services.

II.B: Biological Sciences

Brown W250

Why Should We Expect to Find Life on Mars?

Roger Wiens

Much of the scientific motivation for NASA's Mars Exploration Program is to understand the planet's habitability and to explore the possibility that simple life existed or exists there.

Recent exploration, including my team's work on the Curiosity rover, shows that Mars was indeed habitable, possessing large, long-lasting freshwater lakes and rivers. Given this environment, even people who believe life was created only on Earth should expect to find life on Mars.

Many rocks originating on Mars have fallen to Earth as meteorites; we currently have > 150 in curation. With this flux from Mars to Earth, we would expect a reasonable flux of material in the other direction as well. Life on Earth is so ubiquitous that this flux must have brought single-celled organisms to our sister planet.

A major problem with studying early life on Earth is the destruction of ancient crust due to subduction, weathering, and metamorphism. By contrast, the martian surface has seen relatively little change over the last several billion years, suggesting that studying life on Mars may be a profitable way to understand early life forms. However, no life—extent or present—has yet been found on Mars.

Curiosity rover experiments have revealed hundreds of ppb of organic materials, but this might be expected just due to influx of primitive meteoritic material which carries organics.

In this talk, I will discuss the current state and prospects for studying organics and life detection on Mars.

II.C: Theology

Brown W210

The Genesis 5 Patriarchs and the Sumerian King List: Is There a Commonality?

Dick Fischer
Genesis Proclaimed Association

When the Sumerian King Lists began to surface among the clay tablets recovered in southern Mesopotamia beginning in the late 1800s, there was a rush to show that these were the source of the biblical patriarchs. The Berossus list, close companion to the Sumerian versions, was analyzed by the Assyriologist Zimmern, who concluded:

> It can hardly be doubted that the biblical tradition of Genesis 5 concerning the antediluvian patriarchs is basically identical with the Babylonian tradition about ten antediluvian primeval kings.

Although "basically identical" is a stretch, an argument can be made that at least some of the biblical patriarchs are also represented on king lists. Although there is general agreement between all seventeen recovered king lists, there are differences that can be attributed to geographical peculiarities, individual scribal mistakes, difficulties in communication between ancient cities, and the shear antiquity of the material. Earlier texts may differ from later texts as fresh scribes make subtle revisions. Also clay tablets are sometimes broken with some of the text missing. Still, by combining the lists into one for comparison purposes, it can be seen that a commonality exists. Some of the recorded patriarchs quite likely are recorded kings also.

Although set down in the Sumerian language, some of the names are Semitic in origin, and it appears probable that Akkadians comprise the majority of the kings listed. If it can be substantiated that some of these patriarchs *also* were kings, then it tells us a lot about their sheer existence, the geographical area and the timeframe in which they lived, and even a little about their historical niche.

II.D: Student/Early Career, Track 2

SC Grand Ballroom

Flourishing in a Science Career

Panel members:

- **Otonye Braide-Moncoeur**
  Gordon College
- **Douglas Lauffenburger**
  MIT
- **Johnny Wei-Bing Lin**
  University of Washington Bothell and North Park University

What habits and ideas help a scientist flourish? What can you do early in your career to help you thrive, now and later? Join our panel of scientists in a range of careers to hear their advice and ask your questions.

The ESN student track is designed so that all the parts work together as a whole, but each individual segment works on its own, so please join us even if you can't make every slot.

II.A: Water Symposium (cont'd)

Brown W280

Climate Change, Climate Engineering, and the Global Hydrologic Cycle

Thomas Ackerman
Professor, Department of Atmospheric Sciences; Director, Joint Institute for the Study of the Atmosphere and Ocean, University of Washington

Measurements from satellite and ground-based instruments over the past two decades provide a much-improved understanding of the global hydrologic cycle and the processes that drive it. A warming climate has increased the water vapor content of the atmosphere and, in general, accelerated the water cycle, thereby increasing precipitation. This increase, however, is not uniform. Rather, wet areas of the globe have become wetter and dry areas dryer. The acceleration also tends to produce an increase in severe rain events and to exacerbate droughts.

Global climate model simulations predict a continuation of these trends through this century. Solar climate engineering, a deliberate cooling of Earth's climate by increasing planetary reflectivity, can quite possibly be designed to reduce global warming but will, at the same time, decrease global precipitation. This occurs because a reduction in solar insolation reduces evaporation, which must in turn reduce precipitation.

In the absence of immediate, substantial reductions in greenhouse gas emission, global society in the next few decades will face very difficult issues of ethics and justice regarding the availability of fresh water, damage from extreme events, the possible use of climate engineering, and the impacts on water availability that its use would entail. Resolving these issues will be very difficult due to the inherent uncertainty in our ability to predict regional-scale hydrologic variability and competing views of responsibility and compensation.

II.B: Biological Sciences (cont'd)

Brown W250

The Teleological Biochemistry of Evolution

Sy Garte
Natural Philosophy Institute

We can see evidence of purpose in the behavior of many living creatures, including ourselves, and yet teleology in the Aristotelian sense has been banned from most biological disciplines, especially evolutionary theory. The biochemical mechanism of evolution is dependent on a tight linkage between inheritable genotype and gene-directed phenotype, which allows the phenotype to be the target of selection.

The problem of teleology in biology may be approached by a close examination of the universal genotype-phenotype linkage: the protein synthesis system. This solution to the conversion of nucleic acid chemistry into protein chemistry is the fundamental root of teleonomy and inherent teleology in living organisms.

The conversion of genotype information to phenotypic characteristics is a highly teleological process. The purpose to having such a system working in biological organisms is to allow for evolution. Cells do not see the future and do not decide to change based on what is needed. Cells do not need to see the future, because evolution provides a way to deal with any novel challenges in the absence of sight, thought, will, or any form of consciousness. Evolution by natural selection is the cellular biological alternative to survival by conscious struggle.

The roots of biological teleology do not lie in the action of evolutionary processes, but can be found in the very fabric of the evolutionary mechanism. In other words, purpose is built into the central biochemistry of evolution.

II.C: Theology (cont'd)

Brown W210

The Genesis Flood: Discussing a Global Deluge from a Water Engineering Perspective

Justin Crick
Student, San Jose State University

The purpose of this talk is to review the Genesis Flood account, and introduce some of its characteristics and reasons why it occurred from a biblical and historical context.

This presentation will then proceed to engage recent young earth creationist Flood theories regarding fluid hydraulics, hydrology, and Earth science, and discuss their plausibility in light of biblical and scientific evidences.

Finally, a recommendation will be proposed on viewing the Flood account from a perspective that affirms and reveres the words of scripture as the inerrant, inspired Word of God, while also respecting the usefulness and context in which modern science and engineering can be applied.

II.D: Student/Early Career, Track 2 (cont'd)

SC Grand Ballroom

Communicating about Science with Christian Communities

Panel members:

- **Katharine Hayhoe**
  Director of the Texas Tech Climate Science Center
- **Stephen Moshier**
  President, ASA Executive Council; Chair, Department of Geology and Environmental Science, Wheaton College
- **Leslie Wickman**
  Executive Director of ASA

How can Christians who are scientists communicate well with their faith communities? What are some good ways to approach controversial questions and areas where some see conflict between faith and science? How can believing scientists share the ways that faith and science strengthen each other?

Join us and hear from a range of experienced scientists and communicators.

The ESN student track is designed so that all the parts work together as a whole, but each individual segment works on its own, so please join us even if you can't make every slot.

II.A: Water Symposium (cont'd)

Brown W280

Ethical and Stewardship Considerations in Aquaculture

Steven Hall
North Carolina State University

Ethical concerns in aquaculture include land and water use, just distribution of resources, environmental concerns and new technologies including chemicals and genetic engineering. Aquaculture, (culturing aquatic plants and animals) now exceeds wild caught fisheries (FAO). It can provide protein for the poor, but it can also impact the environment, especially important water resources. Ethical challenges include (1) rich vs. poor; (2) creation care; (3) economics; and (4) human and animal health issues. Certain species such as *Tilapia nilotica* can provide protein efficiently and are "poor-friendly." The wealthy may demand expensive fish, including carnivorous fish.

Environmental impacts include waste nitrogen, solids, phosphorus, and other components that may affect water quality. Oceanic net pens and other open systems are harder to "clean." Scale can also have an impact: many new operations are large. Destruction of mangroves (which may protect coastal zones) to culture shrimp is one concern.

Health effects such as bacteria can be negative, while many fish are considered healthy protein. Unhealthy metals such as mercury are more controlled in closed recirculating systems. Questions about developing technologies may raise additional ethical questions.

Aquaculture should provide high quality, affordable, and safe protein; use more plant-based diets; be locally relevant to maximize native species; maintain ecosystem balance; protect endangered species; and minimize environmental impacts. Aquaculture is an important source of products such as sustainable protein, and wise and ethical management is key.

II.B: Biological Sciences (cont'd)

Brown W250

The Recent Common Ancestry of All Humanity about 6,000 Years Ago

S. Joshua Swamidass
Washington University, Saint Louis, Missouri

Theological objections to evolution commonly center on Adam and Eve. The scientific account and the traditional biblical account seem to be irreconcilable. However, we might share a common ancestor as recently as 3,000 years ago. Consequently, all humans in recorded history might share common ancestry with a historical Adam and Eve as recently as 6,000 years ago.

This surprising result makes sense only once several key terms are precisely defined: mitochondria Eve, Y-chromosome Adam, common ancestry, and sole progenitorship.

Our aim here is to explain this seminal study, and explore its implications for the dialogue of faith and science. From this clear starting point, we see the genetic data is entirely consistent with a very a recent historical Adam and Eve who are ancestors of us all, but not our sole progenitors.

In light of this result, we urge caution in overstating the scientific evidence against a historical Adam and Eve. Nothing in science rules out that they were real people in our recent history who stood at the headwaters of the human race.

II.C: Theology (cont'd)

Brown W210

Why the Identity of Noah Is Important for the Origins Debate

Alan Dickin
McMaster University

Debate concerning Noah's Flood has usually focused on the nature and extent of the Flood, but rarely on the identity of the Flood hero. However, because the story of Noah is found in the "primeval" history of Genesis, it is critical for grounding Genesis 1–11 within a geological, historical, and spiritual framework.

Many evangelicals today believe that Genesis 1–11 is mythological rather than historical, and that genuine spiritual revelation began only with Abraham. But, in fact, the Flood hero is the best historically attested biblical figure until the time of King David.

The Flood hero is recognized in several different Mesopotamian traditions, but critically, he is also the focus of two distinct biblical traditions. Ironically, it is often those who believe in distinct sources for Genesis who also disbelieve the historicity of Noah. However, the story of Noah is intrinsic to both the Priestly and Yahwist accounts, of which the latter is usually dated to the time of David.

Although the story of Noah was probably redacted during the Israelite exile in Babylon, its place in the Yahwist account provides good evidence that the core of the story predated the exile. The inference is that Abraham brought Mesopotamian epic traditions with him from Ur, and that these passed through the hands of Moses. This validates the primeval history of Genesis as a genuine ancient tradition, and not an "invented history" as many evangelicals suppose.

II.D: Student/Early Career, Track 2 (cont'd)

SC Grand Ballroom

Speed Mentoring, Session 2

Various Mentors

Wondering how to put your career in science and your mission as a believer in Christ together? Curious how to flourish as a scientist? Wondering where to find mentors? Join us for speed mentoring!

Our ESN track speakers and others will be available to share advice and answer your questions in a small group setting. This interactive session will allow you to meet mentors and peers and learn from them.

The ESN student track is designed so that all the parts work together as a whole, but each individual segment works on its own, so please join us even if you can't make every slot.

III.A: Energy, Water, and Environment

Brown W280

Environmental Stewardship through Recovering Resources from Wastewater

K. Orner,[1] C. Cools, J. R. Mihelcic, and **J. Cunningham**
[1]PhD candidate, U of South Florida

Water Resource Recovery Facilities, also called wastewater treatment plants, remove contaminants prior to discharging treated effluent. Removing nitrogen and phosphorus prevents algae blooms but usually requires expensive chemical and energy input. These costs are exacerbated by recycling nitrogen and phosphorus multiple times through the treatment system via return of nutrient-rich sidestreams (e.g., digester effluents). Existing technologies require a net input of energy to remove nitrogen and release N2 gas to the atmosphere rather than recovering it for use as an agricultural fertilizer. To address this problem, digester effluents can utilize struvite precipitation and microbial fuel cells to recover nutrients and energy, thereby saving wastewater treatment plants costs in chemicals and energy.

Results indicate that struvite precipitation removed 33% of nitrogen and 87% of phosphorus from the liquid during struvite precipitation. To remove the remaining nitrogen and recover energy, microbial fuel cells oxidize organic matter using bacteria. The application of microbial fuel cells to the sidestream is a novel approach to remove nutrients without the input of energy. Results from almost 300 days of operation indicate a combined 80% total nitrogen removal and 30% removal of COD while obtaining a power density of 91 mW/ m^3 reactor volume. The results indicate that electrons which were donated during organic decomposition in the anodic chamber are being accepted by the denitrification reaction in the cathodic chamber. The research will continue with collaboration with county engineers at the pilot scale at a testbed facility being constructed in Hillsborough County (Tampa, FL) and through a Fulbright Research Grant near Monteverde, Costa Rica.

III.B: Biological Sciences

Brown W250

Extended Evolutionary Synthesis as Replacement of Neo-Darwinism

Perry Marshall
Author, *Evolution 2.0: Breaking the Deadlock between Darwin and Design*

While Neo-Darwinism is said to be accepted by most scientists and taught in most textbooks, its details have been the subject of fierce contention by people across a wide spectrum of fields. Challengers are by no means restricted to religious fundamentalists or intelligent design advocates; it has been called into serious question by experts from many fields and world views.

The November 2016 "New Trends in Evolutionary Biology: Biological, Philosophical and Social Science Perspectives" conference in London focused on the extended evolutionary synthesis. Presenters asked, Can the modern synthesis of the 1940s morph to accommodate new discoveries such as epigenetics, symbiogenesis and niche construction? Or does it need to be torn down and rebuilt from the ground up?

This presentation asserts that the extended synthesis is not merely a modification, but a rejection of major tenets of Neo-Darwinism. This represents a sea change in evolutionary thought and is more readily verified by experiment. The extended synthesis solves several major problems in Neo-Darwinism and presents new opportunities to heal the rift between science and religion.

III.C: Education

Brown W210

Relationships among Evangelical College Students' Worldviews and Their Knowledge, Beliefs, and Acceptance of Anthropogenic Climate Change

Joel D. Light
Assistant Professor of Biology
University of Northwestern, St. Paul

Research has determined that the way people think about topics and how they learn, is very convoluted. More research is warranted on how a student's worldview influences how he or she interacts with specific scientific topics. Anthropogenic climate change is one current scientific topic on which more worldview-focused research needs to be conducted.

Evangelicals have been found to be the most resistant group to accept the scientific evidence for human-induced climate change and, therefore, the most reluctant to engage in climate friendly action. There is limited understanding of where this strong resistance comes from and why some evangelicals accept anthropogenic climate change and why many do not. Research indicates that worldview may influence this phenomenon.

This study investigated how an evangelical student's worldview related to their knowledge, belief, and acceptance of anthropogenic climate change. Through detailed qualitative analysis of participant responses to the various instruments employed in the study, differences emerged between individuals along the continuum of anthropogenic climate change acceptance in the evangelical culture.

These findings could provide the necessary tools for engaging this reluctant population in more meaningful climate change conversations.

III.D: Theology and Other

SC Grand Ballroom

Natural and Revealed Theology's Impact on One's View of God and Nature

Jimmy Davis
Hammons Chair and Professor of Chemistry, Union University

It seems to me that arguments employing natural theology work wonderfully in Sunday School but seem to have no persuasion when applied to nonbelievers. Is this the influence that the promoters of natural theology intended?

How one views the characteristics of God, his relationship to his creation, and his relationship to people is impacted by whether one approaches these issues from a natural or revealed theological approach.

In both Roman Catholic and Protestant thought, two streams of theology (natural and revealed) have impacted these views. The stream of revealed theology came for the people of the book (Judaism) while the steam of natural theology came from the rationalism of the Greeks.

The presentation will examine the development of natural theology with thoughts on the relationship between natural and revealed theology from Socrates to Charles Darwin. A case study involving the interactions of Charles Darwin and Asa Gray will examine the impact that natural theology and revealed theology had upon Darwin's and Gray's views of God, nature, and humanity. This case study has implications for our continuing dialogue between science and faith.

III.A: ENERGY, WATER, AND ENVIRONMENT (CONT'D)

Brown W280

Industry vs. the Planet: A Christian Perspective on Reconciling Environmental Stewardship with Industrial Advancement

Michael Whelan
Anchor QEA

Our civilization continues to grapple with the fundamental challenge of balancing industrial activity with protection of Earth's natural resources. The two elements have been at odds for over a century, as evidenced by the persistence of environmental problems, and are likely to remain so. What does scripture tell us about reconciling environmental stewardship with industrial activity in the long run?

The recent remediation of a heavily industrialized portion of San Diego Bay, California, has completed a long-standing story arc in my own professional career, spanning from my earliest days at Mines to today. In this talk, the work completed in San Diego is described as a representative example of modern environmental cleanup projects in heavily industrialized areas, illustrating the role of governmental regulation on the environmental cleanup process, the participation of heavy industry in implementing the work, and the consistency of both with Christian principles.

Scripture indicates the dual importance of humankind's industrial activity and our countering push for environmental protection. While the two sides are frequently viewed through the overly simplified but popular bimodal filter of "good vs. bad," the expression of each as a biblical mandate implies that both are to be taken into account when devising successful cleanup policies and programs. Applying a Christian perspective toward a truly sustainable future dictates a collaborative and pragmatic approach if we are to properly balance industrial and environmental needs for the long-term care of God's creation.

III.B: BIOLOGICAL SCIENCES (CONT'D)

Brown W250

A Place for Striving and "Agency" in Evolutionary Theory?

Emily R. Herrington
Grad student, U Pittsburgh

The "extended evolutionary synthesis" (EES) has been opposed by many prominent evolutionary biologists, citing concerns that more inclusive approaches to evolutionary phenomena will blur the picture of known mechanisms and processes. Interestingly, EES advocates position their views as continuous with (not replacing or significantly diverging from) longstanding neo-Darwinian (NDS) articulations of evolution. Rhetorically, this is consequential as previous attempts to update the NDS or to refine the dogma of evolutionary biology have been explicitly antagonistic in their articulation by reformers.

The unlooked-for rejection of EES desiderata by thought leaders in modern biology may therefore raise a question for some as to whether EES approaches will indeed dilute scientists' understanding of basic evolutionary mechanisms, or whether the EES will helpfully expand and complicate biologists' understanding of how organisms participate in their own becoming and/or pass on acquired attributes that do not require DNA encoding.

By asking researchers to consider the phenotype and its vicissitudes as an undertheorized, yet pertinent feature of natural selection, EES proponents problematize longstanding popular interpretations of Darwinian evolutionary theory which emphasize selection pressures and Mendelian inheritance over and above individual and population-level "responsiveness" to the stresses or constraints of an inherited environment. This presentation will consider the necessity of an extended evolutionary synthesis from within the frame of feminist philosophies of science, where the ostensibly neutral or "objective" language of academic scientific literature has been scrutinized for its inadequacy and naïveté.

III.C: EDUCATION (CONT'D)

Brown W210

The Relevance of Undergraduate Education and Climate Change Issues

Louise Ko Huang[1] and **Chong Ho Yu**[2]
[1]Center for Research in Science
[2]Department of Psychology
Azusa Pacific University

Contradictory and misrepresented information from media and other similar sources often result in knowledge gaps as well as misperceptions of climate change. Consequently, accurate climate change communication has become increasingly vital in bringing awareness and understanding of its impact.

Recent research indicates that education is the single predictor of public climate change awareness. With the introduction of climate change topics early on in their undergraduate studies, students may gain more awareness and understanding of such complex topics. Studies that focused on the role of environmental attitudes revealed that people with high levels of environmental awareness are inclined to act more pro-environmentally. Furthermore, while climate change awareness is often considered a political ideology, it is also closely connected to Christian theology.

This presentation will discuss the instruction of these topics in undergraduate chemistry courses in a Christian university. The matched t-test showed significant gain in the factual knowledge regarding climate change after the course. In addition, the relationship between self-report firmness of Christian faith and environmental stewardship is also examined. One interesting finding is that the t-test found no significant relationship between firmness of faith and four areas of religious positions (stewardship, eschatology, substantiality, and development) related to stewardship, except the one about whether Capitalism or Socialism is in alignment with the Bible. The effectiveness on raising climate change awareness and other issues that lead to appropriate action will be explored.

III.D: THEOLOGY AND OTHER (CONT'D)

SC Grand Ballroom

Does Science Lead One to Atheism?

Hans Weichselbaum
Massey University, New Zealand

Since the Middle Ages, the aim of the natural philosopher was to find natural, rather than supernatural, causes to explain observed phenomena. This approach was then formalized through a Christian philosopher who coined the term methodological naturalism (MN) only three decades ago. MN allows one to disregard the supernatural while engaging in science—without rejecting God. In contrast to MN, ontological naturalism (ON) is a worldview that denies the existence of anything beyond the natural world, including God.

However, shortly after its inception, MN has come under attack from two sides. (1) Supporters of the intelligent design movement and some Christian philosophers claim that MN restricts the practice of science and may lead one to ON. (2) A number of philosophers and scientists from the atheist camp regard MN as an unnecessary assumption which only obstructs science. We should instead adopt the real thing, namely ON. Note that both critiques predict an inevitable slide from MN to ON.

Others have suggested a form of provisional methodological naturalism (PMN) which allows the scientist to study (and confirm or refute) supernatural phenomena. This requires a sharp demarcation between the "natural" and "supernatural" which is difficult to nail down.

Science explains observed phenomena through natural causes. Having established a "natural" cause, however, does not rule out the possibility of supernatural causation, for example, by means of overdetermination. Anybody denying the supernatural realm has already rejected MN and adopted ON as the stronger form of naturalism. The theist and, more importantly, the agnostic who accepts MN will find no evidence or logical reason for abandoning MN in favor of ON.

III.A: Energy, Water, and Environment (cont'd)

Brown W280

Why Haven't You Installed a Solar Array Yet?

Ruth Douglas Miller
Kansas State University

The most common objection I hear from people asking me about solar power is, "Oh, I'm waiting for the prices to come down before I look into that." But prices for photovoltaics (PV) have been plummeting since the 1970s, and across the US, electric power generated from solar panels is at or below the retail electricity price. Simply put, if you have sufficient unshaded south-facing space on your property, and you use electricity, you should be installing solar panels.

"But how do I do that?" you ask. There are now easily accessible tools for determining how large an array you need, and how well that array will do at your location. NREL's online PVWatts application is an easy-to-use estimator that ends up telling you how much energy you can expect to generate per month through the year, and the value of that energy based on your own utility rate.

Then, you can go to one of several commercial PV sellers (Wholesale Solar, GoGreen Solar, Blue Pacific Solar) and either buy a bundled system or create your own; the sellers will include the necessary electrical diagrams and calculate what you will need for supports and fasteners.

Finally, depending on your locality, most electricians have some experience installing photovoltaics, or, you can use the industry's "find an installer" website (NABCEP).

This presentation will walk you through specifying your own solar power installation at your house, using the tools above.

III.B: Biological Sciences (cont'd)

Brown W250

An Overview of *Evolution: Scripture and Nature Say Yes!*

Denis O. Lamoureux
St. Joseph's College,
University of Alberta

Evangelical theologian and evolutionary biologist Denis Lamoureux will offer an overview of his latest book which was written for students who are high school seniors and college freshmen. It draws from his twenty years of teaching exclusively science and religion courses to undergraduates at a major public university (over 100 classes delivered). This is the book that Lamoureux wished he would have read prior to entering a secular college that quickly led him to reject his Christian faith.

Pedagogical strategies to be emphasized include (1) the power of personal stories of struggling with evolution, (2) the necessity of offering a range of Christian options on origins, (3) the affirmation of the traditional understanding of intelligent design (contra ID theory), (4) the discovery of the ancient understanding of nature in the Bible (i.e., an ancient science), and (5) the fruitfulness of class discussions.

Other resources that will be introduced are (1) online high school lectures, (2) MOOC science and religion course through Coursera, and (3) Skype question and answer sessions.

Please note: Complimentary copies of this book are available at the Zondervan exhibit.

III.C: Education (cont'd)

Brown W210

Engaging Students in Science and Faith through Study Abroad

Wade A. Neiwert
Bethel University

A distinct mission of all Christian universities is to enhance their students' personal faiths, helping them to develop a Christian worldview that is authentic. Science programs within these universities strive to help students integrate scientific content with their personal faiths. This can prove to be challenging at times, especially as the tendency to compartmentalize and separate science from faith takes over. Many students fail to see the intricate connections between science and the Christian faith.

My study-abroad course, History of Science in Europe, has proven to be an exceptional foundation upon which to help students learn about and experience these deep connections. Study-abroad programs abound, but relatively few focus on science, and even less make its historical and modern interdependence on the Christian faith a key component. The experiential nature of study-abroad uniquely lends itself toward making the relationship between science and faith more personal and impactful.

I will share the structure of the course, its content, and our travels, in addition to evidence of the impact it has on student perspectives about science and faith in their own words from blogging, journals, and papers. This course travels across Europe over January, visiting numerous cities, museums, and churches and reading several insightful texts. The discussions that ensue as a result of these experiences are truly life changing.

Plans for how to develop a more rigorous study of student perspectives on science and faith and implementation of such a study in the context of study-abroad will be introduced.

III.D: Theology and Other (cont'd)

SC Grand Ballroom

Revisiting Pollution and Property Rights: A Christian Libertarian Perspective

Jamin Hübner
John Witherspoon College

In contemporary discussions of pollution and creation care, it is common for proposed resolutions to center on achieving the "right" international policy. It is generally assumed that global problems find their solution in global regulation, and that the lack of transnational law enforcement is what led to environmental destruction in the first place; the Industrial Revolution outpaced policy-makers' ability to develop appropriate boundaries, and now the developed world is reaping these fruits.

In this presentation, I will offer an alternative narrative that demonstrates the parallel eradication of property rights in the late nineteenth and early twentieth century with the rise of industrialism, which consequently led to the alarming environmental destruction of our time.

Contrary to popular belief, a strict enforcement of local, individual-based property rights would (and has) eliminate(d) large-scale environmental destruction precisely because pollution constitutes a violation of such rights. Given that property rights has had a long history in the Judeo-Christian tradition, this is a presentation that directly integrates Christian thought with environmental ethics and remains a crucial topic of our time.

IV.A: Engineering

Brown W280

Current and Future Approaches to Brain-Computer Interface Technology

Jonathan Touryan

Over that last two decades there have been major advances in the use of neural signals to communicate with and control computers. These brain-computer interface (BCI) technologies have been primarily focused on restoring capabilities lost through injury or disease. As such, they utilize a broad range of techniques from directly implanted micro-electrodes to less invasive scalp-based electroencephalography (EEG). While these approaches have significantly improved the quality of life for the disabled (e.g., ALS patients), their application space is limited to the medical domain.

However, recent advances in EEG signal acquisition technology and machine learning have enabled novel approaches for BCI that have the potential to augment capabilities in healthy individuals. This growing area of neurotechnology utilizes brain signals that can now be measured in complex tasks and real-world environments. To achieve this required advances in signal processing techniques for the removal of electrical noise from both biological (e.g., muscle) and nonbiological (e.g., electromagnetic radiation) sources that often mask microvolt brain activity in the EEG record. Likewise, novel pattern classification techniques were required to identify the task-relevant neural activity within the high-dimensional EEG time-series.

Here, we present a brief overview of current BCI technologies and describe some recent advances in this emerging area of applied neuroscience. Finally, we place these developments within the broader context of wearable technologies and the future of human-machine integration, and its implication for the faith community.

IV.B: Medical Sciences

Brown W250

Science, Ethics, and God's Will: Approaches to Medical Technology

D. Gareth Jones
University of Otago,
Dunedin, New Zealand

Christians as much as others are dependent for their health and well-being upon medical technology. What implications does this have for Christian witness and even for theology? Real-life illustrations abound: from *in vitro* fertilization (IVF) and preimplantation genetic diagnosis (PGD), to noninvasive, prenatal whole genome sequencing with its potential to make available a vast array of genetic information early in pregnancy. From tissue engineering of functional parts of the human stomach and other tissues, to the pharmaceutical modification of cognition and morality.

Procedures such as these may have theological overtones, and Christian commentators frequently search for rules to provide guidance, designating a procedure as acceptable or unacceptable. Unfortunately, this simple classification may be unhelpful, since the complexity of the issues raised defies traditional theological approaches.

First, I shall emphasize the central significance of an understanding of the science, since all technology is scientifically driven. Second, rules, principles, and virtues have their place, but tend to be theoretical, and may not conform to scriptural precepts and the priorities enunciated by Jesus.

I shall ask what God's will might amount to in any specific situation, and what it reveals about one's character and relationship to God. I shall take as examples two contemporary areas: genetically based treatments of cystic fibrosis, and the burgeoning domain opened up by CRISPR/Cas9-based genome editing.

IV.C: Education

Brown W210

Ideas for Fortifying Biological Education

Stephen Dilley
St Edward's University,
Austin, Texas

I argue that professors and teachers ought to strengthen their students' biological education by enhancing the teaching of evolution. In particular, I recommend that, when professors and teachers present arguments for evolutionary theory, they ought to avoid a particular class of arguments that are problematic. The class of arguments in question are those that rely on God-talk as part of the positive case for evolution.

To establish my thesis, I examine "evidence for evolution" sections in a wide range of biology textbooks. I argue that, in a surprising number of cases, many arguments for evolution rely crucially on claims about "what God would do" in organic history. Close analysis of these arguments reveals the following:

1. The theology in question is essential to the arguments in which they appear.
2. The theological claims in question are by-and-large not derived from creationist (or intelligent design) theology. Instead, textbook authors bring their own theology to the table.
3. These authors overwhelmingly fail to provide justification for the truth of their partisan theological claims.
4. Many of these claims are highly contestable.

In light of these findings, I suggest that educators avoid teaching problematic theology-laden arguments for evolution and instead expose students to strong arguments for evolution that do not rely on God-talk. Doing so will enhance biological science education.

IV.D: Theology

SC Grand Ballroom

The Necessity of Death

John R. Wood
The King's University

The phenomenon of death remains a central question for natural and social scientists. I recently discussed physical death in ecological processes, briefly exploring the implications of programmed cell death in ecology. There is continuity across biotic endings that extends from cells to the biosphere. And these physical endings have implications for the practices of caring for the creation.

The traditional views of stewardship and the story of Adam and Eve are increasingly challenged by the suggestion that death plays a positive role in the created order. Today the mechanisms of aging and death are carefully studied by a wide range of natural scientists. And new anti-aging therapies, including part- and whole-body replacement techniques are presenting unique challenges to the traditional view of death in a biblical context.

Historians and philosophers have suggested that the dominant views of life and death today arise, surprisingly, from esoteric debates preceding the Reformation. It could be that the technical debate on the univocity of being—the character of God and the creation—between Thomas Aquinas and John Duns Scotus can give us new insight into the thorny questions of the fruitfulness of creation. Death on this view turns out to be a necessity.

IV.A: Engineering (cont'd)

Brown W280

Summary of US Air Force Academy Unmanned Aviation Research

Ryan K. Osteroos
The US Air Force Academy, Colorado Springs, Colorado

The need for well-developed, stable, efficient, and safe unmanned aviation systems to perform a growing number of highly complex and dangerous tasks has increased significantly over the last ten years.

Multiple departments at US Air Force Academy (USAFA) are involved in various research projects meant to satisfy these increasing requirements for both Department of Defense and industry partners.

The proposed presentation will give an overview of the various research projects currently being conducted at USAFA in this area. Most of the research that will be presented has or is currently being conducted by teams of cadets under the supervision of USAFA faculty.

IV.B: Medical Sciences (cont'd)

Brown W250

The Human Microbiome: Medical, Philosophical, and Theological Complexity

John Pohl
University of Utah

The human microbiome consists of the vast collection of microorganisms and their associated genetic signatures which interact with our species through every organ system of the human body.

We have just begun to explore this important aspect of biology and medicine, although we still do not understand fully the mechanisms involved between the microbiome and health, including the pathogenesis as well as the treatment of human disease. Additionally, the use of agents such as probiotics, prebiotics, and synbiotics are beginning to be utilized for specific diseases although the full potential benefit of such agents is not clearly known.

This presentation will discuss the human microbiome, the use of medications that may influence the microbiome, and the potential philosophical and theological aspects of the microbiome as this term affects our definition of what it means to be human.

IV.C: Education (cont'd)

Brown W210

Does the Second Law of Thermodynamics Contradict the Theory of Evolution?

Michael A. Everest
Westmont College

For several years, I have had undergraduate chemistry majors in thermodynamics courses write a paper that requires moderately sophisticated scientific and theological thinking. Specifically, I ask students to imagine that a church has invited them to serve as a science advisor and to draft a position paper for the church answering the question: "Does the Second Law of Thermodynamics contradict the Theory of Evolution?"

The assignment requires students to describe two distinct positions on the issue; moreover, students must describe these two positions such that proponents of those positions would agree that the student's description is, indeed, what they believe. After sympathetically describing two positions, students must recommend a stance for the church to take.

Most students draft papers that conform to mainstream science and also respect the values and motivations of Christians. In reading my students' papers, I have come to discover that, although all the authors in the mainstream scientific literature would answer the title question with a resounding "No!," they disagree on the reasons. Therefore, not only have my students learned to integrate faith and science with pastoral concern through this assignment, but I have also learned something about the science, myself.

IV.D: Theology (cont'd)

SC Grand Ballroom

The Ultimate Purpose of Stewardship: "The Earth Is the Lord's and Everything in It …" Psalm 24:1

Stephen Huffey
Private Scholar

Discussion about the environment often encounters a glaring gap of reasoning. It might be reasoned that if God will create "a new heaven and a new earth" (Rev. 21:1), then such teleology allays concern about the present creation. What foundational focus can motivate stewardship, science, and doing the will of God? Genesis gives impetus to Revelation about what God designed from the beginning.

In Genesis 1, daily progressive "separation" from the chaos led to "the heavens and the earth." The first verb at Genesis 1:1, "created" (Hebrew *bara*), is found to be better translated "separated." Each creation day brought higher order. It ultimately led to Adam and Eve. We live in the seventh "day—era," for the purpose to which six creation days led. The seventh day was "blessed and sanctified" (Gen. 2:3).

If "sneaking a peak" at the end of the story in Revelation, "everything" (Ps. 24:1) is "*bara*—separated" to ultimate order: goodness and evil are separated to heaven and hell, forever. Our focus is to produce works which are ultimately separated as wheat or tare heads (Matt. 13:24–30, 37–43).

Now, goodness and evil are intertwined at their roots. The purpose of creation is to separate to the final order. We are his agents in creation for separation. Creation supports our actions. This is the worth of creation and us, for God.

IV.A: Engineering (cont'd)

Brown W280

Balancing Economics with Ethics to Save God's Creation

Paul H. Carr
AF Research Laboratory (Emeritus)

The Golden Rule of ethics must re-balance our economy. At present, those with the gold make the rules. Pope Francis's *Laudato Si': On Care for Our Common Home* states that we have the moral imperative to stop plundering our planet for profit, the poor suffering the most.

Does Adam Smith's "invisible hand" guide the pursuit of individual gain toward creating the Wealth of Nations? Let's update this 1776 economics and re-balance it with Garrett Hardin's 1968 "Tragedy of the Commons," in which the pursuit of individual gain leads to negation of the common good.

The burning of fossil fuels is polluting, for free, our common atmosphere with carbon dioxide. This is warming our planet via the Greenhouse Effect. Melting ice could raise sea levels up to 18 feet by 2059. External costs such as these must be priced into our economy.

Former Treasury Secretary George Shultz advocates a revenue neutral fee on fossil fuels with a dividend to be returned to everyone. This would give non-carbon-emitting energy sources an economic advantage, and also stimulate our economy.

IV.B: Medical Sciences (cont'd)

Brown W250

Alternative Medicine and the Failure of Protestant Christianity

E. Janet Warren
Physician/Theologian

Complementary and alternative medicine (CAM) is becoming increasingly popular, and increasingly confusing, in North America. Some Christians uncritically use CAM, some "Christianize" it by adding a new label, and some reject it entirely. I believe we need to carefully evaluate it and especially consider the spiritual needs that it fulfills.

In this presentation, I review CAM, its reception in culture and the medical community, and critiques of it from both scientific and Christian perspectives. It is popular partly because it offers "natural," "simple" solutions, feeds a culture of choice, and offers hope. I suggest that part of the reason for its popularity is due to failures in both traditional medicine and contemporary Western Protestant Christianity.

Drawing on work by McGilchrist, who claims that Western culture has overemphasized logic, linearity, and compartmentalization, and has neglected a right hemisphere perspective on the world, I suggest that the Christian community needs to recover experiential, imaginative, and affective aspects of faith and life. We are called to responsible stewardship, which includes both scientific evaluation, responsible integration of faith and science, and nurture of the soul.

Some classic Christian contemplative practices are, in fact, similar to those offered by CAM. The church can offer hope in a trustworthy Savior, holistic healing, and a caring community.

IV.C: Education (cont'd)

Brown W210

Veracity Claims Assessment by Christian College Students

Michael Tenneson
Evangel University

Most college-age students should be functioning in in early formal operational stages and are likely to apply egocentric thinking (Piaget). A frequently cited (and usually encouraged) alternative to egocentric thinking is critical thinking. Critical thinkers identify presuppositions, evaluate truth claims validity and accuracy, consider alternate perspectives, and then act accordingly.

Extant studies of college student epistemological development usually describe sequences of stages or hierarchical positions (e.g., Perry and Piaget). However, insufficient data exist to determine whether or not (a) students utilize multiple epistemological positions, (b) these positions vary with culture or context, or (c) they are mental constructs, conversational practices, or social constructs.

Published studies of college student practical truth-claim evaluation do not exist. This, along with the lack of any valid and reliable survey instruments designed to study college student attitudes and beliefs about truth claim evaluation (particularly dealing with theology and science) prompted this project. We report on the development of a valid and reliable Deciding Truth Scale.

Preliminary analyses suggest that Christian college students are aware of recommended critical thinking approaches to evaluate truth claims. They also appear to favor speaker characteristics that underscore his or her credibility. They believe that new truth claims must align with currently held religious beliefs, will not be easily abandoned, and must appear to be accurate. Finally, for this population, faith is paramount, experiential, and biblically based.

IV.D: Theology (cont'd)

SC Grand Ballroom

The Implications of Relativity upon Our Understanding of Genesis One and the Christian Doctrine of *Apokatastasis*

Peter Hiett
Pastor, The Sanctuary Denver
Denver, CO

For several hundred years theologians have labored under a supposedly "enlightened" view that space and time are constants. This has radically limited our ability to exegete ancient texts written by people who did not share such limitations. In the last century, our understanding of space-time has advanced dramatically and, at the same time, come into alignment with the worldview of the Bible.

Gerald Schroeder argued that fifteen billion years from the perspective of the earth is six days from the perspective of the Big Bang (CBR, quark confinement, emission of light). This observation, combined with quality exegesis of Genesis 1:1–2:4, makes for a remarkable reconciliation of scripture and the geologic record. However, the implications for anthropology and theology are staggering. Even if Schroeder's equations are questioned, modern physics allows us to freely believe what scripture has revealed for thousands of years and what the Church Fathers referred to as the doctrine of *apokatastasis*—the restoration of all things.

I would argue that scripture has always presented a seventh day—in which "everything" is "very good"—as far more than a fleeting twenty-four-hour period in the distant past, but as the eternal consummation and destination of all creation. Humanity is still being created in the image of God through the undefeatable Word of God—Jesus. Even *hades*, *sheol*, and *gehenna* are part of the temporal creative process that consummates in the new creation filled with a-temporal, eternal Fire, that is, the very presence of our God, who is Love.

V.A: Ethics, Environment, and Economics

Brown W280

Creation as Invitation: How Nature Complements Scripture in Calling Us Back to Our Maker

Dominic Halsmer, Philip Riegert, and **Jeff Lamp**
Oral Roberts University

This study explores how God's voice resounds throughout the natural realm, producing a personal invitation to reject our own selfish ambitions and embrace a vital relationship with Christ. Specifically, concepts from engineering, theology, and ecology will combine to provide a fruitful model of nature as a series of nested affordances that emanate from God's wisdom, creativity, ingenuity, and generosity.

An affordance is simply a relationship that results in a capability. Nested (sequential and interdependent) affordances offer a unifying concept that assists in handling the complexities of design engineering and reverse engineering in natural systems. The universe exhibits this nested hierarchical structure of affordances at all levels. Human flourishing occurs as a form of niche construction in which we fully apprehend these affordances and pass them on to our offspring.

From an ecological perspective, nested affordances allow for a scientific framing of the biblical and theological depiction of the role of human beings in God's governance of the world. Human beings were tasked with the vocation to be God's image-bearing priestly co-regents with God over creation, extending God's benevolence to all creation. However, in the Fall, human beings have forsaken that role, subjugating themselves to creation in the form of idolatry that adversely affects creation and humanity's place within it. God's redemption in Christ entails, in part, the restoration of humanity's relationship with creation leading toward the redemption of creation itself. The narratives of sin and redemption provide a theological context for discussions of nested affordances and niche construction.

V.B: Physical Sciences

Brown W250

Transhumanism-Christianity Diplomacy: To Transform Science-Religion Relations

David C. Winyard Sr.
Mount Vernon Nazarene University

Progress in science and technology raises the possibility that essential elements of human life could be transformed and enhanced by applications of science and technology. Transhumanism is a philosophical and social movement that believes that such transformations are both possible and desirable.

In several respects, transhumanism's goals overlap with the hopes of Christians, who long for the Second Coming of Christ and the subsequent elimination of sin, suffering, and death for all eternity.

Based on Bruno Latour's work, I analyze the superficial similarities between transhumanism and Christianity to argue that diplomacy between Christians and transhumanists is both possible and potentially beneficial.

In developing this argument, I examine a new Christian Transhumanist Association, its leaders, and their diplomatic strategy of "theological minimalism." I argue that this strategy is flawed because it does not apply the rich insights of orthodox, biblical theology to the most vexing problem of transhumanism development: the threat that an artificial superintelligence could be hostile to human life.

V.C: Science Literacy

Brown W210

Science Literacy for the Church

Jack C. Swearengen
Professor (retired)

Mistrust, suspicion, and even fear of science is common in churches and seems especially prevalent in evangelical congregations. The historical face-off between Galileo and the Roman Catholic Church is well known; "evolution vs. creation" is a more recent example. But many other science-faith conflicts are nascent: anthropogenic global warming, fluoridation, GMO crops, genome manipulation, extraterrestrial life, to name a few.

These battles may seem inconsequential, and many of them simply don't need to be battles at all. But the consequences are damaging the church. Millennials especially have just stopped attending, and well-meaning believers wind up advocating for unsound public policies. Yet few worshippers view literacy in science as a felt need, with the unfortunate result they are unable to discern between real and imagined threats and credible vs. unsubstantiated claims. A calling to scientific literacy in the church will incorporate such into discipleship training. It will explain what science is and is not; clarify that there are several "origins" theologies, introduce theology of nature and the environment, and more.

ASA already is serving as a dynamic resource for such a calling, but many more opportunities can be identified. The author will share some of the things he has been doing under this umbrella, and the audience will be invited to share some of their own experiences.

V.D: Theology

SC Grand Ballroom

Habitability for Redemption

Hugh Ross
Founder and president, Reasons to Believe; teaching pastor, Sierra Madre Congregational Church, adjunct professor at Regent University, A. W. Tozer Seminary, and Southern Evangelical Seminary

A Bible survey revealed that every major creation text links the doctrine of creation to the doctrine of redemption. Some passages declare that God began his redemptive work before he created anything. Thus, the Bible seems to imply that all God's creation works are for the purpose of redeeming "a countless number" of human beings.

A three-year survey of the scientific literature apparently affirmed that every known component of the natural realm and every known event in natural history plays a role in making possible the redemption of billions of humans within a brief time window.

In this talk, I will describe four out of the several hundred transformationally miraculous events in Earth's recent history that makes possible billions of humans hearing and responding to the gospel message of salvation within just several thousand years.

A major factor making human redemption possible is the ice age cycle. Ice ages are rare in Earth's past. Only during the last 0.005% of Earth's history has an ice age cycle operated—an enigma given that the Sun radiates more brightly today than at any time since life began!

Research shows how the simultaneous movements of eight continents plus Greenland contributed to the cycle's launch and how the cycle made global civilization possible.

Redemption of billions is possible because of the uniquely fine-tuned features of the past ice age in the cycle and the present interglacial.

V.A: Ethics, Environment, and Economics (cont'd)

Brown W280

The Promise of Theocentric Environmental Ethics

Raymond J. Lewis
Wheaton College

A clash between popular anthropocentric values and environmentalist ecocentric values permeates our consideration of environmental ethics. I will explore a resolution by developing a distinctively Christian theocentric position that avoids the problems of either anthropocentric or ecocentric views, while also paying appropriate attention to both human and environmental values. Such a view is embedded in a rich doctrine of creation.

God as creator clearly shows he values creation, having made it out of an overflow of Trinitarian love. God's transcendence and immanence in relation to the creation maintains both God's distinctness and God's loving involvement. God made the world rationally with functional integrity that life might flourish as it does. All of God's creation is a temple where his divine glory is on display for all to see.

In a theocentric view, the center is placed on what God values, rather than placing the center in human concerns or concerns of the ecosphere. God has made and will redeem both humans and the entire ecosphere, and yet has also placed people in the place of being both a part of creation and yet set apart from the rest of creation. The potential of applying such a theocentric ethic to the care of creation will be explored using current environmental issues.

V.B: Physical Sciences (cont'd)

Brown W250

Cosmological Presuppositions

George L. Murphy
Trinity Lutheran Seminary (retired)

Religious and/or philosophical presuppositions with which a scientist begins can affect work in any area of science. But physical cosmology, the study of the entire physical universe, is especially susceptible to such influence because it almost inevitably touches on questions of ultimate origins and purpose. The fact that a theory is motivated (in whole or part) by such presuppositions does not mean that it is wrong. But that possibility can alert other scientists to the need for some "tendency criticism."

We can never be sure what presuppositions a scientist starts with, but we can make reasonable guesses. I will consider first some significant historical examples—Einstein's introduction of the cosmological constant, Milne's kinematic relativity, and the steady state theory of Bondi, Gold, and Hoyle. These display an interesting range of possible presuppositions—Spinoza's pantheism, Christianity, and atheism.

We will then look at two areas of current interest—cosmic acceleration (with associated theories of dark energy and the cosmological constant) and debates about the possible creation of the universe from "nothing."

V.C: Science Literacy (cont'd)

Brown W210

Bringing Light, Not Heat: New and Forthcoming BioLogos Resources

Kathryn Applegate
BioLogos

BioLogos invites the church and the world to see the harmony between science and biblical faith as we present an evolutionary understanding of God's creation.

While "evolutionary creation" is not a new idea for most ASA members, it is very likely new for many in your church or classroom. Starting the conversation can be difficult.

Come and hear about new and future BioLogos resources and learn tips for engaging your community graciously and effectively on what is—tragically often—a polarizing, divisive conversation.

V.D: Theology

SC Grand Ballroom

Fine Tuning of the Universe: Evidence for the Existence of God

Walter L. Bradley
Emeritus Professor of Mechanical Engineering, Texas A&M University; Emeritus Distinguished Professor of Mechanical Engineering, Baylor University

Romans 1:19–20 seems to suggest that God's creation contains sufficiently compelling "finger prints" that "those who do not believe in a Creator God are without excuse."

The very specific mathematical forms that nature takes and the requirements that many universal constants found in these mathematical forms, such as the gravity force constant, the electromagnetic force constant, Plank's constant, Boltzmann's constant, and the speed of light, are found to be very nearly what they must be to provide a universe that meets the necessary requirements for complex conscious life to exist.

This "fine tuning" argument in support for (but not proof of) the existence of God is challenged by atheists (and some theists) who claim that the multi-universe provides sufficient probabilistic resources to make this improbably "Nature of Nature" probable after all.

Others will argue from the work of philosophers, such as John Duns Scotus, that fine tuning cannot, in principle, ultimately support the existence of God. For example, Randy Isaac has presented such an argument at an ASA chapter meeting in Boston in October 2015.

This presentation will evaluate the veracity of these two objections to the use of "Fine Tuning" to support the existence of God.

V.A: Ethics, Environment, and Economics (cont'd)

Brown W280

The Ecological Virtues of Bill Mason

Paul Heintzman
University of Ottawa

Although much has been written in the last few decades about ecological virtue ethics, very little has been written on this topic from a Christian perspective. This presentation will explore the ecological virtues of a legendary Canadian canoeist, filmmaker, and painter, Bill Mason, who was also a Christian.

Mason was articulating a Christian understanding of environmental stewardship as early as the 1950s. While Mason's environmental ethic or beliefs can be derived from a number of statements he made in his writings and films, for the most part he lived rather than talked about his Christian environmental ethic.

Such an approach to life is consistent with virtue ethics which are based upon areteology (what kind of person should I be?) and associated with being and character rather than deontology (what are my duties?) and teleology (what are the consequences?) both of which are related to doing and conduct. Bouma-Prediger identified 14 ecological virtues that arise from the biblical story.

This talk will demonstrate that a number of these virtues such as respect, receptivity, humility, honesty, and hope were integral to Mason's character and led to the statement about him that "few people of any nation have been so influential in creating a sense of responsibility for the environment." Thus this presentation illustrates what a Christian ecological virtue ethic would look like in one individual.

V.B: Physical Sciences (cont'd)

Brown W250

The End of an Era? The Data Deluge and the Scientific Method: A Case Study in Medicine

D. S. Oakley
WAVi Company

The "Scientific Method" is commonly understood as the hypothesis-focused data analysis rubric introduced by Bacon. It was developed at a time when data were difficult to attain and this data "shortage" lasted for centuries. Even as recently as Einstein's general relativity, validating data took many decades to collect.

The information revolution of the last 10 years has created an unprecedented data glut, changing the way we think of data and necessitated new methods for organizing and analyzing information. Some have suggested this to be the end of an era, meaning the end of hypothesis-based analysis in favor of simple correlative techniques. While this, of course, is an over simplification, as was the scientific method itself, correlative methods have often proven necessary, particularly for ultra-large business-oriented data sets.

In this new world, then, what becomes of the scientific method? While this is not clear, what is clear is that hypothesis-driven methods are no longer always practical.

We present a test case in brain science, where "correlative" analysis of brain-electrical activity, using blind machine learning, produces useful medical information while making no attempt to understand the underlying brain function. As it may be argued that the Baconian method itself had roots in Luther's biblical method, how might these new methods affect biblical methods of the future?

V.C: Science Literacy (cont'd)

Brown W210

Linking Citizens to Science in the Interest of Faith

Dana Oleskiewicz
Aquatic Ecologist, Environmental Educator, Consultant

The least understood discipline in education is science. Mechanics of reading are learned at a young age and practiced throughout a lifetime, just as math facts (addition, subtraction, multiplication, and division) provide the foundation for all of mathematics. The central and most critical tenet of performing science, however, is, at times, not embraced within Christianity. Science is to be used only to explore the natural world. Incorporating spiritual beliefs in scientific pursuits restricts its effectiveness by closing the door to more rigorous study, limits the preparedness of students in education, and leads to false information that permeates our society.

Creation science is predicated on using the Bible, a text of spiritual truths, to make scientific claims. This philosophical approach is not only inappropriate but essentially renders the tool useless. God gave us the rules of science to teach us as we explore, unencumbered by the vast array of religious beliefs. Science points to truth on nature regardless of who is involved or their religious affiliation.

Linking citizens to performing science is one way to ensure science integrity, as the essence of the process is then better understood. Citizen science, as used in natural resource management, can engage our church communities in the scientific process through collaborative study design, data collection, building conclusions, and participatory decision making. In so doing, a better appreciation can be gained on how thorough and detailed the procedures are when scientists apply their craft, leading to greater trust in the institution of science. Faith is also enhanced within the context of enabling the Lord to more accurately reveal his truths about creation.

V.D: Theology

SC Grand Ballroom

Dispensationalism and the Alternative Ethics of Revelation

Mitchell Mallary
MPhil Candidate,
Logos Institute of St Andrews

Pope Francis rightly reminds us that "doomsday predictions can no longer be met with irony or disdain." The current rate of production and consumption, pollution, waste, and deforestation are, according to Francis, precipitating devastating crises that demand immediate action. It is therefore not surprising, albeit lamentable, that the Pope himself has been a target of none other than the president of the US, who recently withdrew from the Paris Climate Accord.

This talk will address the history and theology of Dispensationalism in America. From Darby to the *Left Behind* series, a common theme has emerged in these theological circles: an agnostic disdain for God's good creation. The theological ideas associated with this belief system have infiltrated not only our churches, but also Christian political engagement, and, notably, US foreign policy as it relates to the modern state of Israel. If the ultimate Christian hope is to evacuate from this earth via rapture, then any efforts to preserve this creation are, in the infamous words of D. L. Moody, "polishing the brass on a sinking ship."

I argue that the theological message of Revelation is the key to unlocking a Christian response to the environmental crisis. In particular, this presentation will outline the often overlooked dimension of the Christian hope: the restoration and transformation of the nonhuman creation.

May our eyes be opened to God's purposes for his creatures: death is overcome by life; suffering transformed into joy; entropy is undone by eternity. These are not alternative facts, but rather are an alternative hope, and thus an alternative ethic. The New Jerusalem compels the faithful, in the strongest terms possible, to live out the Lord's Prayer—*on earth as it is in heaven*.

V.A: Ethics, Environment, and Economics (cont'd)

Brown W280

Determining the Content of Excellent Creation Care and the Need for a Center for Environmental Stewardship and Dialogue

Johnny Wei-Bing Lin
University of Washington Bothell and North Park University

For all the enriching dialogue regarding the imperative of creation care over the last several decades, relatively little work has been done regarding understanding how to determine the content of creation care.

In *The Nature of Environmental Stewardship* (Pickwick Publications, 2016, nature.johnny-lin.com), I formulate a taxonomy for analyzing the content of creation care that covers worldviews, ethical theories, science epistemology, science-policy studies, politics, and economics.

In this talk, I discuss what a synthesis of all elements of this taxonomy might entail and presuppositions that can work against such a synthesis. I also argue for the creation of a center that will foster deeper understanding between the different sides regarding environmental issues as well as bring together those sides in dialogue in the hope of producing creation care solutions that enjoy greater social stability.

V.B: Physical Sciences (cont'd)

Brown W250

Quantum Field Theory, Personhood, and the Trinity: Echoes and Resonances

Arnold E. Sikkema
Trinity Western University

Starting over 100 years ago, quantum physics contributed to a significant shift in worldview, revealing a cosmos of uncertainty, probability, indeterminism, subjectivity, and holism. Writings of and about the nineteenth-century mathematical physicist James Clerk Maxwell, as well as the twentieth-century theological work of Thomas F. Torrance and Colin Gunton, demonstrate the beginnings of relating field theory to anthropology and theology.

Moving this forward to quantum field theory (for example, the quantum electrodynamics made famous by Richard Feynman's diagrams) strengthens the echoes and resonances this area of modern physics has with the intrinsically relational nature of personhood and the Trinity.

A revised ontology which acknowledges the (quantum) entanglement of thing with law, together with a multi-aspectual approach to created reality, allows for a coherent, rather than top-down or bottom-up, approach to both human and divine agency.

V.C: Science Literacy (cont'd)

Brown W210

Perspectives of Science among Asian Americans and Applicable Implications to Reaching the Broader Younger Generations for Christ

HanSung Hong[1] and **Se Kim**[2]
[1]Pastor, Fairfax, VA
[2]DoSER

Millennials are leaving the church. Studies reveal that ~70% of young adults leave their church life. When it comes to second-generation Asian-Americans, the rate is higher. As Christians, we are called to prepare the young to live fully for God. There is an urgency for leaders to understand this "silent exodus" as the first step toward equipping future generations in their faith journey.

According to Barna Group, a primary reason that the young depart is that "the church is anti-science." The presenter, a pastor, has explored this in a small way by looking at the loss in Korean-American churches as part of a DMin research. The study investigated the reasons millennials leave, highlighting the science and faith conflict.

In contrast to the typical topics, young Christians have more nuanced thoughts on the science and faith relationship as it impacts social justice and their lives. Though focused on immigrant churches, the findings translate to American youths and the ideas to support young believers can be extrapolated to the broader church.

This presentation will also include a secondary speaker who will comment on strategies to work with scientists to foster a positive dialogue in churches. The hope is to share opportunities for fellow believers and church leaders to better connect with and pass on the pursuit of Christ to the next generation.

V.D: Theology

SC Grand Ballroom

Eschatological Visions and Climate Change Decisions

David A. Larrabee
East Stroudsburg University

Ecological stewardship has become a generic term that encompasses different visions of the future. Some authors envision a future that allows the expansion of a consumption-based economy, but with sustainable technology. At the other extreme are authors who envision a future that replaces the consumer-driven economy with a simpler lifestyle that is closer to the land.

Dealing with the effects of climate change requires the consideration of multiple conflicting moral claims involving technologies such as fracking, nuclear power, CO_2 sequestration, and renewable energy as well as different patterns of consumption. The prioritization of these claims depends on one's eschatology, broadly defined.

Eschatology, the study of last things, is usually understood in a religious context, but it also applies within a secular context of economic theory and the role of science and technology. Every consequentialist ethical system has an implied eschatology, often unstated, which is taken on faith.

A Christian approach to environmental ethics and climate change must start with an eschatological vision that is consistent with scripture. Each eschatological vision envisions a relationship between humanity and nature, which should be consistent with scripture. Moltmann's transformative eschatology and Warner et al.'s reconciliation ecology are steps in the right direction.

The church has been moving from a vision of human dominion over the earth to a vision of the wise steward of the earth's resources. We will argue that the time has come to move from stewardship of creation to a divine vocation of serving creation.

VI.A: Engineering and Appropriate Technology

Brown W280

Quality, Reliability, Safety, and Economics: The Role of Nondestructive Evaluation for Energy Systems in Creation Care and Sustainability

Leonard J. Bond
Professor and Director, Center for Nondestructive Evaluation, Iowa State University

Ensuring safe, secure, reliable, abundant and sustainable energy is critical for economic development. There are those who see the need for a revolutionary transformation in the technologies employed to meet global needs.

In looking at the technologies encountered in most energy systems, there are clearly some common elements which can be inspected using established nondestructive testing (NDT) technologies, or variants of them, for example, pressure vessels, pipes, and concrete.

This presentation considers aspects of the evolution of nondestructive testing/nondestructive evaluation (NDT/NDE) and then discusses some examples of advanced NDE for sustainable energy systems, including managing costs of operations and maintenance, while minimizing environmental impact to make inherent risks acceptable.

It will be proposed that creation care, good engineering practices, and economics can all align as we address climate change and seek to meet the needs of providing safe, secure and affordable energy needed to support a growing global population, at least, up to some limits!

VI.B: Physical Sciences and Appropriate Technology

Brown W250

A Quick Overview of Practical, Low-Cost Options for Helping Rural Poor in Developing Countries

Martin Price
Founding CEO of ECHO International (retired volunteer)

The past decade has seen a major increase in the number of college students majoring in community development and of young professionals trying to envision what practical and creative innovations they might become involved with in struggling rural communities in developing countries. ECHO International specializes in helping both those thinking of this type of work or who are already doing it, by sharing proven, low-budget innovations that do not require specialized training. This talk will give a fast look at a few examples of things such persons might end up doing.

Examples (as time permits) will include keeping bruchid beetles from destroying beans during storage by rolling the barrel twice a day for two weeks; effectively treating malaria in areas remote from pharmacies by making tea from an Asian shrub; introducing perennial disease-resistant vegetables selected for ability to survive and produce even in extremely stressful climates; purifying and clarifying turbid water in a few hours by shaking it with crushed moringa tree seeds; increasing harvest of tilapia in ponds by increasing food supply using many vertical stakes in the pond upon which microorganisms can attach and grow; and making fuel briquettes from waste from farm or city streets, using an easily made press.

I will be available to talk individually about ECHO's 14-month paid internships in practical agriculture and appropriate technologies. To learn more about ECHO, visit www.echonet.org.

VI.C: Science Literacy

Brown W125

The Nature Mentor Momentum

Kate Hogan
Community Outreach Coordinator, Audubon Society of Greater Denver

As the Audubon Society of Greater Denver, we have made it our mission to advocate for the environment, connecting people with nature through education, conservation, and research.

Our organization is best known for our interactive birding field trips throughout the Denver-metro area and our outdoor education experiences at the Audubon Nature Center at Chatfield State Park.

We specialize in wildlife and environmental education, local conservation efforts, and non-game wildlife research.

Our presentation will include a basic introduction to our organization and our current programs and projects that we are invested in as well as give listeners an opportunity to engage in dialogue and to respond to a call to action for the necessity of nature mentoring.

Every community needs a network of excited and dedicated nature mentors to share their passion with others, to raise awareness about the natural world that surrounds us all, and to inspire others to follow in their footsteps.

VI.D: Theology

SC Grand Ballroom

Scientific Explanations Are Purposefully Limited to Natural Causes

Robert C. Bishop
Wheaton College

Methodological naturalism is often thought of as a restriction on scientific inquiry–that such inquiry cannot appeal to God or the supernatural more broadly. Some Christians have worried that this restriction is a constriction on scientific inquiry.

In his book *Divine and Contingent Order*, theologian Thomas Torrance offered a theological argument that methodological naturalism as a way of studying nature scientifically is required by historically orthodox Christian theology. Torrance's argument is missing from contemporary discussions of methodological naturalism and provides an unappreciated theological resource for clarifying the relationship between theology and scientific inquiry.

I will explore Torrance's argument and show that it connects with a very important feature of scientific practice–scientists' focus on physical/material possibilities rather than on logical possibilities for explanations of natural phenomena on their own terms.

VI.A: Engineering and Appropriate Technology (cont'd)

Brown W280

A Christian Approach to Sustainable Engineering

William Jordan
Baylor University

There are many overlapping ways in which a Christian engineer can approach her work. One approach is for the Christian to work hard and honestly at her job. While this is important, a Christian approach to engineering should be much broader than that.

Christian engineering can be seen as the deliberate practice of engineering to further the advancement of God's kingdom here on Earth. Even within that broad concept there are several additional aspects that can be explored. One of them is Christian humanitarian engineering which is the practice of engineering with a goal of helping poor people improve their lives. The subject of this presentation is a Christian approach to sustainable engineering. While this could include humanitarian engineering, it does not have to do so.

Sustainable engineering is a key part of sustainable development. While it relates to environmental damage and climate change issues, it is broader than that. The author will use the short definition for sustainable development that says it is

Enough
For All
Forever

Some Christians have reacted negatively to this topic because of their opposition to the big government and international commitment solutions that have been proposed. While governmental actions are part of the solution, free market solutions can also play a role. Some insights to this topic will be developed from Francis Schaeffer's landmark book *Pollution and the Death of Man*, and from Pope Francis's recent encyclical *Laudato Si': On Care for Our Common Home*.

VI.B: Physical Sciences and Appropriate Technology (cont'd)

Brown W250

800 Carbon-14 Measurements in Lake Suigetsu, Japan: An Opportunity to Directly Test the Young Earth Model

Gregg Davidson[1] and **Ken Wolgemuth**[2]
[1]Geology & Geological Engineering, University of Mississippi
[2]Founder, Solid Rock Lectures; Adjunct Professor, U of Tulsa

Lake Suigetsu, Japan, has become a veritable treasure trove of regional paleoecology, climate, weather, seismic activity, and volcanism over the past 100,000 years, due in large part to the preservation of tens of thousands of annual laminations (varves).

Over 800 carbon-14 measurements have been made in the upper 45 m, covering the entire span of the radiocarbon dating range (~52,000 yrs). The core and published carbon-14 data allows a unique opportunity to directly test young earth creationist (YEC) challenges to radiocarbon dating.

The most popular YEC model claims that atmospheric carbon-14 was near zero during the Flood, rising rapidly in the subsequent centuries toward its current value. Measurable carbon-14 in pre-Cenozoic samples is claimed to be evidence of deposition during Noah's Flood only a few thousand years ago.

Conventional geologic studies indicate that atmospheric carbon-14 was rarely less than its current value, and was upwards of 60% higher during the past 50,000 years due to fluctuations in cosmic ray influx. The Lake Suigetsu data allow an unprecedented opportunity to compare actual data with the competing expectations of the two models. The Suigetsu data uniquely and unequivocally fit conventional geologic expectations.

VI.C: Science Literacy (cont'd)

Brown W125

Projects to Promote the Effective Bonding of Science and Christian Faith

Jeffrey K. Greenberg
Wheaton College

Strong political and economic interests dominate American culture without the essential guidance of science and godly morality. Some may disagree with this dark assessment, but reality is indicated by our daily news and US surveys of public attitudes. As the Sons of Issachar in 1 Chronicles 12:32 were perceptive in discerning the times, so should God's people be today. In addition, those "Sons" knew what Israel should do. This Issachar spirit is both prophetic and leadership oriented.

Consider Pope Francis (Master's degree, chemistry) in reaching beyond Catholicism to share a coordinated vision for Shalom in Creation. His encyclical, *Laudato Si'* (Praise to You), integrates applied science into the needs for human flourishing in a healthy, functioning-as-designed Creation.

Other less obvious efforts bridging the moral-knowledge gap include the book, *Grand Canyon, Monument to an Ancient Earth*, written to bring scientific excellence to an easily misled church. Another project partnering non-religious scientists with Christians and others of faith, produced the volume, *Geoscience for the Public Good and Global Development: Toward a Sustainable Future*. This was published by the Geological Society of America and includes the article, "Religious Faith as Motivation in Using Geoscience to Develop a Sustainable Future." The audience for this includes faith and science communities, seeking service as a common bond. A future volume involving a great diversity of Christians is also planned to recruit young Christians into science vocations. Christians will be sharing many disciplinary-vocational stories via the new book project strategically attracting students into science as Kingdom service.

VI.D: Theology (cont'd)

SC Grand Ballroom

Paradox in Christian Faith: Simplicity and Complexity, with Insights from Theology and Modern Physics

Jason N. Hine[1] and **Richard F. Carlson**[2]
[1]Geographic Information Systems, Esri
[2]University of Redlands (retired)

The simple truth of Christianity is "Jesus loves me this I know, for the Bible tells me so." This is wonderfully true, but there is more. As we go deeper into our faith, we find puzzling complexity, some of which is paradoxical. We have examined several paradoxical issues of interest to faith, with attention specifically drawn to issues for which both modern physics and theology provide some insight.

In this presentation, we address the following issues:

1. The Bible points out that at the end of the creation week in Genesis 1, God judged creation to be "exceedingly good." In Proverbs and Job, wisdom is a hallmark of creation. Yet paradoxically the Bible contains many references to harmful consequences of the natural order, resulting in harm that falls not only on humans but also on all living creatures and on the physical creation itself. In Romans 8, we read that creation continues to groan. How does this relate to the wisdom displayed in creation and God's judgment that the creation is "exceedingly good?"

2. Throughout the Bible, we read that one of God's attributes is justice. But did Job experience justice in his God-allowed afflictions? Is justice seen throughout all creation? Again, why does creation groan?

3. Indeterminism (along with determinism) can be seen at work throughout creation, working both for and against humans, other life, and even for all of nature. What role does indeterminism play in creation, and how does its existence reflect God's wise planning?

VI.A: Engineering and Appropriate Technology (cont'd)

Brown W280

Extinguishing the Three-Stone Fire

Paul Arveson
Solar Household Energy, Inc.

Billions of people still depend on food cooked over an open 3-stone fire. This ancient practice has many serious health and environmental consequences. WHO estimates that over 4 million women and children die every year from respiratory diseases from cooking smoke.

In 2012, a Global Alliance for Clean Cookstoves was launched with a goal of providing 100 million improved cookstoves that have higher efficiency and reduced emissions. This includes solar cookers, which have no emissions, use no fuels, and can reduce fuel costs for low-income people and refugees.

Currently, I am working with an international team to develop an ISO standard for protocols that measure the performance of improved cookstoves. The US has an existing standard for solar cooker power.

Using this standard, we have been conducting heating tests of solar cookers to establish repeatability of temperature measurements. This experience will be useful in continuing work aimed at refining a protocol for the ISO standard and for constructing systems for solar cooker testing at regional centers around the world. We welcome energy researchers to join us in this endeavor.

VI.B: Physical Sciences and Appropriate Technology (cont'd)

Brown W250

Salt Range, Pakistan—Still Unsolved?

John C. Munday
Professor Emeritus (retired), Department of Science, Technology, and Mathematics, College of Arts and Sciences, Regent University

The Salt Range Formation in northeastern Pakistan lies under Cambrian age sandstone, leading to assignment of its age as Eocambrian. However, it contains botanical remains of higher plants, thus some reports assign it as Eocene.

Young-earth creationists use the discrepancy to infer that the standard interpretation of the geologic column is in error.

Mainstream proposals to resolve the discrepancy include the following: the higher plant remains are contaminants, the salt is an intrusion, the overlying sandstone is an overthrust, and higher plants evolved much sooner than widely believed.

The issue has remained unsolved for more than a century.

VI.C: Science Literacy (cont'd)

Brown W125

Conducting Meaningful Conversations in Faith and Science

Walter Rogero
Pastor, First Christian Church
Mountain Home, AR

As Christians interested in the nexus of science and religion, we sometimes find ourselves in conversation with—or even making presentations to—persons who hold racially opposing views from our own.

This session offers practical steps for creating relationships and developing meaningful conversations between people who maintain divergent or opposing views on issues of faith and science. Its suggested methodologies and approaches draw from the presenter's field experiences as an active pastor in several theologically conservative settings; from his time as a Senior Program Associate at the American Association for the Advancement of Science's Dialogue on Science, Ethics, and Religion; from his doctoral research on presenting matters of faith and science to Christian congregations; and from his formal missiological training.

Through focusing on the importance of relationship and contextualization, the session emphasizes lifting conversation beyond common points of contention to the far more interesting topics which underlie them.

VI.D: Theology (cont'd)

SC Grand Ballroom

Human Life: Accident or Inevitable?

David Siegrist

Stephen J. Gould famously stated that if one wound back the tape of evolution, it might then play out again in a completely different fashion.

Simon Conway Morris, on the other hand, holds that the development of human consciousness was virtually assured as part of the evolutionary process.

This presentation very briefly describes some of the basic chemical and biological characteristics that support the tendency for life to develop into even more complex forms. It also describes some of the apparently extremely unlikely accidents that seem critical to the development of human life as we know it.

The presentation then posits the concept of "environmental possibilism" in which background physical constraints and tendencies underlie a possibility space in which life evolves, still subject to chance and providence, with agency enabled for humans.

This presentation builds on a previous one I have given on "Life: Accident or Inevitable?"

1

Perovskite Solar Cells: Fastest Advancing Solar Technology to Date

Kenell J. Touryan
National Renewable Energy Laboratory (retired)

Perovskite is a calcium titanium oxide material composed of calcium titanate, with the chemical formula $CaTiO_3$. The mineral was discovered in the Ural Mountains of Russia in 1839 and is named after Russian mineralogist Lev Petrovski (1792–1856).

A perovskite solar cell is a type of cell which includes a *perovskite structured* compound, most commonly a hybrid organic-inorganic lead or tin halide-based material, *as the light harvesting active layer.* Such cells are inexpensive to produce and simple to manufacture (unlike the Si-solar cells in use today). Solar cell efficiencies of devices using these materials have increased from 3.8% in 2009 to 20.1% in 2014 making this the fastest-advancing solar technology to date.

This poster will include a layman's description of how the device is made and the status of its commercial availability. It will be done in a self-explanatory manner, emphasizing the fact that as stewards of God's creation a cost effective and an environmentally benign power source is very much part of a Christian's responsibility to pursue.

2

Water Quality Impacts of Arizona's Salt River Project Canal on Papago Park

Raul Botello[1] and **Berenise Charlton**
[1]Student, Grand Canyon University

Papago Park is located in the center of Phoenix, Arizona. Visitors have access to popular hiking trails, historic sites, the Phoenix Zoo, Botanical Garden, and more importantly, bodies of water recreationally used for fishing. Most visitors use the park to fish and may be unaware of the risks associated with fish consumption or exposure to contaminated water.

The purpose of this study is to measure water quality in Papago Park Lagoon 1 and the canal that feeds into it by monitoring *E. coli* and Total Coliform. Although the lagoons within the park are not used for swimming, *E. coli* can be seen as an indicator of other potential pathogens. *E. coli* and Total Coliform have been accepted as bio-indicators for monitoring the microbiological quality of not only drinking water but also other matrices such as full-body contact, partial-body contact and fish consumption. The acceptable risk of illness is 46/1,000 people if the *E. coli* geometric mean is 126 cfu/100mL.

Preliminary data for Papago Park shows 191.8 MPN/100mL Total Coliform concentration threshold for samples from the canal and 416.0 MPN/100mL for Lagoon 1. Furthermore, sample results showed an increase in *E. coli* of 15.8 MPN/100mL concentration threshold from the canal to lagoon. The data collected from this study may help public officials identify ways to reduce potential risks and protect public health.

3

E. coli as an Indicator of Water Quality at Papago Park

Amanda Burns[1] and **Berenise Charlton**
[1]Student, Grand Canyon University

The quality of many water reserves is easily degraded due to the introduction of contaminants. The extent of these potential risks can be determined through the examination of the presence of *E. coli*. Under the Clean Water Act, the human population became stewards acting on God's behalf to protect water reserves. Therefore, government agencies such as the Arizona Department of Environmental Quality (ADEQ) enforce and monitor the set standards of *E. coli* concentrations to 235 cfu/ 100mL for full body contact and 575 cfu/100mL for partial body contact.

Our study focused on Papago Park, located in Phoenix, Arizona, in which 7.8 acres of the land are covered by water reserves connected to the Salt River Project Canal. These water areas are open to the public for recreational uses. The purpose of this study is to determine the relationship between water quality and recreational usage indicated by the presence of *E. coli.*

Upon sampling, preliminary data shows *E. coli* concentrations were at 75.9 cfu/100mL while the highest total coliform concentration was greater than 2,419.6 cfu/100mL. Even though these are within the limits, it poses high health risks, such as gastrointestinal illnesses, to individuals, even upon brief exposure. Nonetheless, with the limitations set, the water pollution may exceed the maximum value without being closed off to public access. This study will help manage water quality at Papago Park and identify remediation methods.

4

Stewardship of Papago Park, Phoenix, AZ: Examining the Effects of Recreational Activities on Vegetation

Carola Davila
Student, Grand Canyon University

Due to Phoenix's mountainous surroundings, desert parks are frequently utilized by Phoenicians for recreational activities. A specific park is known as Papago Park, it is home to a unique variety of native plants, such as saguaro, mesquite, palo verde, and creosote.

It is most known for its distinctive sandstone butte known as The Hole in the Rock, which was named by the Hohokam Indians. It is also known by a white pyramid entombed by Arizona's longest elected governor, George Wiley Paul Hunt. The park's recreational activities include hiking, biking, and fishing.

In an effort to protect these desert parks, measuring and collecting data is necessary for the identification of the extent of human impact on Papago Park. The data have been collected using a transecting method which measures the density of plants per 25-meter plots that go out in north, south, east, and west directions. At every meter, a 2.5 ft. tall, quarter-inch diameter rod is dropped, any vegetation touching the pin is identified and recorded.

Preliminary results show an average of 89% soil and 11% vegetation. Due to the low percentages of vegetation densities, designated trails and increased signage are recommended. In addition to low vegetation densities, litter is observed throughout. Additional waste facilities and a brochure explaining the park's significance are also recommended.

5

A Teaching Strategy to Relate Christian Faith and Scientific Explanations of Origins: Its Impact and Effectiveness

Joanna R. Klein,[1] M. Elizabeth Barnes,[2] and **Sara E. Brownell[2]**
[1]University of Northwestern, St. Paul
[2]Arizona State University

Christian students often question how to integrate their faith with the scientific information they are learning in the classroom. One issue at the forefront is how to relate scientific and biblical explanations of origins. While Christians hold a variety of positions regarding evolution, many perceive that evolution and Christian faith are in conflict. To address this perceived conflict in an upper level genetics course at a Christian university, we embedded a unit centered on the book *Language of God* by Francis S. Collins. Additional instruction elaborated on points addressed in the book; and students participated in an online discussion forum, concluding with a final written reflection.

To test the effect of this curriculum on student perception of the conflict between evolution and religious faith, we administered a survey before and after students read the book. We found that while there was some movement in student opinion, many students did not change their thinking over the course of the unit. Our findings contribute to a growing body of research that explores the effectiveness of teaching methods and materials for evolution education and will inform future instruction.

6

Addressing the Undiscussed

Dina Higgins and **Samantha Russell**
Grand Canyon University

The education of our students is a solemn responsibility; we are not only preparing them for their future careers but for service to humankind. This preparation needs to address more than the subject matter, we must be sure to address the wellbeing of the student.

The top two causes of death for college students are accidents and suicides. According to the National Center for Statistics and Analysis, ten percent of all drivers 15 to 19 years old, and eight percent of all drivers 20–29 years old, involved in fatal crashes were reported as distracted at the time of the crashes. Half of all teen occupants who die in passenger vehicle crashes were unrestrained and 41.5% of students had texted or e-mailed while driving.

These numbers suggest that an educational opportunity is being missed. To address this, a safety minute has been added at the beginning of an introductory level engineering course. Short informational videos are shown and then the safety factor discussed.

The suicide rate of college age students is an undiscussed plague facing our students. The balance of the demands of school, work, and life can be complicated. A "Favorite Verse" slide has been added to each class giving both students and instructors a moment in God's Word. This time allows for a personal exchange of the importance of the Word of God in everyday life.

7

Integrating a Christian Worldview into an Introduction to Engineering Course

Samantha Russell, Manny Cota, and **Michael Sheller**
Grand Canyon University

Engineering ethics are often covered in an introductory course in an engineering program through exploration of The Code of Ethics for Engineers. The Code captures ideas such as conducting oneself with integrity and honesty, speaking objectively and truthfully, and considering safety, health, and welfare of the public with utmost concern. These ideas are essential for current and future engineers; however, they do not provide an ethical basis to hold to these canons.

We attempted to explore specific aspects of this basis in an introductory engineering course through the lens of a Christian worldview (CWV). The course consisted of a series of integrated lectures and labs that culminated in the building of a rough prototype of a robotic hand. Concurrently, certain fictional essays by Nathaniel Hawthorne and additional readings on the topics of philosophy of science and transhumanism were discussed both in class and in an online platform. The final topic in the course paralleled discussions on transhumanism and the construction of the robotic hand.

Questions were asked regarding the nature of our humanity and our creation in the *Imago Dei*, given the fact that we can replace our physical selves with engineered constructs like the robotic hand. The students were asked to write an essay incorporating the ideas discussed throughout the course. Several students' essays are being entered into a competition in *Christianity Today*. Finally, this course provides an introduction and impetus for a required CWV course later in the program.

8

Combining Engineering Fundamentals and Personality Indicators in a First-Year Retention Program

Marette Hahn, Christian Clifton, Joel Conrad, Rachael Wecker, Destiny Woods, Sarah Montgomery, Sheri Smith, and **Michael Sheller**
Grand Canyon University

Personality markers have been shown to be predictors of success in engineering programs. The Indigo personality assessment has been used in high schools and universities to identify at-risk students based on five distinct metrics: managing stress, self-confidence, self-esteem; sense of belonging; resiliency; self-direction; and feelings about future. However, retention programs based on personality assessments are not necessarily attractive to university students in engineering.

In this program, all students in the first-year, introductory engineering course were required to take the Indigo personality assessment and were invited to the program. Workshops were created to explore fundamental engineering concepts in combination with discussion questions that addressed the above metrics from a Christian worldview. For example, after a brief introduction to its material properties, clay was used to create models of heroes who inspire the students to succeed. A discussion to address the metric of self-direction then followed examining the connection between the traits of a good hero and the qualities to which they aspire. One student focused on Jesus as his hero stating, "It is his love and compassion for others, not just in words but also actions, that I want to emulate in my life as an engineer by helping others."

Many of the students involved expressed interest in continuing with similar programs during their entire four-year program of study. Future plans include recruiting students from additional STEM programs so quantitative analysis investigating the relationship between retention and personality metrics can be pursued.

9

Developing Tools to Promote and Measure Science-Faith Integration in Emerging Young Adult Christians

Robbin Eppinga and **Lydia Marcus**
Dordt College, Sioux Center, Iowa

The recent and significant increase in the number of young adults self-identifying as having no preferred religion rather than Christian suggests that there is a great need to help young Christians integrate science and faith, especially at this time when many voices—religious and atheist—are proclaiming science and faith to be incompatible. According to Pew Research Center, 78% of US citizens who identify as atheistic, agnostic, or nonreligious grew up in religious homes, and 36% of these religious "nones" cite a perceived conflict between science and religion as the reason for their loss of faith.

Here we present our recent two-pronged approach to addressing this problem at our institution. First, we are building and implementing new learning modules designed to help emerging young adults integrate science and faith. Second, we have built and are testing a new survey-based tool to measure the impact of these learning modules on the learner's science-faith maturity.

We implemented two learning modules addressing evolution, extinction, climate change and creation care at Dordt College, a Christian liberal arts college that draws conservative reformed Christian students. Feedback from students, obtained through our survey-based evaluation tool, indicated that the modules helped students think through their perspectives on science and faith questions and integrate their faith with current science more effectively.

10

Eradicating Bible Poverty around the Globe

Richard E. Denton, Tod J. Allman, and **Stephen A. Beale**
Dartmouth College

People around the world are impoverished in a variety of ways: financially, educationally, emotionally, socially, and spiritually. There is also Bible poverty; more than 300 million people around the world do not have any part of the Bible in a language they can understand well. In additional, more than one billion people do not have an Old Testament in their own language.

The Bible Translator's Assistant Inc. is developing technology to eradicate Bible poverty around the globe. Specifically we're developing a software system which is capable of translating the entire Bible, commentaries, devotional materials, and Christian classics into a new language in a fraction of the time required by manual translation. Our software system is a large-scale multilingual natural language generator designed and developed entirely from a linguist's perspective. The system incorporates extensive typological, semantic, syntactic, and discourse research into its semantic representational system and its transfer and synthesizing grammars.

The system has been tested with a variety of languages including English, Korean, Kewa (Papua New Guinea), Jula (Cote d'Ivoire), North Tanna (Vanuatu), Tagalog (Philippines), and Ayta Mag-Indi (Philippines). In every case, the system has generated initial draft translations that are of such high quality that they typically quadruple the productivity of experienced mother-tongue translators.

This poster will present some of the details of the semantic representational system and the transfer and synthesizing grammars. It will also describe the results that have been achieved in the Philippines.

11

Evolution of Nutrient Resorption in Sunflower

Ashley Rea,[1] **Chase Mason,** and **Lisa Donovan**
[1]Grad student, University of Georgia

Plant resorption of nutrients from senescing tissues to growing tissues represents a key component of nutrient use and nutrient cycling. However, the evolutionary patterns of nutrient resorption remain unclear, particularly for herbaceous plants.

To determine how nutrient resorption correlates with other leaf traits, we compared nitrogen and phosphorus resorption in 27 *Helianthus* (sunflower) species to previously published leaf trait data. To determine how nutrient resorption correlates with native site environmental characteristics, we compared nutrient resorption to native site soil and climate data for each population. Specifically, we asked the following questions: (1) How does nutrient resorption relate to other leaf economics traits? (2) How does nutrient resorption relate to leaf phloem and defense traits? (3) Does site environment predict nutrient resorption?

We found that nutrient resorption correlated with leaf structural investment, productivity, and chemical defenses but not with phloem capacity. Nutrient resorption correlated positively with water availability, but it generally was not predicted by soil fertility or nutrient limitation.

Our results show that higher precipitation predicts higher nitrogen (but not phosphorus) resorption levels and, therefore, lower leaf litter quality, which has important implications for nitrogen cycling. Our results also suggest that nutrient resorption may be a resource economics trait, with higher levels of resorption seen in more resource-conservative species.

To our knowledge, this is the first study to use a common garden survey with phylogenetically controlled analyses and preselected leaves to determine evolutionary patterns of nutrient resorption in herbaceous species.

12

A Case for Cornelia de Lange Syndrome: Regulating Protein Phosphorylation to Understand Disease

Julie Woodman
Colorado Christian University, Lakewood, CO

Cornelia de Lange Syndrome (CdLS) is a severe developmental disorder with a multitude of congenital defects. CdLS is caused by one of a few different genetic mutations in the patient's DNA, many of which have been mapped to a gene called NIPBL. This same gene is found in yeast with a similar sequence and similar cellular function though it carries a different name, Scc2. We provide evidence that in yeast, Scc2 becomes phosphorylated and that these post-translational modifications play critical roles in regulating the protein's activity.

We first mapped several phosphorylation sites throughout the Scc2 protein. We then genetically altered these sites to abolish phosphorylation or to constitutively mimic the modification. We find that mimicking constitutive phosphorylation, and thus abolishing the ability to regulate the protein with phosphorylation, severely disrupts its function.

This work provides greater insight into the etiology of CdLS. It may also serve useful to determine the effects that a CdLS patient's mutation may have on disrupting cellular functions.

13

Ortho Cleavage of Protocatechuate in Lignin Degradation by *Bacillus subtilis*

Daisy Savarirajan[1,2], Ramesh Velupillaimani[1,2], and **A. Mahadevan[2]**
[1]College of Science, Engineering, and Technology, Grand Canyon University, Phoenix, AZ
[2]Center for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai, India

Bacillus subtilis (MDB1), isolated from the coastal waters of Bay of Bengal, Chennai, India, utilized protocatechuic acid (PCA) as the sole carbon source. The strain efficiently degraded PCA up to 20 mM and utilized glycerol as a cometabolite. Rothera's test indicated cleavage of the benzene ring at *ortho* position and the formation of keto compounds of the β- ketoadipate pathway. Production of protocatecuate 3, 4 dioxygenase (3, 4-PCD) due to the intradiol cleavage of PCA was confirmed by enzyme assay. The strain was resistant to various antibiotics and harbored a single, cryptic, mega plasmid. Plasmid cured cells of *B. subtilis* (MDB1) also utilized PCA (20 mM).

The low pathogenicity of *Bacillus subtilis* makes it possible for potential use in bioremediation. Moreover, this specific marine strain has a significant advantage among an array of microbes used in environmental clean-up of aromatic pollutants formed by the breakdown of lignin present in industrial and agricultural wastes in marine environments.

14

Biochemical and Spectroscopic Characterization of PSI-LHCI-LHCII Supercomplex from *Chlamydomonas reinhardtii* Cells Adapted to State 2 Conditions

Ramesh Velupillaimani,[1,3] Daisy Savarirajan,[3] Julian Whitelegge,[2] Su Lin,[1] and **Andrew N. Webber[1]**
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[2]U of California, Los Angeles
[3]Grand Canyon University, Phoenix, AZ

To determine the photosynthetic antenna remodeling and excitation energy transfer during state transition, two forms of PSI-LHCI supercomplexes were isolated from *Chlamydomonas reinhardtii* cells acclimated to State 1 and State 2 conditions. Following detergent solubilization and sucrose gradient density centrifugation, State 1 thylakoids yielded three green bands (B1, B2 and B3). From the top of the gradient, band B-1 contained the major LHCII proteins, band B-2 contained the PSII core complex, and band B-3 contained the PSI–LHCI supercomplex. State 2 thylakoids yielded four green bands (B1, B2, B3 and B3'). The additional band B3' contained PSI-LHCI-LHCII supercomplex polypeptides (as evidenced from SDS-PAGE polypeptide profile).

Analysis of band B3', using liquid chromatography combined with electrospray-ionization mass spectrometry (ESMS), revealed around 50 different Intact Mass Tags (IMTs); many of these IMTs were assigned to known components of PSI as well as the thylakoid ATP synthetase. ESMS fractions were further digested with trypsin and the peptides analyzed by liquid chromatography with tandem mass spectrometry (LC-MSMS). The analysis confirmed the presence of subunits PSI, ATP synthetase, LHCI, as well as some specific members of the LHCII super family. Spectroscopic characterization of B3' band using time-correlated single photon counting and streak camera fluorescence kinetic measurement at room temperature revealed an increased antenna size in the PSI-LHCI supercomplex. Global analysis of the fluorescence kinetics indicated an additional fluorescence decaying process with a lifetime of 258 ps, which likely originates from the functional coupling between the LHCI and LHCII antennas.

15

Interpreting Goose Poo for Improved Orchard Establishment

Christopher Buschhaus
Crandall University

Weed management during orchard establishment remains a problem for organic producers. The simplest solution starts with using conventional methods to establish the fruit trees and then transitions to organic methods during the growth period.

Another possibility increases the complexity of the agroecosystem by introducing select herbivores such as geese to naturally reduce weed pressure. This also provides the benefit of a secondary crop. In such a system, the understory cover crop must balance many functions, including nourishing the geese. What combination and ratio of cover crops do geese prefer? Direct observational studies are limited in determining the relative quantities of the consumed plants.

Here we report trialing a method that has gained use primarily in larger herbivores for determining forage consumption, namely the analysis of plant wax markers in herbivore faecal matter. The waxy coating of plants have distinct chemical signatures. As these compounds are minimally degraded during digestion, their recovery from faecal matter provides an indication of the relative quantities of species consumed. These insights in turn may govern the selection and ratio of understory plantings in orchards or other agroforestry systems for enhanced weeding by a secondary crop of geese.

16

Expanding Magnetic Resonance Techniques into Live Whole Cells for Membrane Protein Studies

Arthur K. Sikora,[1,2] Benesh Joseph,[3] Morgan Matson,[1] Jacob Staley,[1] and **David Cafiso[1]**
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[2]LaGrange College, LaGrange, GA
[3]Johann Wolfgang Goethe University, Frankfurt, Germany

Membrane proteins may be influenced by environment, and they may be unstable in detergents or fail to crystallize. As a result, approaches to characterize structure in a native environment are highly desirable. Whole cell DEER studies represent a novel general strategy for precise distance measurements on outer membrane proteins in whole *E. coli* cells and isolated outer membranes.

In this work, the cobalamin transporter BtuB was overexpressed and spin labelled in whole cells and outer membranes, and interspin distances were measured to a spin labelled cobalamin using pulse EPR. A comparative analysis of the data reveals a similar interspin distance distribution between whole cells, outer membranes and synthetic vesicles. This approach provides an elegant way to study conformational changes or protein-protein/ligand interactions for large outer membrane protein complexes in whole cells and native membranes, and provides a method to validate high-resolution structures of membrane proteins in their native environment.

In this study, the concentration of BtuB used corresponds to about 105 copies per cell, which is comparable to the expression level of some endogenous outer membrane proteins. A comparison of data between three different membrane environments indicates that the lipid composition does not significantly influence the loop conformation. These native preparations provide a versatile tool to study membrane proteins and unlike the alternate approaches, does not require the tedious processes of solubilization, purification, and membrane reconstitution of the target protein.

This work was supported by NIGMS, GM035215 (DSC) and *Deutsche Forschungsgemeinschaft* SFB 807 (BJ).

17

Chance, Divine Foreknowledge, and the Sovereignty of God

Charles Kankelborg
Montana State University, Bozeman, MT

Divine foreknowledge is arguably an important underpinning of divine sovereignty. The best available understanding of quantum mechanics entails truly random microscopic events. Moreover, nonlinear systems prevalent in nature can amplify small perturbations, so that quantum uncertainties cascade upward in scale to generate random macroscopic outcomes. Does the ubiquity of random processes in nature place limits on the ability of God to foreknow events in our universe? Hence, is the sovereignty of God limited?

I argue that the traits of random processes in the physical world are routinely reproducible by processes designed and used by human beings to generate random numbers. Random number generators allow us to pursue stochastic modeling in a framework that also permits complete foreknowledge and reproducibility. Building on this analogy, I propose a toy model to demonstrate that there is no necessary conflict between random chance and divine foreknowledge. The model is posed as an example; other modes of divine foreknowledge may be more theologically satisfying. However, apart from the specific question of foreknowledge, the approach presented here may provide an avenue to investigate other challenges to divine sovereignty.

18

Why Forgive? Differential Outcome Following Interpersonal Injury as a Function of Reasons for Forgiving

Kathryn Belicki, Shanmukh Kamble, Tammy Stewart, and **Nancy DeCourville**
Brock University and Karnatak University

Here we describe two studies: one conducted with 274 students at Brock University, Canada (194 women, 79 men, 1 undeclared), and one with 159 students at Karnatak University, India (114 women, 42 men, and 3 undeclared). All participants had forgiven an offender. They completed the most recent version of the Reasons for Forgiving Questionnaire (R4FQ), a questionnaire we developed over several studies that identifies nine different forms of forgiveness based on the primary reason for forgiving.

Participants were also asked to imagine that they were sitting beside the offender and then completed measures of mood (Positive and Negative Affect Schedule—Expanded Form, and the State Anger subscale of the State-Trait Anger Expression Inventory-2), as well as the Transgression-Related Interpersonal Motivations Inventory that measures two motives: a desire to avoid the offender and vengefulness toward the offender. Reasons for forgiving were differentially associated with mood, desire to avoid the offender, and vengefulness.

In general, forgiving for a principle, or out of affection for the offender, or from empathy for the offender were associated with positive outcomes, while reasons for forgiving that were focused more inwardly on the well-being of the forgiver were associated with poorer outcomes. These findings help account for the very small relation that has been found in prior research (including our own) between forgiveness and well-being. Specifically, there are many forms of forgiveness, and not all will be associated with improved health.

19

Attachment to God versus People: Relations to Outcome Following Traumatic Events

Jolena-Sophia Des Alexandra and **Kathryn Belicki**
Brock University

This research focused on attachment styles to people and God, and the differential impact of attachment to people versus attachment to God on outcome following different types of upsetting events (interpersonal offenses versus impersonal tragedies). Attachment style refers to the quality of bonds a person typically forms with others.

Prior research has shown that attachment to God is correlated with attachment to people. Given this, we wanted to investigate whether attachment to God is essentially another expression of general attachment or whether it is a different, albeit, related construct. We hypothesized that they would be different and that this would be reflected in (1) both attachment to people and attachment to God independently contributing to prediction of outcome following upsetting events, and (2) both attachment measures differentially predicting outcome following interpersonal offenses versus impersonal tragedies.

Two studies were conducted: one with 183 Christians who had experienced an interpersonal offense; the other with 187 Christians who had experienced an impersonal tragedy for which no person could be blamed. Participants completed measures of attachment to God and to people, as well as measures of post-traumatic symptoms, forgiveness of people, and forgiveness of God. On balance, the results suggested some independence between attachment to God and attachment to people. For example, attachment to God significantly accounted for variance in post-traumatic symptoms following an impersonal tragedy but not following an interpersonal offense. Moreover, attachment to people predicted forgiveness of the offender, while only attachment to God predicted forgiveness of God.

20

Why Science and Faith in a Designed Universe Are Not Mutually Exclusive Using Plantinga's Arguments

Anjali Fahnestock and **Emily Grace**
Sterling College

The question of how religion fits into today's modern world, with advancing technology and science at the forefront, is often asked by many people. The general consensus is that science and religion are two distinct fields with little intermingling.

Using Plantinga's arguments in *Where the Conflict Really Lies: Science, Religion, & Naturalism*, as well as modern scientific research, one can see that the study of faith and science in unison is not only complementary but also deepens the understanding of the other.

The presence of a Creator is found in all aspects of life—from the prehistoric past, with events such as the Cambrian Explosion, to the natural wonders in plants and animals, at the cosmological level with the fine-tuning theory, and even at the subatomic level with quantum mechanics.

To study science from a naturalist point of view is to approach the field from an incomplete perspective.

21

Choices and Management

O. Favour Ayodele
Patriot Bible University, CO
Nigeria Extension

The typical fundamental of faith, engineered by man's choice to fulfil both mandate and destiny is *"And if it seem evil unto you to serve the Lord, choose you this day whom ye will serve; whether the gods which your fathers served that were on the other side of the flood, or the gods of the Amorites, in whose land ye dwell: but as for me and my house, we will serve the Lord"* (Joshua 24:15).

A man with vision and mandate knows how paramount it is to make his dream a reality; decision on this regard must be aligned with the creator's will. *"As many that know their God shall be strong, and do exploits"* (Daniel 11:32).

To every destiny there's a purpose, and to every purpose there's a path to follow. No one lives without choice; this is the most basic divinity ideology—to give every man free-will dominance against being pressured or monitored but to willingly adhere to both his input and the consequencial aftermath. When man's choice is absolutely at the opposite side of God's principle, sandy life will be inevitable.

The guidelines found in the Bible to discover the reality of humans' existence for maximum impact must be duly followed. Exploring new heights in a scientific environment must be by the application of God's philosophy with efficient management regardless of the daily trial, challenges, and tribulation that Christians face from every corner of the world.

The choice to explore the deep part of God will shape and put the world right. This classification is of clarification on managing what we choose to do that must be in line with God's perspective so that every level of man's kismet will always have a positive result toward scientific approach.

22

Effects of Climate Change on Crop Choices in Colombia

Amy K. Blom,[1] Etelvina Salas,[2] Lillian Hall,[2] and **Raymond J. Lewis[1]**
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The small-scale farmer in Colombia has sat in the crossfire of an internal conflict for many decades, often pitting small production with the land use interests of other, often militarized, groups. In addition to these challenges, small farmers are facing a new and increasing threat to their livelihood—climate change.

I spent six months volunteering with a grassroots peace building organization in Colombia named Sembrandopaz ("sowing peace"). With the help of Sembrandopaz, I surveyed approximately fifty families regarding agriculture and food in two rural, small farming communities near the Caribbean Coast of Colombia.

The initial goal was to provide a description of trends in agricultural production and food consumption for families in the communities. As I conducted the surveys and talked to key informants in the communities, climate variability was a major theme that emerged; a theme intimately linked to food production and food consumption in both communities.

Existing research has demonstrated that increasing temperature and more erratic rain patterns have already been shown and will continue in Colombia as a result of climate change. These climate changes were frequently expressed in my interviews, and the resulting effects have led to decreased quantity and variety in agricultural production. This has negatively impacted career, food consumption, and nutrition for the small farmer on the Caribbean Coast of Colombia.

23

How Different Philosophies of Science Affect Your Faith and Worldview

Jim Buchholz
California Baptist University

The two most prominent views of philosophy of science are often referred to as "Puzzle Piece" and "Intermediate Solutions."

An informal definition of a "Puzzle Piece" (or "Treasure Chest") philosophy of science might go something like this. Every time we find an answer to a fundamental question in science, we have found another piece to the puzzle of nature. Each piece is a valued entry in the realm of the whole puzzle. Likewise, the term "Treasure Chest" is often preferred because of the intrinsic implications to the word treasure. We have found another piece of treasure in the "Chest of Nature."

An informal definition of an "Intermediate Solution" philosophy of science might go something like this. Expect every answer to a fundamental question in science to be replaced by something better, later. Every solution to a fundamental problem in nature is an intermediate solution. Understandings in nature will continue to get better, deeper, and closer to the truth. Do not be stunned by paradigm shifts in scientific explanations of nature. Expect them.

I will discuss these philosophies of science and how they affect our faith and worldview.

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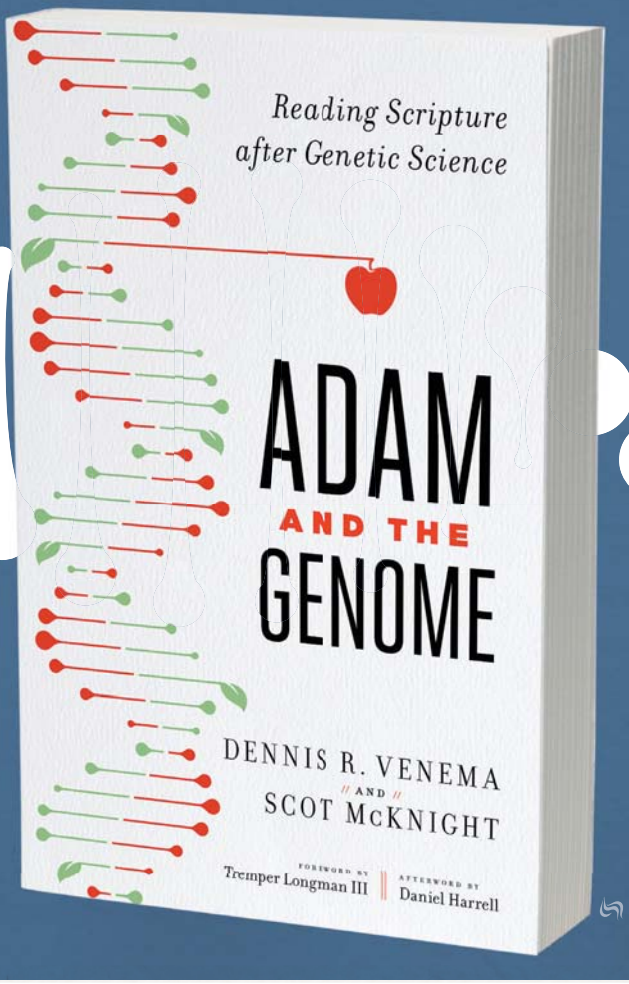

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