The Joyful Complementarity of Science and Faith

But...How Should Believers View Advances in Biotechnology?

Francis S. Collins, M.D., Ph.D.
American Scientific Affiliation
July 28, 2018
“Gene Hunter”

• Cystic fibrosis
• Huntington’s disease
• Neurofibromatosis
• Hutchinson-Gilford Progeria Syndrome
Reading the human DNA instruction book
The future of health begins with you

www.joinallofus.org
Rose Window, York Minster  
(Photograph by C.J. Bassham)

View Along the Axis of the β DNA Double Helix  
(Courtesy of Dr. R. Langridge)
Nature provides some interesting pointers to God

- There is something instead of nothing
- "The unreasonable effectiveness of mathematics"
- The Big Bang
- The precise tuning of physical constants in the universe
- The Moral Law
Faith and Science

- Two ways of knowing
- Science answers how, faith answers why
- Reading both of the books God gave us (Bacon)
  - The book of God’s words – Scripture
  - The book of God’s works -- Nature

*No problem, right?*
This week’s guest artist: Francesco Marciuliano

WE CAME FROM CHEESE!

WE JUST APPEARED IN THE BAG!

THE NEVER-ENDING DEBATE BETWEEN CHEDDAR AND EVANGELICAL GOLDFISH CRACKERS.
A Scientist Presents Evidence for Belief

The Language of God

Francis S. Collins
A simple synthesis of science and faith

Almighty God, who is not limited in space or time, created a universe 13.8 billion years ago with its parameters precisely tuned to allow the development of complexity and beauty over long periods of time.
God’s original plan included the mechanism of evolution to create the marvelous diversity of living things on our planet. Most especially, that creative plan included human beings.
After God’s plan for evolution, in the fullness of time, had prepared a sufficiently advanced brain, humanity was gifted with free will, consciousness, and a moral sense. Thus humans were granted special status, “made in God’s image”.
We humans used our free will to disobey God, leading to our realization of being in violation of the Moral Law. Thus we were estranged from God our Creator, who embodies all that is good, loving, and holy. For Christians, Jesus Christ is the solution to that estrangement.
What could this synthesis be called?

Bios = Life
through
Logos = The Word

Or more simply, “BioLogos”

*God speaking life into being*
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.
GORDON
COLLEGE

In Honor of R. Judson and Janice Carlberg

The trustees, faculty, staff, students and friends of Gordon College designate this hall of worship and community engagement in honor of Gordon’s seventh president, Jud Carlberg, and his wife, Jan, in recognition of their dedication to fostering a welcoming and vibrant community marked by leadership, devotion, creativity, and passion for excellence.

JUNE 2011
In essential things -- unity
In non-essential things -- liberty In all things -- charity
But...How Should Believers View Advances in Biotechnology?
Some ethical challenges in biotechnology

- Privacy of human DNA databases
- Animal research – especially non-human primates
- Neuroethics – the BRAIN initiative
- Human embryonic stem cell research
- Human-animal chimeras
- Dramatic life extension
- Gene editing
CRISPR-Cas9 and Gene Editing

- Basic science advance: from studies of yogurt, bacterial viruses
- Achieves precisely targeted editing of genomes – “search and replace”
- Has revolutionized basic molecular biology
- Applications to human genetic disease now being actively explored
The Promise...

Welcome to the Golden Age of Human Gene Editing

Gene Editing of CCR5 in Autologous CD4+ T Cells of Persons Infected with HIV

CRISPR gene editing tested in a person

Trial could spark biomedical duel between China and US.
The Peril...

“We must not allow our technology to exceed our humanity.”

- Albert Schweitzer
Concern About “Playing God” Is Not New to Biotechnology

Recombinant DNA
Genetic Engineering
Cloning
Human Genome Project
Synthetic Biology
Genome Editing
DIY

70s  80s  90s  00s  10s  Present
Applications of Human Gene Editing

- Somatic cell gene editing
  - Focused on a particular organ
  - Does not affect the “germline”, so not passed on to children
  - Holds promise to cure many genetic diseases
  - Already being used for cancer immunotherapy
  - Clinical trials for sickle cell disease will begin this year
Fulfilling The Promise…
Toward the 1st Cure for the 1st Molecular Disease?

Sickle Cell Disease (SCD)
- 1910: Disease described
- 1949: Inheritance shown to be recessive
- 1957: Genetic basis determined
- 1980: Hemoglobin genes cloned
- 1998: Hydroxyurea, first approved SCD drug
- Recently: Bone marrow transplants, but few patients have match
- 2017: Gene transfer via viral vectors
- 2018: CRISPR/Cas gene editing
Disorders with Known Molecular Basis

Source: Online *Mendelian Inheritance in Man*, Morbid Anatomy of the Human Genome
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- Germline gene editing
  - Involves changing the DNA of a human embryo
  - Affects future offspring too
  - Medical applications harder to identify
  - Potential to go beyond treatment to enhancement?
Advances in Gene Editing

Moving From Abstract to Concrete…

- Once hypothetical concerns and academic discussions of bioethics made more real by advances in biotechnology
  - Area of greatest concern: Use of improved gene editing tools (CRISPR/Cas) for germline modification of humans

- Is there justification for prevention of disease?
  - Specific examples are not very compelling

- Is there justification for enhancement?
  - Scientific concerns
  - Safety concerns
  - Philosophical/theological concerns
  - Equity concerns
  - Boundaries not really clear
Is Enhancement Always Bad?

**Timetable to Feasibility vs. Level of Concern**

1. Hair coloring
2. Music lessons
3. Immunizations
4. Prayer
5. Viagra
6. Ritalin for attention deficit disorder
7. Ritalin for college students taking exams
8. Drugs to treat morbid obesity
9. Drugs that keep normal people thin
10. Human-animal chimeras to produce transplantable organs
11. Building transplantable organs in a dish
12. Gene editing to cure sickle cell disease
13. Gene editing to cure thousands of rare diseases
14. Gene editing of human embryos to prevent disease
15. Gene editing of human embryos to enhance performance
16. Extension of life-span to 120 years
17. Extension of life-span to 500 years
18. Downloading human consciousness to a computer
19. Designer babies with precisely predictable outcomes
Long-standing Widely-Shared Judeo-Christian Ethical Principles *Can* Guide Us

- **Respect for persons:** Recognition of the personal dignity and autonomy of individuals, with special protections for those with diminished autonomy
- **Beneficence:** Obligation to protect persons from harm by maximizing anticipated benefits and minimizing potential risks of harm
- **Justice and Equity:** Benefits and burdens of research should be justly distributed
But make no mistake: the implications of human germline gene editing are profound

- Safety risks are currently unknown
- Future generations would be affected but don’t have the chance to give consent
- Who decides what represents an “improvement”?
- If germline editing actually provides benefits, will that lead to further separation between the haves and the have nots?
- What does it mean to be human if that can be fundamentally altered by tinkering with our biological instruction book?
  - How would this affect our relationship with the Creator? The Imago Dei?
  - “Fearfully and wonderfully re-made”?
Psalm 139:13-16

For you created my inmost being;
   you knit me together in my mother’s womb.
I praise you because I am fearfully and wonderfully made;
   your works are wonderful,
I know that full well.
My frame was not hidden from you
   when I was made in the secret place,
   when I was woven together in the depths of the earth.
Your eyes saw my unformed body;
   all the days ordained for me were written in your book
before one of them came to be.
Concern About “Playing God”
Scientific Community is Paying Attention
Concern about “Playing God”
In the Absence of Ethical Consensus, Science Moves Forward…
Mindful of the Perils … but Focusing on the Promise

Gene Therapy for Spinal Muscular Atrophy

Jerry Mendell/Nationwide
Children’s Hospital, Columbus, OH
Toward the Future

Striking the Balance for Responsible Innovation

- Bringing hope to those who are suffering is an ethical imperative
- Doing nothing is the most unethical of the options
- So we must proceed, but proceed responsibly
- Longstanding ethical principles can form the cornerstone
- International consensus is desirable, but will be difficult to achieve
- People of faith have an important role to play – but need to be well-grounded in the science
“If any one age really attains, by eugenics and scientific education, the power to make its descendants what it pleases, all men who live after it are the patients of that power. They are weaker, not stronger: for though we may have put wonderful machines in their hands we have pre-ordained how they are to use them.”

C.S. Lewis

*The Abolition of Man*
“Praise the Source of Faith and Learning”

Words: Thomas Troeger
Music: Hyfrydol
Praise the source of faith and learning that has sparked and stoked the mind.
With a passion for discerning how the world has been designed.
Let the sense of wonder flowing from the wonders we survey.
Keep our faith forever growing and renew our need to pray.
God of wisdom, we acknowledge that our science and our art
And the breadth of human knowledge only partial truth impart.
Far beyond our calculation lies a depth we cannot sound
Where Your purpose for creation and the pulse of life are found.
As two currents in a river fight each other's undertow
Till converging they deliver one coherent steady flow;
Blend, O God, our faith and learning till they carve a single course,
Till they join as one, returning praise and thanks to You, their source.