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(Part One)

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ABOUT IN-SIGHT

In-Sight exists as the first tri-annual international (Mostly Canada & US), interdisciplinary, non-peer-reviewed, non-profit, academic independent interview-based journal to ask graduate students, instructors, professors, and experts from various fields questions about their backgrounds, previous and expected research (if any), philosophical foundations, and examinations of controversial topics in their fields of expertise and inquiry, among other questions intended for great breadth and depth of responses. Additionally, it will include submissions uni-, multi-, and inter-disciplinarily and about a variety of topics from undergraduate students, graduate students, instructors, professors, and experts. We publish individual pieces throughout and full issues in the ‘spring’, ‘summer’, and ‘winter’: January 1 to May 1; May 1 to September 1; September 1 to January 1, and so on.

Open, General Acknowledgement and Appreciation

In-Sight exists because of three identifiable sectors of support: academics, contributors, and readers. Therefore, all time and effort does have identifiable people, groups, and organizations. All of whom deserve open, general acknowledgement and appreciation. Each earned acknowledgement and appreciation for single or continuous, individual or group, contribution in the construction of *In-Sight*. Many of them without mention of name contributed time and effort to the production of the journal. Some of them groups or organizations providing much needed social media and networking support. Finally, and certainly greatest, readers create the bulk of support. For every person, group, and organization involved in this project, we express deepest gratitude to all types of direct or indirect assistance from every side for contributions to this initiative.

Design and Development

In-Sight's design and development itinerary completed three of four phases circa January 1, 2014. *Phase 1* began on August 1, 2012, with the founding of ‘independent interview-based undergraduate journal’ status. *Phase 2* began with creating tri-annual status in the full year of 2013 to increase production of material. *Phase 3* ceased the undergraduate status to upgrade the journal to ‘independent interview-based journal’ to remove strictures, both implied and actual, based on ‘undergraduate’ status. *Phase 4* will incorporate various social media to increase popular presence of *In-Sight*. In the future, more phases will develop from re-design and transformations of *In-Sight*.

General Philosophy

In academic settings, integrity exists as the foundation for knowledge, where honesty becomes necessary for integrity, especially honesty of inquiry, and honesty of inquiry goes unfettered by dogma or obfuscation – commonly called ‘academic freedom’. Meaning the ability to question anything and pursue implications of findings despite any reticence, from any harbored biases and fear of backlash, and unabashedly expressing these implications without pre-mature alteration or omission to discover knowledge. In the interviews and academic material completed and uploaded to this electronic and online journal, *In-Sight* exists to attain, at a minimum, a modicum of academic freedom mainly through an interview format.

Format, Overview

Format of the issues of *In-Sight* have specified subjects or ideas per issue. Each issue divides into an interview and submission section.

Format, Subject Issues

For interview sections of subject issues, one issue contains *only* graduate students, instructors, professors, or experts from *one* field because of emphasis on *a subject*, e.g. Psychology, English, and so on. For submission sections of subject issues, one issue accepts *only* professors, instructors, graduate students, or undergraduate students from *one* field because of emphasis on *a subject*, e.g. Psychology, English, and so on. Some exceptions of non-academic contributions acceptable with sufficient reason sent to the Editor-in-Chief.

Format, Idea Issues

For interview sections of ideas issues, one issue contains *many* graduate students, instructors, professors, or experts from *many* fields because of emphasis on *an idea*, e.g. Epistemology, Crime, and so on. For submission sections of ideas, one issue contains *many* professors, instructors, graduate students, and undergraduate students from *many* fields because of emphasis on *an idea*, e.g. Epistemology, Crime, and so on. Some exceptions of non-academic contributions acceptable with sufficient reason sent to the Editor-in-Chief.

Format, Sections ‘A’, ‘B’, and ‘C’

Titles of issues specify format for issues, e.g. ‘Issue 1, Subject: Psychology’, ‘Issue 2, Idea: Epistemology’, and so on. Interview, essay, and response sections have tags to provide requisite indication of their part in the issue. Interviews have the mark ‘A’; submissions have the mark ‘B’; responses have the mark ‘C’, e.g. ‘Issue 1.A, Subject: Psychology’, indicating only psychology interviews, ‘Issue 2.B, Idea: Arts’, indicating Arts-based submissions, ‘Issue 2.C, Idea: Arts’, indicating responses to interviews or essays.

Frequency

We publish individual pieces throughout and full issues in the ‘spring’, ‘summer’, and ‘winter’: January 1 to May 1; May 1 to September 1; September 1 to January 1, and so on. Regardless of idea or subject issues, or section ‘A’, ‘B’, or ‘C’, *In-Sight* publication dates for each month include the following: 1, 8, 15, and 22. Overall frequency depends on material quantity and completion dates. **In cases of multiple delayed publications, publication dates will change for the issue at an accelerated rate until completion of the whole issue.**

Interview, Research

Depending on the interviewee, much research needs doing prior to any soliciting of an interview, which means preliminary research. If an interviewee consents to an interview, **a typical, but not**

absolute, minimum of one to four weeks for comprehensive research needs doing prior to conducting an interview. This includes purchasing and acquisition of articles, books, prior interviews, watching of video material, reading of social media material, and the synthesizing of those works to produce questions.

Interview, Consent

Interviewees either provide written or verbal consent based on an interview request. The written or verbal consent relate to the interviewee having the power to deny/accept conducting the interview, and for final decision of publication as a single interview on the website or in the full issue publication with all other issue-interviews in PDF and on the website. See 'Copyright' for information on ownership of publications.

Interview, Conducting

Interview form depends on interviewee preference: in-person, Skype, phone call, question set, or via e-mail. Most prefer question sets provided via e-mail. Most questions mix between standardized and specialized forms. Standardized for consistency of journal format. Specialized for relevant-to-interview questions. All questions have design to elicit in-depth and full responses from interviewees.

Interview, Editing Stage One

Editing consists of the interviewees original interview with minimal editing to keep the intended meaning and message of the interviewees intact, even where certain answers may contain controversial or 'politically incorrect' statements, opinions, or information.

Interview, Editing Stage Two

The interviewer sends the interview draft back to the interviewee to confirm the originally intended meaning and message seem sustained to the satisfaction of the interviewee. If the interviewee requires any further alterations, omissions, or edits, the interviewer repeats the cycle of edit to confirmation of accuracy of message and meaning to re-edit until the interviewee evaluates the final version of the interview as sufficiently accurate to their intended meaning and message. Any major editing consists of corrections to grammatical and/or spelling errors. This editing aims to optimize the correspondence between the interview and the interviewees intended message and meaning to the satisfaction of the interviewee.

Research Ethics

The nature of the journal does not aim to answer an overarching research question, gives interviewees full control over editing and publication, and provides readers an accurate representation of the interviewee in their own words. Therefore, no ethics board approval necessary for the operation of *In-Sight*, especially given the detachment of both funding and constraint of

publication from any institution, despite academic positions or alma maters of staff. See 'Internal and External Funding' for information on funding.

Internal and External Funding

Scott D. Jacobsen provides all internal funding for *In-Sight*. All internal funding includes purchasing of articles, books, chapters, prior interviews, video material, social media material, and all marketing efforts of *In-Sight* such as the website. In the case of external monetary funding, only monetary funding not restricting academic freedom for *In-Sight* will have consideration. **At this time, *In-Sight* operates with zero external funding.**

Attachments

In-Sight's attachments means constraints or restraints based on functioning out of institutions or groups. For instance, an institution or group would consist of a university, an agency, a think-tank, and/or an interest group of some form. *In-Sight* functions autonomously from any institution or group. This provides total freedom of content for consistency with principles of operation for academic freedom.

Advertising Policy

All advertising for the journal exists as open-access for any individual. See 'Open Access' for more information.

Open Access

In-Sight exists as open access for online contents, where any content of *In-Sight* becomes accessible for **reading or downloading** to any interested individual/group.

EDITOR-IN-CHIEF

Scott D. Jacobsen studies psychology at Simon Fraser University (SFU) and mandarin at The University of British Columbia (UBC). He worked, experimented, and presented posters and panels in three psychology labs working on lifespan cognition, prevention of teen gang violence and involvement, and gender and media issues at Kwantlen Polytechnic University (KPU). He frequently presents (and occasionally submits) independent work in posters, panels, and papers in various journals within areas of research interest. Scott founded (2012), and works as the Editor-in-Chief for, an independent interview-based journal, *In-Sight*. He works on a book entitled *Women of the Academy: Reflections, Biographies, and Insights from Female Academics*. He writes and photographs for the student newspaper of SFU, *The Peak*. He contributes to the student newspaper of UBC, *The Ubysssey*. He sings in a university choir and performed with the Vancouver Symphony Orchestra (VSO).

He published work in *The Peak*, *The Ubysssey*, *In-Sight*, and *American Enterprise Institute* (AEI). Scott researched, lectured, and authored/co-authored chapters for the University of California, Irvine's (UCI) *Interdisciplinary Center for the Scientific Study of Ethics and Morality* (*Ethics Center*). The UCI *Ethics Center* awarded him with the distinction of *Francisco Ayala Scholar* awarded to the strongest participants of the program. He competes at regular intervals in Model United Nations (MUN) conferences including Harvard's World MUN. He coauthored one book with collected material, *Inquiry: Musings from Mentorship*, as a private publication. He wrote and edited for Risa Simon of *TransplantFirstAcademy* and *ProActive Path*. His research interests are cognitive psychology, epistemological psychology, historical philosophy and psychology, logic, linguistics, positive psychology, psychiatry, psychometrics, set theory, and statistics. Scott's core research interest is highly gifted (≥ 3 -sigma) youth disadvantaged with low-income or learning deficits. He works part-time as a laborer in construction during the week and weekend. If you want to contact Scott, you may inquire or comment through e-mail: Scott.D.Jacobsen@Gmail.com.

ACADEMIC ADVISORY BOARD

Dr. Wayne Podrouzek works as an Instructor for the Psychology Department of University of the Fraser Valley and Head of the Psychology Department of Kwantlen Polytechnic University. Dr. Podrouzek earned his a Bachelor of Arts in Child Studies and a Bachelor of Science (Honours) from Mount Saint Vincent University, a Master of Arts from Simon Fraser University, and Ph.D. from Simon Fraser University under Dr. Bruce Whittlesea.

Dr. Daniel Bernstein works as the *Canada Research Chair in Lifespan Cognition* for the Psychology Department of Kwantlen Polytechnic University. Dr. Bernstein earned his Bachelor of Arts at the University of California, Berkeley, Master's at Brock University, PhD at Simon Fraser University, and did Post-Doctoral work at the University of Washington. His research interests lie in "Belief and memory; Developmental metacognition; Hindsight bias; Mild head injury; Sleep and dreams."

Dr. Glen Bodner works as an Associate Professor in the Psychology Department of the University of Calgary. Dr. Bodner is a cognitive psychologist who studies factors that affect memory, including both memory accuracy and the subjective experiences associated with memory. Current research in his lab, supported by an NSERC Discovery Grant, investigates how these aspects of memory are shaped by task and context factors.

Dr. Sven van de Wetering works as an Instructor for the Psychology Department of University of the Fraser Valley. Dr. van de Wetering earned his BSc in Biology at The University of British Columbia, and Bachelors of Arts, Master of Arts, and PhD in Psychology from Simon Fraser University. His research interest lies in “conservation psychology, lay conceptions of evil, relationships between personality variables and political attitudes.”

Dr. Azra Raza, M.D. works as a Professor of Medicine and Director of the MDS Center at Columbia University in New York, N.Y. Dr. Raza completed her medical education in Pakistan, training in Internal Medicine at the University of Maryland, Franklin Square Hospital and Georgetown/VA Medical Center in Washington, D.C. and completed her fellowship in Medical Oncology at Roswell Park Cancer Institute in Buffalo, New York.

Dr. Sally Satel, M.D. is a resident scholar at AEI and the staff psychiatrist at the Oasis Clinic in Washington, D.C. Dr. Satel was an assistant professor of psychiatry at Yale University from 1988 to 1993. From 1993 to 1994 she was a Robert Wood Johnson policy fellow with the Senate Labor and Human Resources Committee. She has written widely in academic journals on topics in psychiatry and medicine, and has published articles on cultural aspects of medicine and science in numerous magazines and journals. Dr. Satel is author of *Drug Treatment: The Case for Coercion* (AEI Press, 1999) and *PC, M.D.: How Political Correctness Is Corrupting Medicine* (Basic Books, 2001). She is co-author of *One Nation under Therapy* (St. Martin's Press, 2005) and co-author of *The Health Disparity Myth* (AEI Press, 2006).

Dr. Hawa Abdi Diblaawe, M.D. was born in 1947 in Mogadishu. Her father was a worker in the city's port and her mother died when she was very young. As the eldest child, Hawa was forced to raise her four sisters in conditions of poverty. But she never lost hope sight of her dreams. “My father was an educated man,” she recalls, “He made sure I had the chance to become a doctor.” With the help of a Soviet scholarship, Hawa studied medicine in Kiev and soon became Somalia's first female gynecologist. She then completed a Law degree at the Somali National University in Mogadishu, where she later became an Assistant Professor of Medicine. She soon opened a clinic on her family's ancestral land in the Afgooye Corridor, using the profits from her family land to provide free health care to all of her countrymen.

Dr. Maryanne Garry is a Professor in Psychology at Victoria University, and the Deputy Dean of the Faculty of Graduate Research. For nearly 20 years, she has studied a puzzle of memory: how is that otherwise intelligent, rational people can remember things they never really saw, or experiences they never really had? Professor Garry's interests in applying science to the law predate her interest in memory research or even in psychological science. Her undergraduate degrees are in Forensic Science and Chemistry. Professor Garry received her PhD in 1993 from the University of Connecticut, and did postdoctoral research at the University of Washington under the direction of Professor Elizabeth Loftus, the world's foremost researcher on human memory distortions.

Dr. Diane Purvey is the Dean of Arts at Kwantlen Polytechnic University. She is the co-editor of *Child and Family Welfare in British Columbia: A History* (Detselig Press) and, with John Belshaw, the co-author of *Private Grief, Public Mourning: The Rise of the Roadside Shrine in British Columbia* (Anvil) as well as *Vancouver Noir, 1930-1960* (Anvil). Her research interests include the history of deinstitutionalization as part of a Canada-wide project and educational leadership internationally. She is a contributor to *Vancouver Confidential* (Anvil). A homegrown Vancouverite, Diane attended the University of British Columbia (B.A., Ph.D.) and the University of Victoria (M.A.) and for several decades taught history in various BC colleges and universities.

LETTER OF APPRECIATION

Outsiders and Outliers features individual outliers, outsiders, or both. It will depend on your referent. The series will run for multiple issues once more. On a generalized level through the individual to the collective, the generosity of spirit coupled with the consistent support and encouragement from every person partaking in this project breeds an uncanny wealth of feedback, perspectives, extemporaneous assistance, and necessary support. Every individual and organization deserves appreciation through, at a minimum, recognition in the prior listed acknowledgement and in such a letter as this. In addition to this, particular individuals have devoted more time, effort, and generalized resources such as expertise and advising. I would like to end this issue's letter with further acknowledgement of the following individuals: Dr. Mahtab Jafari for mentoring, lunches, advising, and critical inquiry; Dr. Kristen Monroe for research opportunities, faith, and complete support; Dr. Betty Rideout and Dr. Wayne Podrouzek for the consistent presence in my life; Dr. Manahel Thabet for encouragement, positivity, and concrete additions to independent work; Dr. Daniel Bernstein for research opportunities, mentoring, consistent stances of support and constructive critique; Dr. Sven van de Wetering for an example of consistent adherence to principled living, and serious consideration of corybantic and cockamamie proposals; Dr. Francisco Ayala and Dr. Elizabeth Loftus for the time to meet, discuss, and provide personal resources; Dr. Colin Ruloff for subtle, consistent inspiration; Dr. Glen Bodner for last-minute support; Dr. Azra Raza, M.D., and Abbas Raza at *3QuarksDaily* for consistent, long-term support and select dissemination; Dr. Neda Kerimi and Elina Halonen for opportunities in collaboration; Dr. Charles Quist-Adade for the research and work opportunities; Dr. Roger Tweed, Dr. Gira Bhatt, and Dr. Arleigh Reichl for research opportunities, but more importantly kindness; Dr. Sally Satel, M.D. for subsequent work opportunities, recommendations, and encouraging remarks; Marilyn vos Savant for select, thoughtful discernment for publications; Dr. Wayne Podrouzek for continued support with recommendations; Dr. Rakefet Ackerman for a positive attitude and example of prompt, polite, and upbeat business correspondence; Dr. Norman Finkelstein for an example of integrity; Dr. Hawa Abdi, M.D. for inspiration; Dr. Evangelos Katsioulis, M.D. for an example of quality correspondence, writing, and responses; Dr. Maryanne Garry and Dr. Diane Purvey for at-a-distance support; Dr. Jim Flynn for a challenging interview; Dr. Kenneth Miller at Brown University and Dr. Michael Behe at Lehigh University for generous and respectful correspondence on a topic with known political charge, and not self-censoring; each interviewee for their thoughtful responses to researched questions; and the academic advisory board for their respective interviewee recommendations.

One last note. In addition to these individuals, this initiative would struggle to reach buoyancy without the unsung heroes for *everyone* within relevant experience for me, all Simon Fraser University, The University of British Columbia, Kwantlen Polytechnic University, and University of California, Irvine librarians, I appreciate all assistance in collaboration necessary for required sufficient comprehension of new disciplines, research, and interviewees involved in this project coinciding with improvisatory and comprehensive feedback.

Scott D. Jacobsen

Editor-in-Chief

DR. MANAHEL THABET¹²



Dr. Manahel Thabet is the president of *World IQ Foundation* (WIQF) and *Smart Tips Consultants*, Vice President of *World Intelligence Network* (WIN), Vice-Chancellor of *The Gifted Academy*, and the patron of the first Women's Leadership MBA program in the Middle East operating out of Synergy University. WIQF and WIN are devoted to the high IQ communities. For educational background, Dr. Thabet earned a Ph.D. in Financial Engineering at the age of 25. Furthermore, Dr. Thabet earned a second Ph.D. in Quantum mathematics at the age of 31. In addition, her distinctions range through awards such as the *Excellence of Global International Environmental and Humanitarian Award*, *L'Officiel Inspirational Woman of the Year Award*, *Genius of the Year Award for 2013* (Representative of Asia), *Excellence of Global International Environmental and Humanitarian Award*, and numerous others. Recently, Dr. Manahel established *The Gifted Academy* (www.thegiftedacademy.com) and earned the *Avicenna Award* as a successor to Tony Buzan (Founder of *Mind Mapping*).

¹ World Intelligence Quotient Foundation, President; Smart Tips Consultants, President; World Intelligence Network, Vice-President; The Gifted Academy, Vice Chancellor; Patron of Women's Leadership MBA at Synergy University.

² First Published on May 1, 2014.

ABSTRACT

The following broad interview with Dr. Manahel Thabet discusses the following: geographic, cultural, and linguistic background; developing as a gifted child and early identification by her parents; original dreams of entering space; earning her first Ph.D. in Financial engineering (age 25) and second in Quantum mathematics (age 31); work at WIQF, *Smart Tips Consultants*, and WIN; non-verbal intelligence tests; myths of the gifted population; emotional struggles as a woman in leadership; distinctions and awards; position as patron of the Women's Leadership program MBA at Synergy University; thoughts on the past of and projections for quantum physics; concerns for the gifted community; responsibilities of the gifted population; thoughts of the near and far future for the gifted population; influences and inspirations; and things giving hope and the complicity of the structure of the universe.

Key Words: Dr. Manahel Thabet, financial engineering, gifted, leadership, MBA, non-verbal intelligence tests, quantum mathematics, responsibilities, Synergy University, WIN, WIQF, women.

1. In terms of geography, culture, and language, where does your family background reside? How do you find this influencing your development?

In fact, I lived in many different countries and diverse cultures. I believe this diversity of location, and moving from one place to another, had enriched my knowledge in many areas and shaped my personality in a deep way.

2. How did you find developing from childhood through adolescence into young adulthood with giftedness? Did you know from an early age? What events provided others, and you, awareness of your high-level of ability?

My family noticed something. I did not start speaking like normal kids. They were worried about that and took me to a speech therapist who advised them to run an IQ test for me. As early as 7 years old, my family knew, I was different. They embraced this fact. They did their best to cope and enable me to utilise my giftedness.

3. You had an original dream to enter space. What happened to that dream? How did you cope?

As a kid who had many dreams like any other kid in the world, I was so fascinated by space and the universe. My dream was to be an

astronaut. Of course, I did not know it is very difficult to be one – lol. I grew up with the love of this field. Ever since I can remember, it has been my passion. I embraced this passion. Throughout the years, I improved the passion through studying, research, development, and hobbies. For one hobby, I enjoy stargazing the most. I am an amateur astronomer. Also, I am a member of Dubai Astronomy Group and in some days you will see me tracking stars from one place to another.

4. You earned a first Ph.D. in Financial Engineering, at the age of 25, and a second in Quantum Mathematics, at the age of 31. Why did you pursue these areas of education? How are your productions changing their respective fields?

This is an interesting question! The common thing between the two fields are numbers. Yes, I am fascinated by numbers. I feel that everything in our lives is calculated in a way or another. Formulas exist in every aspect of our lives, even in love and relations.

5. You have earned the title 'Queen of Bourse'. What does this mean? How did this originate?

I was at the stock market once, and a reporter saw my performance, which was at that time

very high. She asked me, “Where are you from?” I said, “From Yemen.” She didn’t know where Yemen is, then I told her I am from the land of ‘Queen of Sheba’. At that point, she wrote from ‘Queen of Sheba’ to ‘Queen of Bourse’. Since that time, people took it as a title.

7. You are President of WIQF, President of Smart Tips Consultants, and Vice-President of the *World Intelligence Network* (WIN). What is the function of these organizations? What other major organizations devoted to similar causes can you recommend for resources and support?

WIQF and WIN are think tanks for the high IQ world. Through the operations of these organization, we are trying to gather high IQ individuals in one platform to discuss ideas and exchange knowledge. As well, we do IQ testing through our connections with accredited sources, ability testing, and personality assessments.

For *Smart Tips*, it’s a consultancy firm. I founded the firm in 2005. We do financial engineering, consultancy, internal auditing, and feasibility studies.

8. In terms of universalizing the testing of intelligence, non-verbal tests appear to have much promise, especially for the high-range. What do you see in the future for high-range non-verbal tests? How will this change general intelligence testing and the identification of gifted individuals?

Nonverbal tests have been considered pure measures of general intelligence and are excellent indicators of abstract reasoning, particularly in the visual-spatial domain. These instruments have negligible ethnic biases, and I support their use in identifying gifted children from culturally diverse groups.

However, they do not measure as wide a range of abilities as IQ tests and would not be as predictive of success in a gifted program.

9. Of the gifted population, there exist many myths. What do you consider the greatest of these? What truths dispel them?

One of the things people should notice is the high level of extremely intelligent people in autistic children. If not discovered, it is a serious waste of human capacity to do wonders.

10. As a woman in leadership and achieving records for many endeavors, what struggles and emotional difficulties have you endured to attain such accomplishments?

Ahhh, living in the Middle East where a male-dominated society still rules is a big challenge. I cannot deny that it is changing, but a woman needs to make double the effort to get less than half of the recognition and support. My journey was a bit bumpy. It took a lot of emotional strength to keep going, but sometimes I would feel drained. However, I will not allow this to drag me down. I am blessed with a caring family and supportive friends.

11. You are the patron for the MBA – Women’s Leadership Program – at Synergy University. What does this program encompass? What does such a program mean to you?

This MBA programme is the first in the Middle East in Women’s Leadership. I was so proud to be selected as the patron of this programme. It means a lot to me to see prospective women leaders coming soon. I have always been a supporter of female education and empowerment of women.

12. You earned multiple awards and recognition including the *Excellence of Global International Environmental and Humanitarian Award*, *L’Officiel Inspirational Woman of the Year* award, *Genius of the Year* award for 2013 (Representative of Asia). What do these and other awards mean to you? What

responsibilities and duties do these imply to you?

Being recognised and being honored with these awards puts you in a position of big responsibility. Once you are put in this position, you are a role model for many. Therefore, ethically, you should be fit to inspire those who look up to you. Whenever I take an award, I do not call it an award. I call it a reward for many days and years of hard work, and then continue attention to what I do best.

13. How has the world of quantum physics changed over the past decade? What do you anticipate to be the next big steps?

Einstein's sentiments still reverberate today, more than a century after humanity's first insights into the quantum world; quantum mechanics makes perfect sense mathematically, but defies our intuition at every turn. So it might surprise you that, despite its strangeness, quantum mechanics has led to some revolutionary inventions over the past century and promises to lead to many more in the years to come. I believe that quantum aspect will be involved in every aspect in our lives. Starting from the theoretical basis which is the teaching of new quantum methods up to using it in quantitative methods in economy up to using it to find cures for diseases using quantitative measurements and cellular techniques.

14. You share a concern of mine. In particular, the sincere desire to assist the gifted population in flourishing, especially the young. Now, many organizations provide for the needs of the moderately gifted ability sectors of the general population, most often adults and sometimes children. However, few provide for the needs of children (and adults) in the high, profound, exceptional, or 'unmeasurable' ability sectors of the general population. Some organizations

and societies provide forums, retreats, journals, intelligence tests, literature, or outlets for the highest ability sub-populations. What can individuals, organizations, and societies do to provide for the gifted population? What argument most convinces you of the need to provide for this sector of society?

Caring about gifted individuals is not something to easily say, it is an action to make. It cannot be highlighted by individuals only, government attention is needed too. Caring about gifted individuals includes education, systems, and qualified individuals to explore gifted abilities in kids, utilities, and so on.

Yes, it is important for people like myself, and others to have their voice out, and call for more attention to this category of people. This cannot be taken care of if so many government entities bind together to form a whole adaptation system to those who need it the most (and I mean here the gifted and talented sector only)

15. In turn, what responsibilities do the gifted population have towards society and culture? Why do you think this?

See, gifted individuals are as normal as other people. They share the same duties and responsibilities towards society. Responsibilities towards society and culture are something ethical. It does not differentiate between gifted or non-gifted.

16. Where do you see the future of the gifted population in relation to society? What about the near and far future of the gifted population in general?

We are heading towards a knowledge-based era. We are transforming our dependency from usable technology to wearable technology, and soon consumable technology. Minds will be the true asset for any nation. The technological revolution we

are heading to embrace just like the production revolution will need special leaders and those leaders will have to be somehow gifted or talented in the technological arena.

17. What projects do you have in the coming years?

Many!

18. Who most influenced you? Who inspires you?

Strangely enough, I can get inspired by anyone or anything. From a writer, inventor, poet, singer actor, animal, or even a view.

Inspiration is not limited if you can embrace it. And I always believe that “if the universe exists the sky is not the limit”.

19. Finally, you have tweeted, “The Universe has many hilarious aspects. So I should not get credit for a sense of humor if all I do is point this out.” What gives you hope, humor, and a sense of wonder?

What gives me hope is when I see those who are deprived from everything smiling. And what keeps me wondering all the time is the structure of our amazing universe and the complicity behind its creation.

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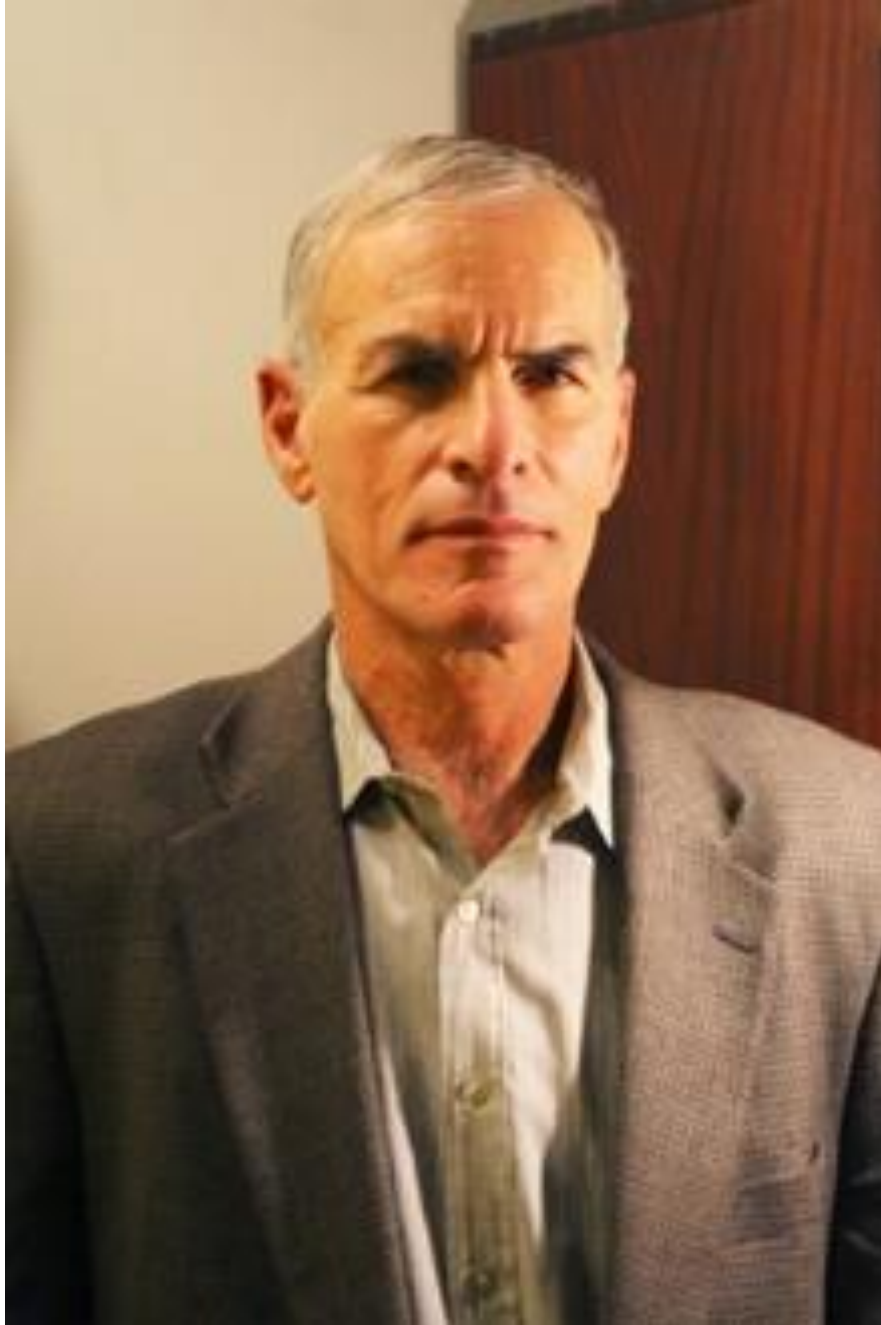
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DR. NORMAN FINKELSTEIN³⁴



Dr. Norman Finkelstein earned his B.A. from Binghamton University and M.A. from Princeton University. He earned a Ph.D. from the Department of Politics at Princeton University in 1988. He has written nine books including *The Holocaust Industry: Reflections on the Exploitation of Jewish Suffering* and *The Rise and Fall of Palestine: A personal account of the intifada years*. His most recent publication is entitled *Old Wine, Broken Bottle: Ari Shavit's Promised Land*.

³ Independent Academic, Political Analyst, and Author.

⁴ First Published on May 22, 2014.

ABSTRACT

In the following brief interview with Dr. Norman Finkelstein, he discusses the following: survival of his parents from the Nazi death camps; personal moral outrage against racism, war, and injustice; terse considerations of controversial topics such as economic inequality and climate change; *The Holocaust Industry: Reflections on the Exploitation of Jewish Suffering*; the Israeli-Palestinian conflict and a potential solution in “mass, nonviolent resistance”; moral and pragmatic responsibilities of academics, and everyone; and influence of his mother and Noam Chomsky on him.

Keywords: academic, climate change, Dr. Norman Finkelstein, economic inequality, Holocaust industry, injustice, Israeli-Palestinian conflict, Nazi, Noam Chomsky, racism, war.

1. In terms of geography, culture, and language, where does your family background reside? How do you find this influencing your development?

My parents survived the Nazi death camps (my father was in Auschwitz, my mother in Maidanek). No one else on either side of the family survived. Everything I've done in my life has been, in some sense, a vindication of their martyrdom. What they endured has been the source of my moral outrage against war, racism and injustice, although Professor Chomsky provided me with the intellectual “method” to articulate it.

2. What do you consider the most controversial topics at the moment? How do you examine the issues? What do you consider the strongest arguments of those with differing views of the issues than you?

Many of the “most controversial topics at the moment” such as climate change/global warming, and unemployment/economic inequality, require not just background but also technical mastery (in the natural sciences and or economics/mathematics) that I do not possess. So, it's difficult to enter these debates with the kind of preparation and confidence that I prefer before taking a stand.

3. In the second edition of your book *The Holocaust Industry: Reflections on the Exploitation of Jewish Suffering* (2003), you discuss what you term the ‘Holocaust Industry’. For

those unfamiliar with your writing, how do you define it? What does this imply? Where does your current research stand on this issue a little over a decade after the second paperback issue?

The Holocaust industry referred to Jewish organizations that exploited the Nazi holocaust for political gain—mostly to immunize Israel from criticism—and financial gain—this shakedown racket mostly in Europe to extract what was called “compensation” for “needy Holocaust victims.” Nowadays, many people refer casually to the Holocaust industry—it's taken for granted or as a given. For example, even the former speaker of the Israeli Knesset, Avraham Burg, in his book “The Holocaust is Over,” refers to the “Shoah industry.”

4. Where do you see the future of the Israel-Palestine conflict? In particular, what about the dangers for areas of further conflict? Where do you see the strongest possibilities for resolution?

I am not optimistic for a just resolution of the conflict unless Palestinians in the occupied territories engage in mass, nonviolent resistance. For now, they have (with good reason) lost interest in, or grown cynical of, politics. What the future brings in this regard, I cannot predict. But if they don't resist, then Palestine will go the way of the Native Americans.

5. If any, what responsibility do academics and researchers have for contributing to society and culture? What do you consider the greatest potential benefits and damages to society, and culture, based on the contributions of academics and researchers?

Everyone has a responsibility to make the world a just and decent place. It's not just a moral but also a pragmatic responsibility. If the overwhelming majority of climate scientists are right, the human race just won't be around much longer, unless we get our act together. Academics and researchers by the nature of their profession have more time, resources and leisure than most of the world's population (of peasants and industrial workers) to right the world's wrongs, so their responsibility is obviously greater.

6. Who most influenced you? Why them? Can you recommend seminal books or articles by them?

My late Mother had, by a wide margin, the biggest impact in shaping my moral outlook. But, although she was very smart (actually too smart for her own good), she was never able to articulate her moral outrage (in part because she was so against "intellectualizing"/"debating" war, destruction and death). It was not until I started reading Chomsky that I found a "method" to be both indignant at injustice and also to preserve scholarly standards. It didn't help me survive in academia, but I think it did help me become more convincing before a broad public.

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DR. JANET METCALFE⁵⁶



Dr. Janet Metcalfe earned a B.Sc. and Ph.D. from the University of Toronto. She did postdoctoral work at the University of California, Los Angeles. At present, her research is on how people know what they know. In other words, their metacognitive abilities, i.e. if they can use their evolutionarily unique metacognitive abilities for self-control. Her lab has been studying peoples' abilities to make judgments of their own learning. This research focuses on the theoretical perspective that proposes that they are able to hone in on their own 'Region of Proximal Learning', which are things that yield maximum learning payoffs. Their efforts in research are directed at specifying the heuristics of how people isolate this region. By doing this, they investigate what it is that people choose to study. However, it is also necessary to investigate whether what they choose to study is advantageous or not. Of course, the limitations in human metacognitive judgments figure large in this research program.

⁵ Professor, Psychology, Columbia University.

⁶ First Published on June 1, 2014.

ABSTRACT

In the following interview with Dr. Janet Metcalfe of Columbia University, she discusses the following: growing up in Toronto; motivations of studying science and the mind; early studies and investigations into the human mind; experience as a woman working in the academy; an emotionally trying experience; summary of 2010-2014 metacognitive research; responsibility of academics to society and culture; and the take-home message of her metacognitive research.

Keywords: Columbia University, Dr. Janet Metcalfe, human mind, metacognition, mind, Psychology, responsibility, Science, University of Toronto.

1. In terms of geography, culture, and language, where does your family background reside? How do you find this influencing your development?

I grew up in Toronto. And I think being a Canadian and having a good educational system is a very good thing for everyone, which is not as accessible here in the US as it is there.

2. What motivated an interest in science and the mind?

I have always been interested. In high school, I was one of those nerdy kids in the library reading Aristotle and Plato. But I was very naïve. I did not realize that there were actually people studying those kinds of issues in the universities. It was not until much later that I realized I could actually do that with my life and not become a sales clerk, Lawyer, or some other field.

3. How did you find your early study and investigation into the human mind?

The first couple years, I was doing theatre design at the *natonale* in Montreal as a designer. Theatre design is pretty wonderful from the outside. From the inside, you have to be extraordinarily talented. It is also very political. You have to be so amazing. I am in awe of people who can do it. You also have to starve for a long time to do it. The odds are very, very against you. I ended up doing a B.A. in costume design in Ottawa. And doing the odd show in Ottawa, working in my spare time with a children's program, and I loved being with children. It was so great. They

were kids from Lower Town, Ottawa. There aren't many slums in Ottawa, but I would not say this is a slum. However, I would not say these kids were privileged. I would take them around to all of the various cultural events to try and give them an opportunity. Then I realized that I really loved doing that. I decided to go back to school and do things in learning. I had to do my learning course at Ottawa. It was Behaviorism, but it was with rats and stuff. So that was out to sleep. I wanted to work with kids and know how they learn. Because we did not know; we still do not know. (Laughs) We know a bit more. We did not know how to teach them. I was pretty convinced that the kids in Lower Town, if they could just get their grades up in school, then they would be on track. That would be their ticket. I went back to the University of Toronto. I started school again.

I sat myself in, although I did not know it, but the University of Toronto and Stanford were the centers of memory research. I took a class and the professor—Bennet Murdock—asked, “I need a research assistant. Just come to my office if you want to be a research assistant.” I went with ten other people. He decided simply on grades. That was me. So I got the position because I had the highest grades. So I was his research assistant. It was amazing! Because he was studying memory and the minds, how we think, and mathematical models of memory, I was put in, as an undergraduate, put in with his postdocs and Ph.D. students. It was fantastic! He's been my mentor ever since. He's still in

Toronto. He's 92. I still see him from time to time. It was such luck. At the University of Toronto, there were so many great people at the time doing such wonderful, great research. So I lucked into it. It was fun.

I applied to two schools for graduate school: York and Toronto. I really wanted to go to Toronto. I didn't know, but people later told me that I'd get into Harvard. But I was a Canadian! (Laughs) It didn't occur to me to go anywhere else. It didn't matter to me because I got into Toronto and it was a great place. It was very lucky for me

4. In terms of working in the academy as a woman, how did you find your early studies, research, and work? Have things changed?

Yes, it is interesting. I was in Canada during my early time and I think there was a lot less discrimination in Canada than in the US at the time. I later taught both at Dartmouth and currently teaching at Columbia. I could not have been a student at either of those places.

In Canada, there was a tradition and some wonderful women in the department already. Well, there was one time. I had a baby in graduate school while I was doing my Master's thesis. My Master thesis was published. Usually they were not published, at least at University of Toronto. Mine was published. It was a very good thesis. They had a prize for the best thesis, but they gave it to a guy. They said that they gave it to the guy because his wife had a baby.

That was the only time I thought, "My thesis was better than his was. And it was because his WIFE had a baby! (Laughs) I was writing this while in the hospital." There were times when it was very rarefied. I was in the Society for Mathematical Psychology, where there were very few women, okay. I did not feel discriminated against. There was simply a lack of women in it. I think it is pretty transparent. I think some of the women now helping women to have self-confidence, and

not take personally rejection letters, are doing a great service. I do not think it has gone away. But Canada was no so dead. Because there were some women in the department already, they had some pretty strong women there. I remember one woman there in her 60s. She had been in the field for a long time.

5. What do you consider your greatest emotional struggle? How did you overcome it?

Well, it is pretty hard having a baby, getting a thesis done, and having my whole salary going into my baby. It was a conflict between career and family life. It is hard being an academic with a family life fighting for tenure. I think women more than men have more assumed responsibility for children than men. There is a biological clock. This usually becomes an issue when you are coming up for having a child and going to compete for jobs and tenure. That is when your children need you the most too. It is VERY, VERY hard. I think we should do a lot more. People helped me! When I was a post doc at UCLA, Elizabeth Bjork was on the board of directors of the Wesley Presbyterian Nursery School, which is a couple of blocks from the lab. It was a great nursery school. She negotiated on my behalf so I could get free childcare there. I got to see my kid all the time. I got to know the other kids. And I got free tuition. She totally ran interference for me. It happened again and again in my career. People helped me a lot. We need to help people a lot. We need to help women a lot. It makes their life possible.

6. Your current research focuses on peoples' metacognitive abilities. In particular, the use of metacognition for self-control. How do you define metacognitive abilities? What have you found with your research on metacognitive abilities since around 2010 onward?

I have been focusing on agency. On people's sense of doing what they're doing. I have

been really focusing on metacognition and agency. I think this is an absolutely fascinating problem. How do I know that I am me, right? So we created a little computer game lovingly called 'space pilot'. There are Xs and Os all over the screen. You move the cursor to catch the Xs. We can intervene in things such as noise into the system and time delay into the system. We can ask people what the performance was like – what is called straight metacognition, “How in control did you feel?” We are finding that there are very dramatic differences AND similarities in this judgment of control, knowing when you are in control. For example, people who have schizophrenia do not have control. They can judge the performance. So there's straight metacognition is okay. There is judgment is okay. But they do not know if we have intervened. There are a whole lot of consequences, I think, in their real life, if they cannot judge real life – if they cannot judge what is coming from the external real world. It is very central for their ability to get around in the real world.

People with Asperger's have some problems too. For example, they have problems with self-boundaries. We have found some interesting glitches. They will take credit for magic. Other undergraduates will not take credit for magic. If it is good and it is kids, it is because of them. There are these very interesting differences.

We have put participants in brain scanners. There are several components that we are able to isolate. It looks like there are a variety of cues that people use to make this very central judgment that your grandmother sings is just obvious, I know I have done it. It is direct knowledge.” Well, it is not direct knowledge. It is inferential knowledge, but inferential knowledge that we mostly get right and it is a good thing that we do. We are starting to know that right temporal-parietal junction in the brain has something to do with detecting when things are not going the way they should, when you feel that things are not

in your control. We know the frontal-polar area, behind your forehead more or less, has to do with making the judgment itself. It is has to do with all kinds of self-relevant judgments. It seems to have to do with all kinds of attributions of the kind of person that you are, but you have to know at some level that this is you doing it.

Also, we know striatum, in the old brain, is the reward system of the brain is connected so that you feel reward for your feeling in control – for you being an agent. So we are starting to get an idea of the neural components and psychological cues that people use. So we are starting to understand it, which is kind of fascinating. That is the stuff since 2010.

7. If any, what responsibility do academics and researchers have for contributing to society and culture?

Oh, enormous responsibility! In terms of keeping everything really honest, the pure sciences, the quest for truth is what it is all about. It is not the quest for money. It is not the quest for fame. It is not the quest for personal anything. It is the quest for truth. That is an extremely valuable contribution. I love being at Columbia and many of the Canadian universities, the liberal arts, and the value of culture. It is treasured in the universities. It's so important that we treasure that. I mean, I go to a lecture and an hour and a half on just on the meaning of a leaf in one painting made by Leonardo. The fact that we have gotten people that were supporting the intense investigation and thinking of details about how things work and the meaning of being a human being. That is what the university is about. Of course, we need money and food. But that core mission is so important for what it means to be a human being. We have HUGE responsibilities! (Laughs)

8. If you have a take-home message about your research, especially related to recent research on metacognitive abilities in relation to learning, what

would you have for people to understand?

Oh my goodness, I don't know. Metacognition is kind of the highest level of thinking that you have got. And the ability to think about your thinking gives you the possibility to control your thinking and to take responsibility – for you to be free. For you to be responsible for shaping your own mind, it gives you that little prod. In that, you can take control of your own mind and future. It is a little bit, but you have this possibility to change yourself. I think that is a fascinating possibility and people can, because we have got this possibility – and maybe another primates have it or so it looks, but most animals do not have that capability. **HOWEVER, YOU HAVE THE POSSIBILITY TO CHANGE YOURSELF IN A GOOD DIRECTION.**

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DR. AUBREY DE GREY⁷⁸



Dr. Aubrey de Grey is a biomedical gerontologist based in Cambridge, UK and Mountain View, California, USA, and is the Chief Science Officer of SENS Research Foundation, a California-based 501(c) (3) charity dedicated to combating the aging process. He is also Editor-in-Chief of Rejuvenation Research, the world's highest-impact peer-reviewed journal focused on intervention in aging. He received his BA and Ph.D. from the University of Cambridge in 1985 and 2000 respectively. His research interests encompass the characterisation of all the accumulating and eventually pathogenic molecular and cellular side-effects of metabolism (“damage”) that constitute mammalian aging and the design of interventions to repair and/or obviate that damage. Dr. de Grey is a Fellow of both the Gerontological Society of America and the American Aging Association, and sits on the editorial and scientific advisory boards of numerous journals and organisations.

⁷ SENS Research Foundation, Chief Science Officer and Co-founder; Rejuvenation Research, Editor-in-Chief.

⁸ First Published on June 8, 2014.

ABSTRACT

Comprehensive interview with Dr. Aubrey de Grey, the Editor-in-Chief of the journal *Rejuvenation Research*, co-founder of the *Methuselah Foundation*, and co-founder of the *SENS Foundation*. The following interview covers: youth of Dr. de Grey; educational history; his work in the field of bio-gerontology and bio-medical gerontology; research conducted up until the present; definitions of ‘aging’ as seven separate processes: cell loss and cell atrophy, nuclear epi-mutations, mitochondrial mutations, death-resistant cells, extracellular crosslinks, extracellular aggregates, intracellular aggregates; hypothetical research project; *Methuselah Foundation* (MF) & *Strategies for Engineered Negligible Senescence* research foundation (SENS) Foundation; and the trajectory of the ‘war against aging’.

Keywords: aging, bio-gerontology, bio-medical gerontology, cell atrophy, cell loss, Dr. Aubrey de Grey, Editor-in-Chief, Education, extracellular aggregates intracellular aggregates, extracellular crosslinks, Methuselah Foundation, mitochondrial mutations, nuclear epi-mutations, Rejuvenation Research, SENS Foundation, Strategies for Engineered Negligible Senescence.

1. How was your youth? How did you come to this point?

Pretty normal, but rather short on social life: I had no brothers or sisters (or indeed any family other than my mother), and I wasn’t particularly outgoing until I was about 15. I was always reasonably high-achieving academically and I immersed myself in that. When I discovered programming, and found I was fairly good at it, I decided to study computer science, and pretty quickly I decided to pursue a career in artificial intelligence research because I felt it was where I could make the most humanitarian difference to the world. At around 30, I started to realise that aging was a criminally neglected problem and that, maybe, I could make even more of a difference there. So I switched fields.

2. Where did you acquire your education? What education do you currently pursue?

I went to school at Harrow, a top UK boarding school, and then university at Cambridge. These days my education comes from my colleagues, via their papers and my interactions at conferences.

3. You work in the field of bio-gerontology. How do you define bio-gerontology? When did bio-gerontology

interest you? Why did this field become a distinct area of research? Why does this garner such controversy?

In order to answer your question with clarity, I need to make a distinction first. There are two separate fields you’re talking about: bio-gerontology and bio-medical gerontology. Bio-gerontology is the study of the biology of aging as a basic science, with the goal of increasing our understanding of how it naturally occurs. Biomedical gerontology is the study of the biology of aging as a technology, with the goal of identifying ways to change how it naturally occurs (specifically, to slow or reverse it). Bio-gerontology has been a branch of biology for about 100 years, starting with ideas like the “rate of living theory”, and it’s not controversial at all. Biomedical gerontology has arguably existed for much longer, if you include the various elixirs that people have explored, but as a true field of technology I would argue that it has only existed for about 15-20 years, since people started trying to use what bio-gerontology had discovered as a guide to the development of therapies. I got interested in it about 20 years ago precisely because it was a field of technology that pretty much did not exist and I thought that maybe we understood aging well enough to start to develop such medicines. Bio-medical gerontology garners

controversy because people are scared of how different the world would be if aging were truly eliminated, and also because (conversely!) people do not want to get their hopes up too soon so they put the issue out of their minds by kidding themselves that it would not be such a good thing after all.

4. What do you consider a pivotal moment in the transition to your current work?

The most pivotal moment was undoubtedly the night in 2000 when I realised that repairing the damage of aging would be much easier than stopping the damage from being created in the first place. That was a huge departure from traditional thinking. Of course there were many other pivotal moments leading up to that, but that's the biggest one.

5. What kinds of research have you conducted up to the present?

SENS Research Foundation conducts and sponsors research in all areas relating to the repair of aging damage. In the SENS scheme, there are seven major types of damage – of course there are many examples within each type, but the classification into seven categories reflects our strategies for addressing them. We conduct research in all seven areas, prioritising aspects that are not being researched as thoroughly by others as we think is necessary. This ranges from stem cell work to create artificial organs or to regenerate existing tissue, to elimination of molecular “garbage” from the insides of cells and the spaces between them, to the restoration of function to mutant mitochondria, to the underlying basis of certain types of cancer – and that's just a minority of the range of our interests.

6. If you currently conduct research, what form does it take?

Our research is really no different than any other biology research: we use the same techniques, the same equipment, our staff have the same skills. What's different about

our work is the goals: we pick our projects very carefully for maximum potential to hasten the development of a comprehensive panel of damage repair therapies that will postpone the ill-health of old age.

7. You define aging as a process. In particular, you define aging as seven processes: cell loss and cell atrophy, nuclear epi-mutations, mitochondrial mutations, death-resistant cells, extracellular crosslinks, extracellular aggregates, Intracellular aggregates. What academic and popular venues can professionals and lay-persons alike read on their own time about these processes in full detail? What processes have the most progress in slowing, halting, and reversing their respective portion of the aging process?

First, instead of “nuclear [epi] mutations” we normally say “Division-obsessed cells” these days. It's the same concept but easier to explain.

The best place to discover about all this is, of course, our own output. Our website sens.org has summaries and somewhat more detailed descriptions of all these areas for the general audience. My book “Ending Aging” is also written to be comprehensible to non-biologists, but it's extremely detailed and no biologist reading it would feel short-changed. Then of course there is my corpus of academic output that first described the SENS approach and its merits; the relevant papers are mostly from 2002 to 2005 and can easily be found in PubMed.

8. If you had infinite funding and full academic freedom, what would you research?

One of the benefits of being an independent non-profit is that we already have pretty full academic freedom. In particular, we are free to work on really difficult projects that do not deliver a steady stream of high-impact publications. Therefore, if we had much more

funding, our overall strategy would not change much: mostly we would grow the projects we already pursue, parallelising them more so that they would go faster, rather than changing direction.

9. What do you consider the most controversial research topic at the moment? How do you examine the issue?

If anything I would say that the key research relevant to bio-medical gerontology is becoming less controversial. An obvious example is the development of iPS (induced pluripotent stem) cells, which has largely obviated the need to work with cells isolated by destroying embryos. Also, as we get better at genetically manipulating species relatively distant from us (like mice), we become progressively less reliant on experiments using non-human primates.

10. How would you describe your early philosophical framework? Did it change? If so, how did it change?

I don't really view myself as having a philosophical framework. I guess that if I have one it is just that it's my moral duty to do the best I can to improve people's lives. But really I would more accurately say that that's simply what makes me feel fulfilled, whether or not there is any objective ethical basis for it.

11. You co-founded the *Methuselah Foundation (MF) & Strategies for Engineered Negligible Senescence* research foundation (SENS) Foundation. You are Editor-in-Chief of the journal *Rejuvenation Research*. What purpose do these and other outlets serve for the bio-gerontology research community?

SRF is SENS Research Foundation; SENS is the methodology, SRF is the organisation pursuing the methodology. MF and SRF are not outlets for the research community – certainly SRF is not, because our focus is to do our own research. MF kind of acts as an

outlet in that it highlights and popularises certain research areas by administering prize competitions. RR, on the other hand, is a regular peer-reviewed academic journal and thus is a standard type of outlet. It is distinctive mainly in that it is firmly focused on intervention, so it publishes work that might be seen as too “translational” for some other bio-gerontology journals but also too early-stage for clinical gerontology journals.

12. Who most influenced you? Can you recommend any seminal books/articles by them?

I have actually been influenced rather little by other opinion-formers. There are a few people I immensely admire, however, and in whose footsteps I try to follow. Let me just mention two, Mike West, founder of Geron and Advanced Cell Technology and now CEO of BioTime, has totally transformed the commercial landscape around some of the most critical biomedical technologies relevant to the defeat of aging, and I certainly recommend his book “The Immortal Cell.” Peter Diamandis founded the International Space University, then the Xprize Foundation, and then Singularity University, all real game-changes in the promotion and facilitation of visionary technologies designed to benefit humanity. His book “Abundance” tells the story really well. I'm privileged to know both Mike and Peter quite well and to benefit periodically from their insight.

13. Where do you see bio-gerontology in the near and far future? Do you have a precise itinerary for major breakthroughs in the ‘war against aging’?

I will answer with regard to biomedical gerontology – see the distinction I made in my answer to question 3. The short answer is no – just as for any pioneering technology, the timeframe and even the order of events leading to final success is spectacularly speculative. However, I do think that the track we are on has at least a 50% chance of

delivering really big increases in healthy (and, as a side-effect, total) lifespan in mice within the next decade and in humans two decades later.

14. What advice do you have for young researchers, especially those engaging in controversial research areas?

The good news is that research in aging has passed through two profound transitions that leave it as a much less controversial option than it used to be. Starting about 20 years ago, it transitioned from a backwater viewed by other biologists as a poor man's field where hypotheses could not be tested, to a high-profile discipline whose leaders would get most of their papers published in *Science* or *Nature*. Then, over the past 5-10 years, it has become far more acceptable to work on aging with a biomedical mindset rather than a basic-science one, in other words with a goal of actually doing something about aging in the future rather than just understanding it better. So my advice would be not to be concerned about historic controversy, but to pick one's research area on the basis of its relevance to the eventual goal. We at SRF are always happy to offer advice on this – we get queries all the time and we do our best to guide young researchers into the most high-priority areas.

15. Besides your own organizations and research interests, what fields of research, organizations, and non-profits can you recommend for interested readers?

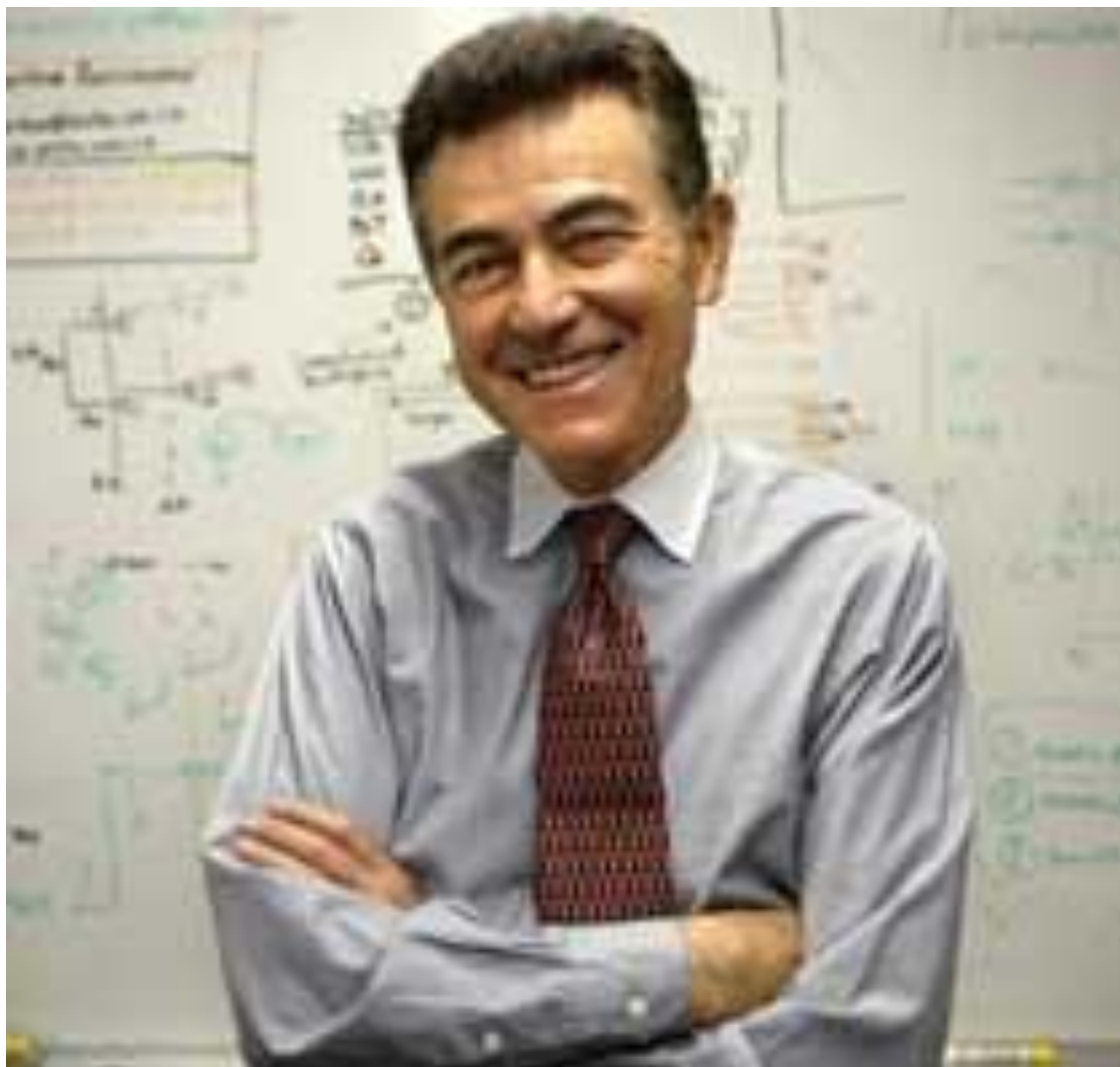
I don't know how to answer that question. Obviously my recommendation to those who share my basis for choosing a research area is to get involved with SENS. If someone is deciding what interests them on a different

basis, they'll come to a different conclusion, but I'm not about to try to tell them what conclusion.

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DR. FRANCISCO AYALA (PART ONE)⁹¹⁰



Dr. Francisco Ayala is the Donald Bren Professor, Biological Sciences, Professor of Philosophy, and Professor of Logic and the Philosophy of Science, and member of the National Academy of Sciences, member of the American Academy of Arts & Sciences, and the American Philosophical Society. In addition to these distinctions, he is the winner of numerous awards including the 2001 *National Medal of Science*, 2010 *Templeton Prize*, *Gold Honorary Gregor Mendel Award*, 1998 *Distinguished Scientist Award*, *President's Award* of the American Institute of Biological Sciences, *Scientific Freedom and Responsibility Award* and *150th Anniversary Leadership Medal* from the AAAS, among numerous other awards. Professor Ayala researches multiple areas including 'the origin and evolution of introns, and on the evolution and functional significance of pseudogenes, ectopic expression, molecular clock of evolution, bioethics, philosophy of biology, and the teaching of evolution in schools'.

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¹⁰ First Published on June 15, 2014.

ABSTRACT

In the following first part of a two-part comprehensive interview with Dr. Francisco Ayala, Donald Bren Professor of Biological Sciences at University of California, Irvine, he discusses: geographic, cultural, and linguistic background; youth and early interest in the natural world; pivotal moments motivating an interest in biology; early study and investigation of biology and evolution; mentoring of Theodosius Dobzhansky; Dobzhansky's influence on Dr. Ayala; Ph.D. thesis work with *Drosophila* flies; Dobzhansky's essay entitled *Nothing in Biology Makes Sense Except in the Light of Evolution* (1973); Charles Darwin, William Paley, *Natural Theology* (1802), and the antecedents to the design arguments for biological organisms' functionality and complexity; his 2007 book entitled *Darwin's Gift to Science and Religion*; and Dr. William Dembski's *Specified Complexity* and Dr. Michael Behe's *Irreducible Complexity*.

Keywords: Academics, Basque, Biological Sciences, Biology, Columbia University, Darwin, Dr. Francisco J. Ayala, Evolution, God, Irreducible Complexity, Irvine, Madrid, Physics, Spain, Specified Complexity, Templeton, Theodosius Dobzhansky, University of California.

1. In terms of geography, culture, and language, where does your family background reside? How do you find this influencing your development?

I was born in Madrid, Spain. My family is of Basque origin. Basque Provinces are in northern Spain. Although, they do not speak the language. I was educated in Madrid, Spain. The dictatorship of General Franco as a political environment felt very restricted. Although, you would have noticed it in the later-day activities. I went to Catholic schools, private schools, in Spain. All the schools in Spain were Catholic and run by priests or nuns. Priests for men. Nuns for women.

2. How was your youth? What motivated an interest in science and the natural world?

When I was 20 years old, I had the first science class, which was called natural science. Much of it was the descriptive natural science, natural biology. However, they had a bit of physics and chemistry. The teacher of that class I found it tremendously inspiring. It inspired my interest in science. I began to read science, but I only started to study science professionally at the university-level several years later.

3. Do you recall pivotal moments motivating your trajectory into the study of biology?

Well, I remember my interest was in evolution. In particular, human evolution was an interest. It was in 1955, when I had just read a book, which had just been published by a French paleontologist and Jesuit Priest called Teilhard de Chardin. I found the book fascinating. The issues that he raised about the meaning and origin of life, human life. It was the first book that stimulated me to study evolution – particularly, human evolution. From there on, in the second part of the '50s, I read a lot about genetics and evolution in Spanish translations.

4. How did you find your early study and investigation into the discipline of biology and human evolution?

Fascinating, I came to the United States of America to Columbia University in New York, where I studied introductory biology with a career in physics. In my first year, I had to take an introductory course in biology. They required that we had to do some lab exercises. Rather than doing them in the regular classroom, I went into the lab of a geneticist called Fernando Galan. I asked him if I could do experiments in his lab as

part of the requirement for my one-year class in biology. He allowed me to do that. I learned to do some genetics with *Drosophila* – so-called ‘fruit flies’. Several years later, when I became very interested in evolution, he, and the person who had been his mentor – another distinguished Spanish geneticist called Antonio de Zulueta, he recommended to explore several alternatives and to go abroad. Biology and evolution in the advanced stages was not very good in Spain at the time. With Franco’s dictatorship, and of the great Spanish scientists left Spain at the end of the civil war. I decided the best place to go was Columbia University. Where there was a very, very distinguished evolutionist, one of the four or five giants of evolutionary biology of the 20th century called Theodosius Dobzhansky. He accepted me as his graduate student. So I came to New York. In three years, I earned my M.A. degree and then my Ph.D. I found the university fascinating in all relevant respects. First, all of the professors were distinguished scientists. Second, all of the students were close to one another and friendly. Third, I enjoyed New York and cultural aspects of New York. I was always interested in sculpture, art, classical music, and poetry. There was no better place to find those things at that time.

5. In terms of Theodosius Dobzhansky’s mentoring style, what did you notice? What style did he bring to other students and you?

He was very much a mentor rather than a professor. He had written to me. The moment I arrived in New York to call him to get in touch. So I arrived in New York around 10 or 11 o’clock. He says, “Yes, come to Columbia University today. At 4 o’clock, there is going to be a seminar by a professor from Cornell University. My former student called Bruce Wallace. Afterwards, I will take you and two, or three, graduate students to my house for dinner.” Well (laughs), this was an unbelievable shock. In Spain, there were not particularly eminent or distinguished

scientists, but always very distant. Here I come to these great scientists, and he invites me to his home. So the effect, as you may imagine! We became friends. He was very interested in my career as a geneticist, evolutionary geneticist – and even as a person. We remained friends until he died in 1975.

6. How did this influence your form of mentoring?

It influenced me very much so. I was always on very close terms with my graduate students, post-doctoral students, and visiting scientists. To the extent that they approach me – or I approach them in the classroom. I am very friendly in the classroom. I follow a policy that, but I do not make it explicit in my labs and graduate classes, but my secretary knows it very well. I have office hours on Wednesdays from 1-3, but if any student would come here from one of my classes – even from a different university, comes to see me. I immediately receive the student. I do not do that with scientists or faculty members. I usually ask them to get an appointment first. So the students always have more access. As well, the personalization is primarily with graduate students and post-docs. I, as I said, become very much personally involved and really like to help with my involvement. Again, it is mentoring rather than teaching.

7. I consider this crucial to development. In the last couple years, I understand at a deeper level the importance of mentoring for development of a student. Under the mentoring by Dobzhansky, your doctoral work focused on *Drosophila* Flies. What kind of work did you conduct for your Ph.D. thesis?

I was very lucky. You could say very wise – probably both. In the first year and classes at Columbia University, when I was still stumbling with my English and the like – I had to learn biology because my training was

in physics, other than the one general course in biology. In the second semester, in addition to the classes, we had lab exercises. The way Dobzhansky planned it for 10 or 12 students. The way Dobzhansky planned the lab with 12 or 15 small projects, which allowed each one of us to choose whatever we wanted to work on. Then we would have the whole semester to do it. I had just read a paper written by Dobzhansky and other great evolutionists such as a student of his called Richard Lewontin. As well as another great scientist called girch, the three of them published a paper on evolution, where they started work of *Drosophila* from Australia, New Guinea, and other areas nearby. They found a problem with their behavior. It was very strange. At the genetic level, they had these strange mating behaviors in these *Drosophila* flies from these different localities. I decided to study them to see if I could find out the reason for this strange behavior. Much to my surprise, I discovered they had combined samples from two different species. In one of them, I discovered they had combined samples from two different species. In one of them, they had combined two species in one sample. There was only one species. After one course and a second course of studying the genitalia of the males, I was able to classify them in different species. That, of course, resolved the issue. Now, I continued that work and I started the second semester. We had ended in the January, but I continued on through the summer, maybe the early fall. But I do not remember the exact length. He said, "You could use this as a Ph.D. thesis – a dissertation." Columbia had a minimum of three years. However, I had planned to go back to Spain. So with their minimum requirement of three years, I decided not to publish it. I began a new project with the sample of flies that I had from Australia, New Guinea, and so on. I began work on something called population dynamics to measure fitness. Not only differences between genotypes, but among these

populations. That is what I published in my third year. But at the same time, I published the other paper in a dissertation for parts of it journals such as *Genetics*. By the time I finished the experiments in the third year, I saw that I had, in addition to the descriptions of the two species that I named, all the components of the work to be published in other journals such as *Ecology* or *The American Naturalist*. Dobzhansky did not want me to go to Spain because Spain was in a miserable condition for science. We were talking about 1964. So Dobzhansky offered me a post-doctoral fellowship at Rockefeller University. Then without me applying for anything, he appointed me as an associate professor there. This was two or three years later. I decided to stay in the US by Dobzhansky and other mentors that I could not pursue a good scientific career out in Spain. However, I could pursue it in the US. Therefore, first became a permanent resident and then a full citizen.

8. Of those biology textbooks that I have seen, they often quote Dobzhansky (1973) from the title of an essay: *Nothing in Biology Makes Sense Except in the Light of Evolution*.

A Philosopher called Michael Ruse says, "Nothing makes sense except in light of evolution." Yes, however, Dobzhansky talked about 'nothing *in biology* sense except in the light of evolution.' That was the title of an address and to the future of teachers. It was the title of an article in *American Scholar* mostly for teachers. I have, myself, quoted this in many places. Including in the text that we published together called *Evolution*. By the time this book appeared with four authors, I helped Dobzhansky and was very much in charge of the project. I decided to put this as the theme for the whole book.

9. Prior to Charles Darwin's Origin of Species, Priest William Paley in the 19th century argued in his book, *Natural Theology* (1802), he provided an analogy

of the watch and watchmaker to reason by analogy for the existence of a designer. In your book from 2007, *Darwin's Gift to Science and Religion*, you discuss some of the larger theological aspects related to the some modern biological debates, especially those relating to modern creationist and intelligent design theory. In it, you argue against creationism and intelligent design as scientific explanations. Dobzhansky makes note of this in his 1973 essay. He argues science and theology do not conflict. In that, science on the one half; theology on the other half. They deal with different subject-matter. Could you discuss some of the larger, brief historical aspects of the design arguments that have come around? In particular, how did they come to the fore?

Yes, the sign of design in nature. Obviously, I have the eyes to see, hands can manipulate, and leaves can photosynthesize, and on and on. Organisms give evidence of being designed. That tended to be explored in classical Greece among the great philosophers of the 5th and 4th century BCE. They were looking at the signs this way. These signs were attributed to the gods, but not in the modern sense of a modern God – not a universal god. This was very much taken up in the Greek tradition. That organisms were designed because there seemed no other way you explain such design. Thomas Aquinas, a great Christian theologian in the opinion of many people, he used this as one of five arguments that God exists. Since the organism is designed, animals and plants, only a universal creator could explain it. That tradition continues. There are very important works including books written about it. The most complete elaboration of the argument was written by William Paley, published in 1802. He was an author of several books of Christian theology. Also, he was known in

the latter part of the 18th and 19th centuries. You may have read this in the book. He was known mostly as a public speaker for abolitionism. He was fighting against slavery. He had to give up his public speaking career. Instead, he decided to study biology. He produced his book *Natural Theology*, which is the most complete book on the argument for design. He provides the most complete argument about design in organisms in nature such as plants and animals. It is a beautiful book, 350 pages or so. There was no other argument until Darwin came with the *Origins of Species* (1859). Well, first of all with the two earlier long essays written by him. However, the 1859 book was the greatest contribution to science and one of the most important discoveries of science was being able to provide a scientific explanation of the design of organisms. Because everything else, we have the Copernican revolution with Copernicus, Galileo, and Newton, and others in chemistry, but the design of organisms seemed impossible to explain in terms of science. In terms of natural causes, the great contribution of Darwin was to provide the scientific explanations of design, which makes it one of the great scientific revolutions of all-time.

10. Some have concepts such as *Irreducible Complexity* of Dr. Michael Behe and *Specified Complexity* of Dr. William Dembski to argue against Darwinian evolution. Do these hold any merit to you?

You see, they provide arguments. I mean, Michael Behe and other proponents of intelligent design are known not to be correct. Behe, he is the only serious biologist among those proponents of intelligent design. He is a professor of biochemistry at a university. He provides these molecular examples that he claims are so complex that they require all parts for them to function. It is the same argument as Paley in terms of design for the human eye and other organs. He claims, therefore, they could not

have arisen by steps, but rather were designed. Evolution produces things step-by-step. He argues, if you cannot produce things step-by-step, then you need to have the cornea, lens, retina, optic nerve, and they could not have come one step at a time. Dr. Behe's examples have been shown to be wrong. As to the terminology of Dembski used in mathematics, by and the way, Dr. Dembski quotes two mathematicians that have published themselves saying the way William Dembski quotes them is wrong. In fact, I use his argument to show that Dembski does not exist. His argument goes as follows: take a protein, one that has, say, 100 amino acids. There are twenty possible amino acids. The probability of having the right one in each position is 1 in 20. So 1 In 10 multiplied a 100 times. Something like that, a number smaller than the number of atoms in the universe, and therefore it cannot arise by chance. Of course, it does not arise by chance. It arises by natural selection, which I explain in many ways. I explained for other

purposes a moment ago. It makes, the highly probable, the necessary outcome doing one step at a time. What I have done playfully, is taking William Dembski's father, each ejaculation produced about 10^{12} sperm, genetically all different. Only one of which that had the genetic combination to give rise to Dembski. Now, his mother produced in her life only 1,000 eggs, which had the sperm entering it that produced Dembski. So you have $10^{-3} \cdot 10^{-12}$. The probability that Dembski exists, A PRIORI – which is how he does the calculations, is 10^{-15} . But that is only the beginning. He could only have the genetic makeup his father had, but his father had 10^{-15} chance of having his genetic combination, but so did his mother. Therefore, once you go to the grandparents, you can see the calculation. This is the calculation that he uses for Specified Complexity. It is the completely wrong way of arguing. Of course he exists, but doing his calculations it would be impossible that he exists.

*****References at end of part two*****

DR. FRANCISCO AYALA (PART TWO)¹¹¹²



Dr. Francisco Ayala is the Donald Bren Professor, Biological Sciences, Professor of Philosophy, and Professor of Logic and the Philosophy of Science, and member of the National Academy of Sciences, member of the American Academy of Arts & Sciences, and the American Philosophical Society. In addition to these distinctions, he is the winner of numerous awards including the 2001 *National Medal of Science*, 2010 *Templeton Prize*, *Gold Honorary Gregor Mendel Award*, 1998 *Distinguished Scientist Award*, *President's Award* of the American Institute of Biological Sciences, *Scientific Freedom and Responsibility Award* and *150th Anniversary Leadership Medal* from the AAAS, among numerous other awards. Professor Ayala researches multiple areas including 'the origin and evolution of introns, and on the evolution and functional significance of pseudogenes, ectopic expression, molecular clock of evolution, bioethics, philosophy of biology, and the teaching of evolution in schools.

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¹² First Published on June 22, 2014.

ABSTRACT

In the following second part of a two-part comprehensive interview with Dr. Francisco Ayala, Donald Bren Professor of Biological Sciences at University of California, Irvine, he discusses: predictions of intelligent design theoretic explanations of biological organisms; thoughts on climate change with caveats of the field not being his area of expertise; responsibility of academics and researchers; conception of God in a world of material processes; responsibilities to earning numerous awards such as the *National Medal of Science* in 2002 and the *Templeton Prize*; personal influences; and projects in the coming years.

Keywords: Academics, Biological Sciences, Biology, Darwin, Dr. Francisco J. Ayala, Evolution, God, Irreducible Complexity, Irvine, Specified Complexity, Templeton, Theodosius Dobzhansky, University of California.

11. Even in terms of the scientific process, does intelligent design make predictions? Do you see any predictions within the framework proposed by them?

One can have certain predictions. I can do experiments and test my hypothesis, which are sometimes corroborated by the results, and other times not. This is what science is about. In terms of predictions of certain experiments, I do not think that one could have predicted in the Cambrian when the first animals came into existence 500 million years ago that one could have predicted them becoming humans, rabbits, or anything else. In the long-term, you cannot always make predictions. With regards to evolution, it is sometimes predictive, but we study what already exists rather than predict what is going to be – we can make predictions in the short-term. We can make predictions that the temperature of the planet is increasing in the short-term. The way in which science is predictive is in very specific ways, and in the short-term, which is essential to corroborate our theories.

12. If I may enter into the topic, which you raised briefly, of climatic change, what do you consider the strongest evidence for people to understand the evidence behind it that the Earth is warming?

It is not my area of expertise, but it seems to me that one sees increasing temperature over the last 20 years because we have these periods of increasing and decreasing temperature. However, when you compare it with the last glaciation, the coldest period in the last geological time happened about 15,000 years ago or so. Since then, the temperature in the Earth has been increasing at a slow rate, but when one superimposes it. The actual temperature increase in the last 20 years or so, you see the great increase in temperature is much, much faster than it ever was, which convinces me of human activity contributing to it. However, I go from the evidence provided by people in the field. It is not my field of knowledge

13. If any, what responsibility do academics and researchers have for contributing to society and culture? Furthermore, and for those that practice in academe, where do you see the greatest benefits and damages to society and culture from well- or ill-conceived contributions?

We have the responsibility of carrying on our jobs properly and responsibly in one instance evolution and genetics. We have the responsibility to teach it well and thoroughly, and become knowledgeable. First of all, one is a scientist in addition to being a teacher. We do research. We need to educate the younger generations because to lead a

productive life in the modern world people need to know science. Science is very important. It can depend on the careers and for the public in general to have a knowledge of science. We live in a world of natural phenomena: physics, chemistry, and biology. So we need to understand that world.

14. In terms of the world of science and faith, and you do consider yourself a man of faith, how do you conceive of God in this world of material processes?

Well, (laughs), very interesting, I was reading something explaining that in the modern world earlier today a notice came to me. The Templeton Prize, it has been given to a Czech Priest named Tomas Halik. He said, “You cannot believe in God in the same way that we believe in the existence of another human being because God is not another being, but the source of being itself. Belief in God is therefore more like seeing in the light. I cannot see in the light. I can only see things in light. Likewise I cannot see and visualize God. We say all I can do is see the world in God.” He says that not, of course, as 100% in Christianity or some other religion as a superhuman being, but as a reality that transcends the world. I think he puts it very well. You can probably, if you look at Templeton report, you can see his picture and words on these matters.

15. You earned the *National Medal of Science* in 2002 and the *Templeton Prize* in 2010. Each awarded for separate contributions to the academic world. What do awards such as these, and numerous others, mean to you? If any, what kind of further responsibilities does this recognition mean to you?

What it means to me in terms of my activities, as it were, is that these recognitions allow me to speak with authority, and therefore with credibility. Of course, these kinds of recognition are very pleasant at the personal level, very satisfying, and very rewarding. I

have a list of prizes with my assistant, which is from several places around the world such as Europe and elsewhere. I have many, many prizes. I have pictures and some of these prizes in my office. I have a very large office – at least 600 square feet or something like that. I have beautiful windows with views outside. I have diplomas and objects on display. That is, of course, very satisfying and pleasing like anybody else. I am vain. So I enjoy these things. Of course, there is the other dimension. I earned the *National Medal of Science*. It provides me with authority to speak on things I like to speak on.

When I earned the *Templeton Prize*, I was given 1 million pounds. It was presented to me by Prince Philip at Buckingham Palace, which I donated right away to fellowships for students. Now, it is even more money now. I do not mind them giving it to me again – just being playful.

16. What advice do you have for young scientists?

When they are going to study for a Ph.D., I always tell the students here to look for mentors. At other universities, students apply for several universities and teams. You want a mentor who is going to give your personal attention. Of course, you have to take your work seriously and work hard. You will not have an 8-5 job. You will have to work 10 hours a day and many weekends too. It is very important within the areas of science that they are interested in to identify scientists who are mentors.

17. This echoes Dobzhansky.

It does. There are many good scientists. There are many who are not, you know.

18. Who most influenced you? Why them? Can you recommend any books or articles by them?

Scientifically in terms of genetics, I would say Dobzhansky. His books too. Of course, I

can mention some other great evolutionists of the 20th century such as Ernst Mayer, George Simpson, and so on. These are the people who influenced me the most.

At a different level, as I was young, I was very interested in art and literature. I can mention much fiction and non-fiction that have had an influence on my life. Artists too. Spanish painters too. I collect Spanish paintings. They influence me because of the view of the world. Very explicit in the case of writers, but not so much in the case of painters or sculptors. But their view of the world makes me understand the world better and to relate to the world better.

19. What projects do you have in progress over the next few years?

(Laughs) Right now! I have been typing a book over the last few days, which is on the philosophy of biology. The title will likely be something like '*Evolution: Philosophical Reflections*'. That is the book that I am finishing. I have already finished writing something about these things. I want to write more about evolution in general and the advances that are taking place as we use molecular biology to understand evolutionary processes. Two lines of work as in the past, doing the work in specific projects. Technically, it is very esoteric. I want to continue writing books for specialists. Others for use as textbooks such as these philosophy texts that I am working on, which I think will probably be used as a textbook in many cases.

By the way, I will mention something that you may be surprised to know. I write all of my textbooks and books by pencil on yellow paper. I type them and write the words here and there. Usually, my first draft is my final draft for the article or book. I have developed over many, many years a synchronization between the speed of my writing by hand, in pencil, and the way I can generate text in my mind – generate sentences. While I can use the computer sometimes for other purposes,

indeed for communication for people, my creative works are still done by writing in paper and pencil.

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DR. KENNETH RAYMOND MILLER (PART ONE)¹³¹⁴



Dr. Kenneth R. Miller is Professor of Biology at Brown University. A cell biologist, he serves as an advisor on life sciences to the *NewsHour*, a daily PBS television program on news and public affairs, and is a Fellow of the American Association for the Advancement of Science (AAAS). Miller is coauthor, with Joseph S. Levine, of a series of high school biology textbooks used by millions of students nationwide. In 2005 he served as lead witness in the trial on evolution and intelligent design in Dover, Pennsylvania. His popular book, *Finding Darwin's God: A Scientist's Search for Common Ground between God and Evolution*, addresses the scientific status of evolutionary theory and its relationship to religious views of nature. His latest book, *Only a Theory: Evolution and the Battle for America's Soul* addresses the continuing struggle over how evolution is to be understood in American society. His honors include the *Presidential Citation* of the American Institute of Biological Science (2005), the *Public Service Award* of the American Society for Cell Biology (2006), the *Distinguished Service Award* of the National Association of Biology teachers (2008), the *Public Understanding of Science and Technology Award* from AAAS (2009), and the *Stephen Jay Gould Prize* (2011) for advancing the public understanding of evolution. In 2014, Notre Dame University presented Dr. Miller with its highest award, the *Laetare Medal*.

¹³ Professor, Biology, Brown University.

¹⁴ First Published on July 1, 2014.

ABSTRACT

First part of a two-part interview with Professor of Biology at Brown University, Dr. Kenneth Raymond Miller, examining the following subject-matter: youth and motivation for an interest in science and the natural world; early study and investigation of biology, inspiration, and pivotal moments; religious convictions; inspiration of the teachings of the Gospels, compelling historical accounts of the life of Jesus, and the logic and reason of Augustine and Aquinas for the faith; proportion of scientists and ‘elite’ scientists adhering to an evolutionary account of life; court battles and scientific investigation of ID; Dr. Michael Behe’s *Irreducible Complexity* and Dr. William Dembski’s *Specified Complexity*; thoughts on teleology in nature; and influence of personal religious views on matters of science.

Keywords: Aquinas, Augustine, Biology, brown university, Dr. Kenneth Raymond Miller, Dr. Michael Behe, Dr. William Dembski, Gospels, ID, Irreducible Complexity, John Templeton Foundation, natural world, problem of evil, Professor, religious convictions, Science, Specified Complexity, teleology, Thomas Nagel.

1. How was your youth? What motivated an interest in science and the natural world?

I had a good time as a youth. I grew up in a suburban town in New Jersey, not too far from New York City. I attended the local public schools, played sports, and hung out with a great group of friends. Outside of school, I was an Eagle Scout, and worked for three summers teaching scoutcraft and swimming at a Scout camp in northern New Jersey.

I was always interested in how things worked, and for a while expected I’d become an engineer, designing and building things. Then, in 9th grade, I took my first course in Biology, and was hooked. My eyes were opened to the intricacy and beauty of the living world, and from that moment on I knew I wanted to be a biological scientist.

2. How did you find your early study and investigation into the discipline of biology? Who inspired you? Do you recall pivotal moments motivating your trajectory into the study of biology?

It’s fair to say that Mr. Paul Zong, my 9th grade biology teacher, was my first inspiration. His classroom was a jumble of plant and animal specimens, and he

emphasized the direct study of living things. He inspired me to enter a science fair for the first time, and in turn I pestered my parents for months to buy me the present he made me dream of having – a microscope. I spent more hours than I can count looking through that instrument, but it made me determined to explore as much of the world of cells as I could.

3. What religious convictions do you hold? What argument or evidence convinces you? Or do you take personal revelation and faith for a foundation?

I am a Roman Catholic. I find the teachings of the Gospels inspiring, and embrace the sense of value and purpose that comes from the faith. Christianity depends, of course, upon specific historical accounts of the life of Jesus, and I find these compelling as well. I am also drawn to the insistence upon logic and reason that one finds in the writings of Aquinas and Augustine, as well as the continuing embrace of scientific inquiry by the Church itself and by its institutions such as Catholic colleges and universities.

4. To clarify the discussion prior to further plumbing of the issue’s depth, what proportion of scientists adhere to an evolutionary account of life? What

about the ‘elite’ scientists in the *National Academy of Sciences*?

Probably 95% or more of all biological scientists accept the board outlines of the theory of evolution. In the National Academy, the percentage is probably even higher.

5. You have been at the forefront of the public fight over creationism, intelligent design, and evolution in high school classrooms, especially with respect to having published an extraordinarily popular and widely-used biology textbook. However, much news in the past reported on intelligent design and creationism having potential insertion into high school textbooks prior to long, hard scrutiny by experts in the scientific community, which seems odd. Especially in light of the fact that most science goes through the rigours of the scientific method and community. In your article *Goodbye, Columbus*, you state, “There was a simple way that ID could... find its way into the scientific curriculum... by fighting it out in the scientific marketplace.” What attempts have been made to “fight it out in the scientific marketplace” compared to court battles over intelligent design?

I have seen very few genuine efforts by the advocates of ID to carry out scientific investigations. Nearly all of their efforts have been in the spheres of politics and public relations. Typically, more than 3,000 papers are presented at the annual meeting of the scientific group to which I belong, The American Society for Cell Biology. If there were genuine scientific results on the complexity of the cell that supported ID, one would expect to find them at these meetings. But ID proponents seem to avoid such gatherings, perhaps because these are places in which their ideas would meet serious, expert scientific criticism. Instead, they prefer to make their arguments to political groups such

as school boards and state legislatures. In such places, they can seek the political support needed to rewrite curriculum standards and revise textbooks. My sense is that if they had a genuine scientific argument, they’d be ignoring the political route, and trying to find the evidence that would convince the scientific community.

6. Most notable of the intelligent design arguments are Dr. Michael Behe’s *Irreducible Complexity* and Dr. William Dembski’s *Specified Complexity*. What does each argue? By your analysis, what evidence and argument most defeats them? How might they respond?

Behe has argued that complex multipart biochemical systems are “irreducibly complex,” which means that the removal of so much as a single part renders them non-functional. In his own words, “An irreducibly complex system cannot be produced directly by numerous, successive, slight modifications of a precursor system, because any precursor to an irreducibly complex system that is missing a part is by definition non-functional.” Therefore, since such systems cannot be produced by evolutionary mechanisms, they must be the products of special creation by “design,” according to Behe’s formulation.

The problem with that argument is that even the systems that Behe himself has chosen as examples contradict that claim. I’ve pointed out that there exist subsystems with his favourite system (the bacterial flagellum) that are missing multiple parts and yet are fully-functional. Even more dramatic is the example of the vertebrate blood-clotting system, which he claimed as an example of irreducible complexity because each and every part of the system had to be present for blood to clot. However, thanks to the work of Russell Doolittle at the University of California, San Diego, it is now clear that there are many vertebrates that are missing multiple parts of the system, and still are able

to clot their blood. Even more devastating are Doolittle's recent studies, which demonstrate how the multipart clotting system arose from simple components, something that Behe has always claimed would be impossible.

Dembski's arguments regarding specified complexity are couched in the terminology of information theory, and this makes them sound authoritative to those searching for a scientific-sounding argument against evolution. In essence, Dembski notes that living systems contain a great deal of information coded in DNA and other molecules. That is true, of course. But he then makes the claim that information cannot be generated spontaneously, and must always come from an intelligent source. Therefore, there must be an intelligent designer who put that information into living systems. The problem with that argument is that we already know where biological information comes from, and that is the process of evolution itself.

The literature has many examples of how novel genes and new functions arise through evolutionary processes. Individual studies have traced the evolution of new enzymes and new receptor proteins, and even new biochemical pathways. Each of these involves the production of new information. That information is generated by well-understood processes such as gene duplication, mutation, and natural selection. Joseph Thornton at the University of Oregon, for example, has traced the development of hormone receptor proteins, a process that generates new information in the form of genes that specify the structures of these critical proteins. Richard Lenski at Michigan State University has traced bacterial evolution for decades, and has recently watched as these organisms developed a new way to metabolize citrate. Where did the information for citrate metabolism come from? Not from an outside "designer," but from the evolutionary process itself. This is why Dembski's ideas have found

no support within the scientific community. It is because they are wrong.

7. Have intelligent design theories made any predictions? Have any intelligent design theories yielded experimental results? What falsifies intelligent design?

First, it's worth noting that the arguments advanced by ID are entirely negative. Think about the claims made by Behe and Dembski. They point to a characteristic of living systems (biochemical complexity or specified information) and then argue that evolution could not have produced these characteristics. They are wrong in their arguments, of course, but the remarkable thing is that neither of these arguments actually produce anything in the way of positive evidence for ID. They simply argue that evolution couldn't do it.

"Design," therefore, is assumed to be the default explanation in the absence of an adequate evolutionary mechanism. But that is a very weak argument, even if their critiques of evolutionary mechanisms were correct. By assuming *a priori* that the only mechanism for living things is special creation by a "designer," they are ruling out, for no reason, a host of other possibilities. These possibilities include, incidentally, as yet undiscovered genetic mechanisms. Since the last two decades have seen several such discoveries, including RNA interference, epigenetic modification, and RNA editing, it would be foolhardy to assume that we have run the table in that respect.

Not surprisingly, a negative critique of evolution, like ID, makes no predictions of its own except that living things will have some characteristics that we cannot yet explain. If that were not true, of course, there would be no need to do research, because we would understand everything. And the "design hypothesis" has proved to be almost completely unproductive in the scientific sense.

It is also worth noting that almost nothing can falsify every claim made for “design” in the strict sense. But that’s actually ID’s greatest weakness. You can invoke “design” to explain anything, from the structure of the ribosome to the winner of last year’s World Series, but that proves absolutely nothing. Whenever we lack a detailed explanation of a biological structure, pathway, or process, you can always throw up your hands and say “it must have been designed,” and that’s that. But that’s not an explanation. It’s really an appeal to ignorance. And my greatest problem with ID is that it proposes that we be satisfied with ignorance rather than continuing to search for answers.

8. Do you see any room for teleology in nature? For instance, if God created the laws of nature, then the non-teleological, i.e. deterministic, laws discovered of physics, chemistry, and biology would, in essence, result from teleology, i.e. an act of creation by God. In other words, the deterministic laws and constants discovered by science can have consideration as teleological by-products, but, of course, *Intentional* by-products from many adhered-to definitions of God.

That depends, of course, on exactly what one means by “teleology.” The Nicene Creed states that God is the “maker of all things, visible and invisible,” which would certainly include the laws of nature to which you refer. Ironically, ID actually demeans the teleological role of God in creation by its claim that natural processes are not sufficient to account for the origin and evolution of life. To an ID adherent, teleology is not inherent in nature, and must be supplied by the supernatural intervention of an outside “designer.”

Evolution, by contrast, accepts that the origin and diversification of life were and are fully natural processes. To a person of faith, that means that the universe itself contained the

seeds of life and consciousness that gave rise to the living world and to our own species. As a result, it becomes much easier to infer intention and rationality to the universe through the evolutionary process. In this very important respect, evolution makes a much more direct connection between God and the natural world that ID ever could.

9. In the arguments for creationism vs. evolution vs. intelligent design, there do arise some peripheral – regarding biology, but ultimate, issues around the larger cosmological questions of origins. In that, in any case of biological systems having origin through design, natural forces, some combination of the two, or an alternative, does the universe itself exhibit transcendent/‘top-down’ design in the form of a first cause/creator/designer or natural/‘bottom-up’ design in the form of a natural law/self-creating universe? For example, if the universe had a designer, in a general sense, all biology would have potential of being in the design plan of the universe from the instance of the cosmos’ creation. Even so, some have characterized this – at the limit – as a debate between two philosophical worldviews: theism and atheism. However, this seems – unfortunately – misleading and prematurely simplifying the matter, and more a reflection of personal views of many major figures in the public debate. How much do worldviews influence the output of research? Do personal religious/irreligious views have any bearing on the facts and theories from science?

I think it’s obvious that personal views on just about anything can influence the attitudes and work of scientists, and that includes religious views. But the great strength of the scientific process is its self-correcting nature. The very fact that scientific work is open to review,

criticism, and correction ensures that mistaken theories and hypotheses don't last for very long. For example, claims that the earth was formed less than 10,000 years ago or that the Earth's geological formations were produced in a single worldwide flood are empirically

testable. Even though these claims were accepted as fact by generations of naturalists, they were quickly abandoned when scientific tools made it possible to test them and to demonstrate that they were incorrect.

*****References at end of part two*****

DR. KENNETH RAYMOND MILLER (PART TWO)¹⁵¹⁶



Dr. Kenneth R. Miller is Professor of Biology at Brown University. A cell biologist, he serves as an advisor on life sciences to the NewsHour, a daily PBS television program on news and public affairs, and is a Fellow of the American Association for the Advancement of Science (AAAS). Miller is coauthor, with Joseph S. Levine, of a series of high school biology textbooks used by millions of students nationwide. In 2005 he served as lead witness in the trial on evolution and intelligent design in Dover, Pennsylvania. His popular book, *Finding Darwin's God: A Scientist's Search for Common Ground between God and Evolution*, addresses the scientific status of evolutionary theory and its relationship to religious views of nature. His latest book, *Only a Theory: Evolution and the Battle for America's Soul* addresses the continuing struggle over how evolution is to be understood in American society. His honors include the Presidential Citation of the American Institute of Biological Science (2005), the Public Service Award of the American Society for Cell Biology (2006), the Distinguished Service Award of the National Association of Biology teachers (2008), the Public Understanding of Science and Technology Award from AAAS (2009), and the Stephen Jay Gould Prize (2011) for advancing the public understanding of evolution. In 2014, Notre Dame University presented Dr. Miller with its highest award, the *Laetare Medal*.

¹⁵ Professor, Biology, Brown University.

¹⁶ First Published on July 8, 2014.

ABSTRACT

Second part of a two-part interview with Professor of Biology at Brown University, Dr. Kenneth Raymond Miller, examining the following subject-matter: an article, *Nagel's Untimely Idea* (2009), critiquing Thomas Nagel's book entitled *Mind and Cosmos* (2012) and extensions of the critique to the problem of evil; new book project; unsolvable problems in practice and principle in the biological sciences; thoughts on a firm adherence to straightforward communication; book recommendation; and the John Templeton Foundation essay *Does science make belief in God obsolete?* (2008).

Keywords: Aquinas, Augustine, Biology, Brown University, Dr. Kenneth Raymond Miller, Dr. Michael Behe, Dr. William Dembski, Gospels, ID, Irreducible Complexity, John Templeton Foundation, natural world, problem of evil, Professor, religious convictions, Science, Specified Complexity, teleology, Thomas Nagel.

10. Of course, not every individual criticising foundational claims of neo-Darwinism have religious convictions. Someone such as Dr. Thomas Nagel comes to mind. In a book review entitled *Nagel's Untimely Idea* (2009), you contributed in the critique of Thomas Nagel's book entitled *Mind and Cosmos* (2012). In it, you state:

He puts forward no statistical argument, no critique of the fossil record, and no discussion of molecular evolution, genetic novelty, or biochemical complexity. His subtitle notwithstanding, Nagel leaves the vast inventory of evidence for evolution untouched.

Furthermore, you point to the heart of his apparent contention with neo-Darwinian evolution. In particular, the issue of consciousness, which isolates Nagel's focus on neuroscience. How does this critique of neo-Darwinism hold to you five years onward? In any scientific discussion, does the identification of an area of mystery in science 'knock down' the dominant theory in the respective field? Or does it provide more space for scientists to research, discover, and propose new explanatory frameworks?

In the very same review, I urged my scientific colleagues to take Nagel's arguments about

consciousness seriously, and these are at the heart of his critique. I believe that he has put his finger on one of the greatest mysteries of modern science, which is how the subjective experience of consciousness can arise from the cellular biology of the human brain. This is a real problem, and contemporary neuroscience does not have a solution.

Does this "knock down" evolutionary theory? Of course not. What it does is to point research in the direction of an important unsolved problem. To me, this calls to mind the chemical nature of the gene, which was one of the major mysteries in biology in the middle of the last century. The solution, of course, was found in the structure of DNA, which explained, for the very first time, how a molecule might be capable of encoding, transferring, and replicating information. To my mind, the consciousness problem to which Nagel has called our attention is exactly the same sort of problem, and it will take a breakthrough of similar proportions to solve it.

11. How do you view the relation between an objective moral foundation – in light of personal Roman Catholic convictions – and an evolutionary explanation of moral judgment through emergence in primates such as ourselves? Does this suffice to you in merging personal religious convictions

and modern scientific theories? How might this extend to the problem of evil?

To be perfectly frank, this is one of the topics I am hoping to address in a book I'm currently writing. Work in evolutionary psychology has supported the notion that our moral sense is very much the product of evolutionary forces, and I find such explanations persuasive. But that does not mean that our moral sense is therefore untrustworthy any more than the fact that evolution has shaped our ability to do mathematics renders that discipline suspect. By contrast, I regard our moral sense as a tool that has enabled us to ask great questions about human behaviour and search for answers that coincide with those given to us by religious teachings and traditions.

12. To date, what are the greatest unsolved problems in practice in biology? Do any problems seem unsolvable in principle to you?

I don't think that I would classify any problem as unsolvable in principle. But that might just be my inherent optimism at work. However, in my own field, I regard the protein-folding problem (predicting the three-dimensional structure of a protein from its amino acid sequence) to be absolutely critical. A couple of Nobel prizes, I'm sure, are waiting for the folks who solve that one.

Other issues include the origin of life, which still eludes us despite much progress in recent years, and the intricacies of development and differentiation, the details of how each of us developed from a single cell.

13. From my vantage, and through reading your work, I see a firm adherence to a personal principle of straightforward discussion on 'tough' topics. For example, from the interview in the *Brown Daily Herald* (2007), "But what I will say is I think that all people who profess a religious faith have first of all the duty to be modest about their

own understanding." What benefit does 'straight talk' play in public discourse regarding theological and scientific matters? What drawbacks arise from it?

I don't see any reason to be guarded or indirect on any topic, including the "tough" ones. When people perceive that you are not revealing your true thoughts on a particular topic, they rightly disregard much of what you may have to say as insincere or disingenuous. That's why I've always tried to avoid that and to be up front about my own values and beliefs. I find that my colleagues value that sort of behaviour, and so do the lay audiences who attend my lectures and other presentations.

14. For research and some other reading: *Creationism's Trojan Horse: The Wedge of Intelligent Design, The Design Inference: Eliminating Chance Through Small Probabilities, The Blind Watchmaker, The Origin of Species, Finding Darwin's God: A Scientist's Search for Common Ground Between God and Evolution, Only a Theory: Evolution and the Battle for America's Soul.* Do you have any other recommendations for further reading?

Yes. For religious people I would particularly recommend the books of John Haught (Georgetown University), particularly "God after Darwin." John is a theologian who has thought long and hard about the religious implications of evolution. Christians, in particular, may be surprised at the extent to which evolution fits into a traditional view of the relationship between God and his creation, as John eloquently points out.

15. Finally, to quote your essay for the *John Templeton Foundation*, Does science make belief in God obsolete? (2008), "I suggest that if God is real, we should be able to find him somewhere else—in the bright light of human knowledge, spiritual and scientific." Do you have any final word on proof for

God, personal witness of God, faith, spirituality, and human reason?

I do not have proof of God, and I am sceptical of those who claim otherwise. But I find something remarkable in the very fact that we, as a species, have been able to learn so much about the universe and the nature of existence. As Einstein once said, “The most incomprehensible thing about the world is that it is comprehensible.” To some, this comprehensibility seems to be either inexplicable or unimportant. But to a theist, it makes perfect sense. To them, the logic inherent in space, time, and matter simply reflects the work of an intelligent Creator. What this means for science, of course, is that scientific inquiry is possible precisely because the universe is structured along lines that make it possible. To me, that is a profoundly mystical and moving experience.

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DR. MICHAEL BEHE (PART ONE)¹⁷¹⁸



Dr. Michael J. Behe graduated from Drexel University in Philadelphia, with a Bachelor of Science degree in Chemistry. He did his graduate studies in biochemistry at the University of Pennsylvania and was awarded the Ph.D. for his dissertation research on sickle-cell disease. From 1978-1982 he did postdoctoral work on DNA structure at the National Institutes of Health. From 1982-85 he was Assistant Professor of Chemistry at Queens College in New York City, where he met his wife. In 1985 he moved to Lehigh University where he is currently Professor of Biochemistry. In his career he has authored over 40 technical papers and two books, *Darwin's Black Box: The Biochemical Challenge to Evolution* and *The Edge of Evolution: The Search for the Limits of Darwinism*, which argue that living systems at the molecular level are best explained as being the result of deliberate intelligent design. The books have been reviewed by the *New York Times*, *Nature*, *Philosophy of Science*, *Christianity Today*, and many other periodicals. He and his wife reside near Bethlehem, Pennsylvania, with their nine children.

¹⁷ Professor, Biochemistry, Lehigh University.

¹⁸ First Published on July 15, 2014.

ABSTRACT

First part of an extensive and thorough two-part interview with Professor of Biochemistry at Lehigh University, Dr. Michael Behe, on the following topics: youth and interest in science and the natural world; pivotal moments motivating his trajectory into the study of biology; root of differences with the biological community's consensus; influence of William Paley and *Natural Theology* (1802); origins of 'irreducible complexity'; irreducible complexity from Behe (1996), *The Challenge of Irreducible Complexity* (2002), *Irreducible Complexity: Obstacle to Darwinian Evolution* (2004), and argument and evidence for the concept of irreducible complexity; Joplin's and Shanks's (1999) reply to irreducible complexity with redundant complexity and intelligent design theoretic responses; Professor Kenneth R. Miller's argument against irreducible complexity from a 2002 article; mathematical probabilities for the limits to Darwinian evolution from Behe and Snoke (2004), Durrett's and Schmidt's (2008) response in an article entitled *Waiting for Two Mutations: With Applications to Regulatory Sequence Evolution and the Limits of Darwinian Evolution*, and the development of the debate; the article *Intelligent Design as an Alternative Explanation for the Existence of Biomolecular Machines* with three definitions of 'evolution' based on Ernst Mayer's *One Long Argument*; and thoughts on the phrase 'scientific materialism'.

Key Words: biochemistry, Biology, Darwinian, Ernst Mayer, Evolution, Irreducible Complexity, Lehigh University, materialism, natural world, probabilities, Professor Michael Behe, redundant complexity, Science, Theology, William Paley.

1. How was your youth? What motivated an interest in science and the natural world?

My childhood was very happy. I was born into a large Roman Catholic family, one of eight siblings. We were not well-to-do, but we had all we needed. All we kids went to Catholic grade school and high school, played sports, were involved in school clubs and such. I was taught Darwinian evolution in Catholic school. We were told that God could make life however He saw fit. So if He wanted to create the universe with laws sufficient to make life, who were we to say differently? That always sounded good to me, so I never gave much thought to the topic. It was only much later in life that I decided that Darwinism didn't comport with the evidence. Ever since I was young I wanted to know how the world worked at its fundamental level, so that's why I chose a career in science. I went on to study chemistry at Drexel University, got my Ph.D. in biochemistry at the University of Pennsylvania, did a postdoc

studying Z-DNA at the National Institutes of Health, got an assistant professorship at Queens College in New York, and then three years later moved to Lehigh with my wife and our baby daughter (the first of our eventual nine children).

2. Do you recall pivotal moments motivating your trajectory into the study of biology?

Drexel University, where I went for my undergraduate studies, offers what they call a "cooperative work-study" program. That means that students go to school for six months of the year, and then for the other six months they work in a job related to their field of study (which the university helps them secure). My first work-study job was at Holy Spirit Hospital near Harrisburg, where I worked running blood tests in the clinical lab. That's where I discovered I didn't want to be a doctor. My second work-study was at the Department of Agriculture Research Facility outside Philadelphia, where I assisted a Ph.D.

in basic biochemical research (on milk proteins – this was after all a government agriculture facility). It was there I got hooked on biochemistry. I had taken a year of organic chemistry just prior to starting at the USDA, and was used to thinking of small organic chemicals of the size of benzene and derivatives, whose molecular weights are on the order of a few score to a few hundred. My boss mentioned casually that one protein we were studying had a molecular weight of a hundred thousand! I couldn't imagine a molecule like that; it seemed fantastic to me. From then on I wanted to know how proteins worked in particular, and how life worked at the molecular level in general.

3. How did you find your early study and investigation into the discipline of biology? When did you begin to differ with consensus on core explanations for biological systems?

For my graduate work in biochemistry at the University of Pennsylvania I joined the laboratory of Walter Englander, a protein chemist and later member of the National Academy of Sciences. Walter had helped to develop a technique called “hydrogen exchange”, which could probe the structure of macromolecules by examining how quickly they exchanged protons in solution with radioactive water. Everyone in the lab worked on the hydrogen exchange of normal adult hemoglobin — except me. My project involved sickle hemoglobin — the mutant version of hemoglobin that can lead to sickle cell disease. We came up with a really neat explanation for the extraordinary concentration dependence of the sickle hemoglobin gelation reaction, as well as its peculiar behavior in the presence of other hemoglobin variants.

For my postdoctoral work I joined the lab of National Academy-member Gary Felsenfeld at the National Institutes of Health, supported by a Jane Coffin Childs Postdoctoral Fellowship. I switched from studying a protein to studying a new kind of DNA,

called “Z-DNA”. Z-DNA has the opposite twist to the normal Watson-Crick double helical structure. It turned out some DNA could flip from the normal structure to the Z conformation and back again, depending on its environment. We discovered some interesting effects on the Z form of a chemical modification of DNA called methylation. I took this work with me to my first faculty job in the Department of Chemistry at Queens College in New York City and when I moved to Lehigh University three years later. I worked on various aspects of DNA structure and DNA-protein interactions for the next couple of decades. At no point was my lab research concerned with evolution. I had little interest in the topic until the late 1980's when I read a book by the geneticist Michael Denton, called “Evolution: A Theory in Crisis”. Denton, who was an agnostic at the time, didn't have any particular axe to grind; he was just sick and tired of hearing Darwinists claim so much for their theory when he saw many serious problems. I had no answers for Denton's criticisms. I had never heard Darwinism criticized by a scientist at all until then, and here I was a tenured faculty member at a good university. I got very ticked off. I concluded that I had been led to accept Darwinism not because the evidence for it was compelling, but for sociological reasons — this is just the way we're supposed to think these days. From that point on I became very interested in evolution.

4. Some of the oldest arguments from design in the ‘modern’ era come from the 19th century priest William Paley. In his book *Natural Theology* (1802), he provided an analogy of the watch and watchmaker to reason by analogy for the existence of a designer. For those not knowing the argument in full, how did William Paley argue for the existence of a designer? Did his work have any influence on your own?

Paley wrote that if you see a watch resting in a meadow you know it was purposely made, that it had a designer, because when you examine it you can see how its parts are put together for a purpose. He then argued that nature is like that, too (its parts are put together for a purpose), so we can recognize the benevolent God behind nature. Paley had no influence on me for the simple reason that I had never heard of the man or read about him until years after I became interested in intelligent design. After reading him I saw that his famous example of the watch is exactly correct — anyone in his right mind would recognize the design of a watch on a heath. Unfortunately, Paley wasn't rigorous in the development of his argument, bringing in many dubious examples from nature. What's more, he extended it beyond a simple recognition of design to an argument for a loving, paternal God. Then all a critic had to do was to point to the fangs of rattlesnakes, say that no loving designer would make that, and sweep out the argument for design with the argument for benevolence. Paley overreached, he mixed a scientific argument for design with a theological one for God and for benevolence, and in the end got neither.

5. Furthermore, for those unfamiliar with your ideas, and in particular, what provided the original basis for the idea of 'irreducible complexity'?

Roughly, an irreducibly complex system is one that requires multiple parts to function, and the removal of a part causes the system to lose its function. A good example of this from our everyday world is a mechanical mousetrap, such as I discussed in *Darwin's Black Box*. All of the mousetrap's parts are involved in trapping mice, and if one of the parts is removed it can no longer do that. I was just sitting in my office in the early 90's cogitating about the problems I saw for Darwin's theory in the structure of biochemical systems. Biochemistry studies enormously complex systems. Okay, I thought to myself, why is that a problem? Well, I answered myself, in a

lot of cases the systems require many parts, and without one or more of them it wouldn't work. You can't reduce it. It's irreducible. When the word "irreducible" popped into my mind I knew I had captured the essence of the problem. In order to work at all, Darwin's theory requires a pretty continuous, gradual evolutionary route. Irreducible complexity is a massive conceptual roadblock to that gradualism.

6. By some markers, you could fall under the category of the founder of modern intelligent design, especially with respect to the academic side through creation of one core idea from Behe (1996): irreducible complexity. You continued this same conversation from the 1996 book with *The Challenge of Irreducible Complexity* (2002) and *Irreducible Complexity: Obstacle to Darwinian Evolution* (2004). In it, you delve a bit further with the use of the same phrase 'Black Box', i.e. "a system whose inner workings are unknown." How would you define it? Where does it gain experimental traction? What do you consider the strongest arguments for the idea? What about against it?

Although most people think of a "black box" as the recorder on a plane that stores data in the event of a crash, in science the phrase means a system that does interesting things, but whose inner working are mysterious. They are mysterious because we can't see into the black box. In my book I used the phrase "Darwin's black box" to refer to the cell, because in Darwin's day the inner workings of the cell were unknown. Most scientists thought the cell was a simple entity — a glob of protoplasm — essentially a microscopic piece of jelly. Now we know the exact opposite is true. The cell is an exceedingly complex, nanoscale factory whose sophistication we cannot match even in our technological age. It is filled with machines — literally, molecular machines. And just like machines in our everyday world (even ones so

simple as a mousetrap) cellular machines need multiple parts to work. Thus they strongly resist evolutionary explanation by the gradual manner Darwin proposed. What's more, their purposeful arrangement points insistently to design.

Irreducible complexity is easy to experimentally demonstrate. Just knock out (destroy) a gene for a necessary part of the cellular system and see that the system no longer functions. That has been done for all the systems I described in *Darwin's Black Box* and many more besides. These results are the strongest argument for – indeed a demonstration of — the concept. There is no experimental demonstration showing that random mutation and natural selection can build any such system. Rather, the most difficult opponent that the concept of irreducible complexity faces is the Just So Story. That is, Darwinists will invent superficial, plausible-sounding tales to account for the machines, much as Rudyard Kipling told children's tales such as “how the tiger got its stripes”. Although not explaining the evolutionary development of machinery in anything like sufficient scientific detail, the plausible-sounding stories can impress laypeople and give those who don't want to deal with design an excuse to declare victory and go back to sleep. The “victory” is hollow, of course – entirely rhetorical rather than scientific. But a surprising number of people are anxious to avoid the issue of design.

7. In particular, some research, for instance Joplin and Shanks (1999), replied to your early argument for irreducible complexity and proposed an alternate explanation called ‘Redundant Complexity’. In the section of their paper on genomics, a far more prominent field in this decade than at the time of publication, they focus on the experiments dealing with the ‘knockout’ of genes in *Saccharomyces Cervisiae*, a species of yeast, to create a less-complex yeast genome through

removing, or ‘knocking out’, non-essential genes. How did the Joplin and Shank (1999) proposal of redundant complexity differ from irreducible complexity? What do you think of the alternate explanation of redundant complexity? Where do you see the status of intelligent design theoretic explanations of findings from the field of genomics?

Briefly, Shanks and Joplin's proposal of “redundant complexity” was that there are so many kinds of active biochemical factors, such as proteins in the cell, that if one is removed then another kind can almost certainly take its place. Their simple mistake was in assuming that, because some biochemical systems are redundant, that all biochemical systems must be redundant. That of course is not true. Although some genes can be knocked out and a function taken over by another system (mostly in metabolic pathways), many others can't. Tellingly, in their article Shanks and Joplin did not discuss any of the irreducible biochemical systems I wrote about in *Darwin's Black Box*.

Genomics is advancing at a breakneck pace these days, and it's premature to reach definite conclusions. Nonetheless, genomics has the potential to strongly support intelligent design. The reason is that investigators are finding layers of sophisticated controls — strongly reminiscent of the structures and controls found in complex computer software — in the genome that no one suspected existed way back in 1996 when I wrote my book.

8. Dr. Kenneth R. Miller (2002), professor of biochemistry at Brown University, published an article stating, “In the final analysis, the biochemical hypothesis of intelligent design fails not because the scientific community is closed to it but rather for the most basic of reasons—because it is overwhelmingly contradicted by the scientific evidence.” What do you consider the strengths and

weaknesses of the counter-argument of Dr. Miller contained, in brief, within the 2002 article – and some of his arguments more generally? Where does this debate stand in the literature at the moment? What about the general public?

I don't want to sound harsh, but I consider Ken Miller's writings to be exercises in damage control rather than a serious attempt to engage the issues. It's silly to say that the scientific community (as a whole – there are some exceptions) is not closed to intelligent design when a coordinated campaign was undertaken by scientific societies to declare design to be unscientific and therefore not needing scientific rebuttal. It's hard to pretend that Darwinists are simply evaluating it solely on its scientific merits when some science magazines actually warned that Western civilization itself would be destroyed – thrown into a new “Dark Ages” — if ID were to prevail. It's also silly to say that design is contradicted by the evidence when some Darwinists don't recognize that experimental results are the opposite of what they had thought

(<http://www.discovery.org/a/442>), or when prominent researchers publish evolutionary “explanations” for molecular machines that are quickly rejected by other workers

(http://www.evolutionnews.org/2007/04/darwinism_gone_wild_neither_se003517.html), or when the best, longest, most closely-studied laboratory evolution experiment shows beneficial mutations involve mostly the degradation of pre-existing genes and see not a glimmer of evolutionary processes building any new molecular machinery of the type that fills the cell

(http://www.evolutionnews.org/2007/04/darwinism_gone_wild_neither_se003517.html).

9. In some academic research over mathematical probabilities based on populations beginning with your work arguing for the mathematical limits to

Darwinian evolution – in Behe and Snoke from 2004, subsequently, Durrett and Schmidt replied to this argument in a 2008 article, *Waiting For Two Mutations: With Applications to Regulatory Sequence Evolutions and the Limits of Darwinian Evolution*. More articles were published concerning the argument-counterargument and further publications in that form. From the start, what did you consider the mathematical limits of Darwinian evolution? How did the debate develop? At present, what do you think of the mathematical probabilities for Darwinian evolution?

The basic problem is that Darwin's theory of evolution is a gradual one – life is postulated to improve slowly, in tiny steps, over long periods of time. Yet a profound discovery of 20th century science is that the information for life is digital, written in the code of DNA. Among other things, that means that at bottom there is no “gradualism”. Rather, there are fundamental “quanta” of mutation, such as the replacement of one nucleotide in DNA by another. You can't replace half of a nucleotide, or a quarter of a nucleotide, or a millionth of a nucleotide. You have to replace one (or more) nucleotides at a time.

How likely is it that a given nucleotide could be mutated if it would give an organism some beneficial effect? That depends on several physical, empirical factors: the number of nucleotides in the organism; the mutation rate; and the generation time. That's relatively easy to calculate and has been confirmed experimentally for a number of kinds of organisms. It's reasonably do-able in evolutionary time. Now here's the controversial, difficult problem for Darwinism: what if some beneficial effect for an organism requires more than one mutation? What if, to secure the improvement, two separate nucleotides have to be changed? Or three? Or more? It turns out that as the number of separate mutations

that are required for a beneficial effect increases, the improbability of its occurrence (or, looked at another way, the time expected to achieve it) increases exponentially and soon becomes prohibitive. This is also where irreducible complexity rears its ugly head. To get an irreducible biochemical feature it would seem that multiple mutations would have to occur before a selectable effect arrived, making it very, very improbable.

My paper with David Snoke simply quantified this problem for some simple cases. Simple and obvious as it was, the paper set off a firestorm at the poor journal that published it – the editor was quickly inundated with angry letters. They then published a response to our paper within months (an extraordinary step for a journal) as well as a response to it by us. People interested in the topic can look it up. Suffice it to say here that the response missed the point. And so did the article by Durrett and Schmidt. I have to admit that I find it frustrating that the topic is so emotional that even modest discussion of obvious problems for Darwinism invariably provokes angry, defensive reactions.

My current thinking is that the limits to Darwinian evolution are much more severe than I had envisioned in 1996, and even more severe than I discussed in my 2007 book, *The Edge of Evolution*. Random mutation and natural selection sometimes produce simple beneficial results for an organism, but usually by degrading some genetic feature the organism already had. Darwin's mechanism cannot coordinate the many changes necessary to build even modestly complex systems.

10. In some of the discussion with intelligent design v. evolution v. creationism, much confusion arises over the term 'evolution', in the article *Intelligent Design as an Alternative Explanation for the Existence of Biomolecular Machines*, you define three conceptions of the term 'evolution', "Change over time, common

descent, and Darwinian natural selection." You take this from the book *One Long Argument* by Ernst Mayer (1991). For those not considering distinct, or even different, definitions of the term 'evolution', how would you define each of these sub-phrases for the super-term 'evolution'? What one features more prominently in the public debate? What one features more prominently in the academic debate?

It's important to realize that theories can be mixtures of logically separate ideas, some of which can be true and some false. If that's the case, then each logically-separate idea has to be tested on its own. It turns out, as the great evolutionary biologist Ernst Mayr noted, that Darwin's theory is a mix of a handful of ideas. The three most important concepts in Darwin's theory are those of change over time, common descent, and natural selection acting on random variation. Intelligent design is concerned exclusively with the third concept (especially random variation); it has no proper quarrel with the first two. Change over time – for example, that there were once dinosaurs and now there aren't – is noncontroversial; everyone agrees with it. Common descent is more controversial, but is in itself not an explanation for how organisms might have arisen or changed over time. For my money, 99% of scientific and philosophical interest is packed into the third concept of Darwin's theory, natural selection acting on random mutation. Darwin's claim to fame was not to have proposed that modern animals descended from ancient ones. (Earlier scientists had proposed this before Darwin.) Rather, his impact was to have putatively identified an entirely unintelligent mechanism that could mimic the effects of purposeful design. That has always been, and remains, the most doubtful part of his theory. We currently have good evidence for change over time and common descent, but evidence for the constructive power of Darwin's mechanism is

meager to nonexistent at best, and strongly contradictory at worst.

11. You have brought to bear the idea of ‘scientific materialism’. How would you define this phrase? Do you consider scientific materialism pervasive? What do you consider the strongest set of evidence and argument for pervasive scientific materialism? What do others with differing views consider the case?

Well, I’m not sure I myself have ever used the phrase “scientific materialism,” although other ID proponents have used it. I would define it either as the idea that the only thing that exists is matter and energy, or as the idea that science can properly study only matter and energy. Those two senses frequently get conflated by people who hold that the only things we can know for sure, or publicly argue for, are things that science studies. And that often transmogrifies into the (often unstated) conclusion that nothing else exists. I myself think that the contention is false: science can study the results of the action of a mind, and does so frequently in disciplines such as cryptography, archeology, and forensic science. It’s important to notice that scientific

materialism is not itself science; rather it is philosophy. Ironically and self-contradictorily, then, the claim by some people that science tells us all we can know is not itself a scientific claim.

This view – scientific materialism – is certainly widespread in academia, not only in the sciences but, strangely enough, also in the humanities. It is much less widespread in the population at large, although it has strongholds in law and journalism. In my estimation scientific materialism is most easily seen in those familiar stories speculating why this or that human mental trait evolved – lust, anger, fidelity, friendship, and so on *ad nauseam*. It seems academically disreputable to take humans as responsible moral agents. Rather, we are often portrayed as the hapless product of evolutionary winds blowing where they will. It seems to me that proponents of scientific materialism rarely argue for it explicitly. Rather, they simply assume it, and treat other views as gauche at best, seditious at worst. It should go without saying that the actual evidence for the power of natural processes to mold minds as the materialists claim is nonexistent, yet that seems to give few of them pause.

*****References at end of part two*****

DR. MICHAEL BEHE (PART TWO)¹⁹²⁰



Dr. Michael J. Behe graduated from Drexel University in Philadelphia, with a Bachelor of Science degree in Chemistry. He did his graduate studies in biochemistry at the University of Pennsylvania and was awarded the Ph.D. for his dissertation research on sickle-cell disease. From 1978-1982 he did postdoctoral work on DNA structure at the National Institutes of Health. From 1982-85 he was Assistant Professor of Chemistry at Queens College in New York City, where he met his wife. In 1985 he moved to Lehigh University where he is currently Professor of Biochemistry. In his career he has authored over 40 technical papers and two books, *Darwin's Black Box: The Biochemical Challenge to Evolution* and *The Edge of Evolution: The Search for the Limits of Darwinism*, which argue that living systems at the molecular level are best explained as being the result of deliberate intelligent design. The books have been reviewed by the New York Times, Nature, Philosophy of Science, Christianity Today, and many other periodicals. He and his wife reside near Bethlehem, Pennsylvania, with their nine children.

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²⁰ First Published on July 22, 2014.

ABSTRACT

Second part of an extensive and thorough two-part interview with Professor of Biochemistry at Lehigh University, Dr. Michael Behe, on the following topics: influence of world views on scientific output; philosophical and cosmological considerations for biological systems and origins; Sir Karl Popper, falsificationism, and predictions of intelligent design theory; considerations of changes in the scientific method and relation to intelligent design; 2005 paper entitled *Scientific Orthodoxies*, intellectual climate among mainstream Catholic discussions on scientific or theological matters; *Kitzmiller v. Dover Board of Education* in December of 2005 and view of litigation with respect to intelligent design v. evolution; *The Wedge Document* of the Discovery Institute; advice do you have for young scientists; upcoming projects; and intelligent design in the near and far future.

Key Words: biochemistry, Catholic, Darwinian, Ernst Mayer, Evolution, intelligent design, Irreducible Complexity, Kitzmiller v. Dover Board, Lehigh University, Professor Michael Behe, Sir Karl Popper, The Wedge Document.

12. In the debate between creationism v. evolution v. intelligent design, there do arise some peripheral – regarding biology, but ultimate, issues around the larger cosmological questions of origins. In that, in any case of biological systems having origin through design, natural forces, some combination of the two, or an alternative, does the universe itself exhibit transcendent/‘top-down’ design in the form of a first cause/creator/designer or natural/‘bottom-up’ design in the form of a natural law/self-creating universe? Now, these have invocation at some point during the debates because cosmological design would supersede biological design. For instance, if the universe had a designer, in a general sense, all biology would have potential of being in the design plan of the universe from the instance of the cosmos’ creation. Even so, some have characterized this – at the limit – as a debate between two philosophical worldviews: theism and atheism. However, this seems misleading and pre-maturely simplifying the matter, and more a reflection of personal views of many

major figures in the public debate. How much do worldviews influence the output of research? Do personal religious/irreligious views have any bearing on the facts and theories from science?

Although most of science can happily carry on without impinging on matters of ultimate concern, views about the ultimate nature of reality can certainly strongly influence theories that touch on them. For example, some physicists opposed the Big Bang theory when it was first proposed in the middle of the 20th century because it seemed to have theistic implication – perhaps that was the creation event of the universe, pointing to a Creator outside of nature. Isaac Newton’s theory of gravity itself was opposed when it was first published because most scientists of the time thought a force such as gravity, which could act at a distance, was reminiscent of spooky teleological concepts of Aristotle. If a scientist takes it as a basic assumption that nothing exists except matter and energy, then he’ll never accept evidence for the existence of the design of the universe or parts of it, and will necessarily cram all facts into a materialistic framework, no matter how bad the fit. On the other hand, a person who believes that some aspects of the universe or life evince design has much more freedom. Just because some

things are designed does not necessarily mean that all things are designed, so he can let the evidence speak for itself.

13. With regards to the larger philosophical and cosmological matters, to you, how would new philosophical arguments, experimental evidence, and theoretical frameworks influence the debate regarding biological systems and origins?

Well, to change my mind at this point would require Darwinists to produce actual evidence that their theory can do what they claim for it. They aren't used to doing that, and I don't expect that to change anytime soon.

14. In addition, with regards to historical considerations of the practice of science, it began with some rudimentary forms from Aristotle, even the attempts to naturalize reality with the atomists, or even the pre-Socratics – especially the Ionian school of philosophy: naturalism. In fact, more modern, historically speaking, scientists were originally called natural philosophers. For example, Isaac Newton went by that title only a couple hundred years ago. However, science seems to me to have treatment like a capitalized abstraction, 'Science', without a lot of context into the history of the endeavor, by which I mean the highly human process of trial-and-error of improving on the failures of prior generations – even in the production of processes such as science. Rather new to the process comes the logician, Sir Karl Popper, creating an entirely new criterion for scientific theories, namely: falsificationism. If something wants consideration as a part of modern science, it best have the ability to become falsified. Furthermore, and more to the point, science makes predictions. In the decades-long debate of creationism v. evolution v. intelligent

design, some core arguments against intelligent design and creationism start with the process of modern science, regarding intelligent design the question comes to the fore, 'Can intelligent design make predictions?' What predictions have those researching intelligent design made?

Well, I, along with many philosophers, don't think Popper's work on falsificationism is the last word. Many theories are notoriously difficult to falsify, yet keep going like the Energizer Bunny. For example, in physics string theory has been studied for decades, but no experimental evidence of the existence of subatomic "strings" has been produced. Some scientists have proposed that our universe is actually the result of a computer simulation by aliens in another universe. That's a bit hard to evidentially support, too. A third example of the failure of falsificationism is Darwin's theory. Despite many wrong predictions and utterly mysterious, long standing problems such as the conundrum of sexual reproduction, as well as the failure to demonstrate the ability of random mutation and natural selection to produce molecular machinery, the theory keeps chugging along, oblivious to severe problems.

One attractive feature of intelligent design theory is that it can easily be falsified. All it would take is for Darwinists to demonstrate that their theory can do what they claim for it – construct molecular machinery – and ID would be blown out of the water. ID properly makes only one strong, necessary prediction: no undirected, unintelligent process will be found to make sophisticated machinery such as that found in the cell. So far, so good for ID. Darwinism makes the opposite, so far unsupported, prediction.

15. Furthermore, what predictions have yielded experimental results? In

addition, what would falsify intelligent design?

See above

16. Regarding the outcomes of predictions and experimental results, from your vantage, how have the intelligent design explanations done better than evolutionary explanations? How have they done worse?

See above

17. The practice of ‘design detection’ or design inference, as termed by Dr. William Dembski (1998), infused into the biological sciences may imply a tacit proposal to altering the operation of fundamental scientific processes. If so, how would this change the practice of science? Do you think the practice of science needs revision? In your analysis of the issues over the last few decades, and only if you think so, how would you revise the practice of science? What might others argue in opposition to this argument?

I don't think the actual practice of science needs any revision at all to accept a theory of intelligent design. Rather, it's just people's attitudes that have to change, because only an unprincipled taboo keeps design off the table. As I noted above, in the past science has been confronted with ideas that shook the foundation of what was thought to be the nature of reality. Newton's theory, with its apparent action at a distance, and the Big Bang theory, with its very suggestive beginning to nature, both changed scientists' understanding of the very nature of nature. Yet they were no problem for science. Design itself is permitted in science, as long as it's kept within bounds. And I don't mean just human design. Francis Crick famously proposed the idea of "directed panspermia", which speculated that space aliens first seeded the earth with life. The SETI project of course

has searched the skies for signals that might be interpreted – from their physical pattern – as having come from an intelligent, probably alien, source. Even design from beyond our universe can be entertained in the most respected scientific venues. For example, *Nature*, the most prestigious science journal in the world, published a short fiction story a while back whose premise was that our universe was created by a physicist from another universe

(<http://www.nature.com/nature/journal/v406/n6791/full/406023a0.html>). (Try publishing a story in NATURE about how God created our universe....) And work by scientists purportedly supporting the notion that we and our "universe" are actually one big computer simulation run by beings living in an entirely different plane of existence from us was described recently in Discover magazine (<http://discovermagazine.com/2013/dec/09-do-we-live-in-the-matrix>).

So science can accept fundamental changes to what it thinks to be the nature of reality (e.g., Newton, Big Bang). It acknowledges that the effects of intelligence can be detected by physical evidence (e.g., archeology, forensic science), even alien intelligence (e.g., SETI). It has no problem thinking beings outside of our universe may effect it (e.g., the fictional *Nature* story), or even that other beings entirely created our plane of existence (e.g., the computer simulation theory). Thus there is no principled reason that the scientific community could not accept and investigate a theory of intelligent design as I and others have proposed. Rather, in my experience it balks for nonscientific reasons: it associates the idea with disfavored religious groups and fears there would be unpalatable sociological results from allowing the idea of design full play.

18. In a 2005 paper entitled *Scientific Orthodoxies*, you recount a story of your wife, Celeste. In the seventh grade, she attended *Our Lady of Saint Carmel* in

the Bronx. The experience presented something of interest. In it, you state, “Catholics have always been rather blasé about evolution.” What do you mean by this? How does this figure up to the present regarding the intellectual climate among mainstream Catholic discussions on scientific or theological matters?

As a rule Catholic scholars consider science to be a subordinate discipline to philosophy, let alone theology. Thus, in the past the thinking was that no discovery of science could challenge what we know from higher studies. Darwinian evolution may be true, but exactly how God created life was much less interesting or important than our knowledge that he had in fact created it, and intended us to know, love, and serve him. What’s more, we knew from philosophy that we have free will, the ability to choose between good and evil, the ability to discern natural law, and so act as God would want us to. That was the background to my future wife’s grade school instruction.

Darwinism, however, has come a long way since then, at least rhetorically if not scientifically. Now the most prominent Darwinists explicitly define their theory as one which required no direction or help from anyone, pointedly including God. Now it is routinely claimed, with all the scientific rigor of a children’s fairy tale, that this or that mental tendency – from the love of mothers for their children to the likelihood that men will grow beards to the tendency to rape – is as much the result of undirected change as the shape of a bird’s beak. The metastasis of Darwinian rhetoric, and its unthinking acceptance by large portions of the lay public, is a cause of grave concern in today’s Catholic Church.

19. In terms of the teaching of intelligent design in United States classrooms, there exists much controversy, which can probably have

fair claim to having a peak of controversy within the *Kitzmiller v. Dover Board of Education* in December of 2005. How do you view the idea of litigation with respect to intelligent design v. evolution? How do you examine the outcome of the *Kitzmiller v. Dover* trial?

I am no lawyer, so I don’t have a strong opinion on how to interpret the various laws and constitutional texts that legal eagles cite on various matters. However, it’s unfortunately true that sometimes the law has precious little to do with reality. If a court decided that it was illegal to teach the Big Bang theory in American public schools because, as many physicists and others have thought, a beginning to the universe supports theism, I would have no professional opinion on the laws. But I would have a very strong opinion on the science. The same goes for the idea of intelligent design in biology. Courts, lawyers, and politicians – often in thrall to Darwinists — can say what they will, but that changes nothing of the evidence from biology – of molecular machines and the digital information of DNA, of the genetic code and gene regulatory networks – that points insistently to design. I can only say that indoctrinating students in Darwinism to the exclusion of other legitimate views is shameful.

As for the *Kitzmiller* trial itself, I view it as little more than a farce. In his written opinion the judge offered his own views on testimony about school board meetings, newspaper editorials, and other quotidian matters. But whenever the topic turned to intellectual questions – whether in science, philosophy, or theology, whether by the plaintiffs’ expert witnesses or the defense’s – he simply copied, word for word, from a document given to him by the plaintiff’s lawyers at the end of the trial.

<http://www.discovery.org/scripts/viewDB/filesDB-download.php?command=download&id=>

1186) There is no reason at all to think that the fellow – a former head of the Pennsylvania Liquor Control Board – comprehended any of the scientific or philosophical issues discussed in depth in his court, let alone made an independent judgment about them. Those who think, as some do (<http://www.uncommondescent.com/intelligent-design/time-magazine-and-judge-john-jones/>), that in the Dover trial a philosopher-king weighed competing ideas and independently saw the merits of one side have been seriously misled. For those who see his plagiarized opinion as somehow intellectually definitive, just think about a court ruling on any matter with which you disagreed, and ask yourself if you think the ruling settled the matter intellectually.

20. One document did produce further controversy such as the *The Wedge Document* of the Discovery Institute. For those unfamiliar, what is the *The Wedge Document*? How do you examine the issues surrounding this document? How would others differ from you?

I first heard the term “wedge” in the context of the ID-evolution debate from Phillip Johnson, then a professor of law at the University of California Berkeley and a skeptic of Darwinism. Phil described the wedge as the strategy of splitting apart two very different definitions of science: 1) science as a no-holds-barred search for the best explanation for nature, versus 2) science as applied philosophical materialism. He saw that the public thought of science in terms of definition one, but that, especially when push came to shove in the area of evolution, much of the scientific community thought of it as definition two. He wanted to make it as clear as possible to as large a fraction of the public as possible that what they thought was an unbiased search in science for the best answer was actually strongly guided by preconceived philosophical prejudice.

I never heard of the “Wedge Document” until some news story about it appeared. It seems to have been a draft of some internal document at the Discovery Institute, probably for fund raising purposes. As far as I know it was never accepted by higher-ups there as an official policy or document. It essentially made the case that the social and political history of the United States was largely guided by Christians and others (such as, say, Thomas Jefferson) who were convinced that nature exhibited purpose, which as an historical observation is unquestionably correct. It also proposed typical think-tank actions, such as holding meetings and publishing books, to once again promote that view.

The document was stolen from the Discovery Institute, scanned, and posted on the internet. Some opponents of ID seized on phrases from the document that spoke of making science consonant with Christianity, and claimed, ludicrously, that here was a grand conspiracy to have religious fundamentalism take over science, probably by stationing preachers in every lab to monitor activities. Reading the document calmly makes it plain that what was meant was to disestablish materialism as an extraneous assumption of science — to have science be the no-holds-barred search for truth that Phil Johnson spoke of, rather than a propagandist for a materialistic philosophical view.

21. What advice do you have for young scientists?

Study hard! Also, unfortunately, watch your backs and toe the line. If you decide to challenge an accepted explanation – even one that is comparatively noncontroversial – keep your eyes wide open and count the potential cost before you do.

22. What projects do you have in progress over the next few years?

I’m interested in trying to establish as rigorously as possible where the likely dividing

line exists in biology between what can be accomplished by unintelligent processes and what requires purposeful design. I've made a start of that with my 2007 book *The Edge of Evolution* and hope to build on it

23. Where do you see intelligent design in the near and far future?

I'm serenely confident that a theory of intelligent design in some form will be adopted in biology at some point, probably not too far in the future. It's not because of anything I or anyone in the ID movement has done. Rather, it's because that is where the data are headed. The astounding elegance and sophistication of the machinery of life are being made more and more plain, and the conclusion of design cannot be long avoided.

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DR. JAMES FLYNN (PART ONE)²¹²²



Dr. James Flynn has combined political and moral philosophy with psychology to clarify problems such as justifying humane ideals and whether it makes sense to rank races and classes by merit. Professor Flynn has been profiled in *Scientific American* and ran for the New Zealand Parliament in 1993 and 1996 as Alliance candidate for Dunedin North. Research Interests include humane ideals and ideological debate; classics of political philosophy; race, class and IQ. He was Head of Department from 1967 to 1996. He is best known for the “Flynn Effect”, that is, massive IQ gains over time.

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ABSTRACT

First part of a two-part comprehensive interview with Emeritus Professor of Political Studies and Psychology at the University of Otago in Dunedin, New Zealand on the main subjects of his research: intelligence and subsequent controversies; graduate students continuing the debate; Eysenck and Richard Lynn; incoming work for the year; environmental influence on intelligence; considerations on climate change; moral imperatives outside of survival for solving climate change; family background and influence on development; influence of Catholicism; duties and responsibilities of being Emeritus Professor of Political Studies and Psychology at University of Otago, New Zealand; differences between intelligence and IQ; definitions of intelligence and IQ; the late Dr. Arthur Jensen and the 1969 journal article entitled *How Much Can We Boost IQ and Scholastic Achievement?*; Dr. Charles Murray and *The Bell Curve*.

Keywords: Catholicism, climate change, Dr. Arthur Jensen, Dr. Charles Murray, Dr. James Flynn, Emeritus Professor, environmental influence, Eysenck, Intelligence, IQ, moral imperatives, New Zealand, Political Studies, Psychology, Richard Lynn, University of Otago.

1. Your most famous research area is intelligence. Of those studying intelligence, you are among those on the top of the list. Many researchers worked in this area and caused many, many controversies, but more importantly sparked debate.

Of the old timers, I guess there's just Richard Lynn and me around. I mean among those people who really duelled over race and IQ.

Jensen died of a very bad case of Parkinson's or something like that. Very sad really, I wrote an obituary for him that was published in *Intelligence*. Rushton died of something different, I'm not sure what his complaint was. Eysenck is dead.

2. You must have some ex-graduate students around that continue the debate.

Yes, there are people who will, though remember, it is a very politically sensitive topic. Jensen's fingers were burned, though he always showed great courage. Rushton, I think, sort of enjoyed controversy, so I do not know how much his fingers were burned over the outrage his views caused. Eysenck was such a great man and had so many interests, that the race issue was not really too much associated with him. Richard Lynn, though he

has made his views on race known, has been more interested in global matters.

3. Did he not attempt to make intelligence a unifying concept in psychology in a recent book?

He may have. Was this on using the 'g' factor? I have a piece on the 'g' factor coming out with a Dutch psychologist, who is a whiz at statistics, an article in *Intelligence*, which may be on the web now, that puts 'g' in perspective. It shows that the exaggerated claims made for it have to be trimmed back very radically.

For example, I have been reading the Wechsler manuals, and I have noticed something interesting. The g-men say IQ gains are significant only if they are on the 'g' factor because they identify that with general intelligence. I am not saying 'g' does not have any significance. I think it has significance in a number of areas, but you cannot really dismiss IQ differences because they are not 'g'. They take the Wechsler subtests and rank them for the degree of 'g' loading, and then they rank them for something else. In this case, IQ gains over time. You find the largest IQ gains do not match the 'g' loadings. They say, "You see. IQ gains are not real intelligence gains. They are specific factors that make you good at various subtests."

But the data show that when you do subtests ranking of normal subjects against people who have had brain trauma, fetal alcohol syndrome, and so on, and when you compare these people with normal subjects, you find that the differences that separate them are not on the 'g' factor. You would have to be pretty peculiar to say that a person with brain trauma or fetal alcohol syndrome does not have a lower intelligence from a normal person. As I have said, I have been a sceptic about 'g' for years, but only when I came across this data could put an end to all this business. IQ gains are very significant whether they correlate with 'g' or not. To say they are not significant, you would have to say, "Well, there is no significant intelligence difference between you and someone who has suffered brain trauma."

4. What other work will you bring out in the coming year?

I am doing some work on the effects of family on IQ as people age. The twin studies, of course, show that eventually genes take over. But they do this through elaborate kinship studies. However, I have managed to find printed data in the manuals that allows me to actually chart how much family influences a person for ages going through school until adulthood. I can do this subtest by subtest.

For example, I found that family effects for vocabulary are much more persistent than, for instance, arithmetic. At the beginning, your family almost totally dominates, before you go to school they either teach you to count or they do not. Of course, you are surrounded by their vocabulary. With arithmetic, very quickly, the school swamps family. It matches kids for their genetic promise fairly quickly. Apparently, by being continually exposed to your parent's vocabulary – after all, chatting with them, listening to them – vocabulary becomes a more persistent influence even up to the college boards at age 17.

This allows me for the first time to say, "Yes, genes do dominate in terms of IQ variance, but there are significant handicaps having to do with certain subtests like vocabulary that effect your ability to do well on the SAT verbal." I have written this up, preliminary study, not a final study, in a book I published with Elsevier. It is called *Intelligence and Human Progress: The Story of What was Hidden in Our Genes*. It really is fundamentally a book on how we have made cognitive progress, stressing the theme that there is a spinoff of this for moral progress. That one of the reasons for us having a more elevated sense of morality is because of our cognitive advance. Moral reasoning has improved.

There is also a chapter, which shows how family affects vocabulary and it points out the way this handicaps young people. The lingering effect of vocabulary at the time they are trying to match themselves for the university. So it is not true that the genetic dominance of IQ variance means that your family background is a null factor. It weakens, but it has sufficient **kick** that it can give you some disadvantages in later life.

5. This sets more nuance to the ways family history burdens or benefits you.

Yes, if you come from a family where the vocabulary is less than adequate, your vocabulary will be less than adequate. Now, going to school and encountering the wider world will slowly replace that family effect with your current environment, but the vocabulary handicap can still be quite significant by the age of 17, when you graduate from high school.

I am also doing some other work with climate change.

6. Why don't we veer into that a bit?

I have finished a book on climate change, but I have not placed it for publication at this time. I am primarily a moral philosopher. Psychology is a sideline for me. I thought, "My heavens, I might at least

confront probably the chief moral issue of our time.” So I have written a little book looking into the science of climate change. Our climate will change. What we are doing is no going to stop it. There was a book called *Gaia* written by James Lovelock. It describes the Earth being like a total system. He has now become very pessimistic. He figures we are going to go past the point of no return.

I wanted to see if there were alternatives that we could imagine. There is another way. If we were rational enough, we could probably limit climate change over the next generation until alternative, clean sources of energy come online. I wanted to investigate the science and at least propose something a little less gloomy than the climate scientists. They are all about ready to throw in the towel. James Hansen, in Britain, he’s one of the heroes in the environmentalist movement, is pessimistic. Of course, the environmentalists have all turned against him.

That’s what I am doing currently. I am trying to publish my book on climate change, exploring whether you can identify intelligence with ‘g’, looking into the influence of cognitive ability on morality, and I am interested in finding a new way of partitioning IQ variance. Those are the main things. I hope by another month or two to have that cleaned up. After that point, I hope to begin an important book, which is on teaching political philosophy. It would be how to teach it without boring students. As I said, my main work is moral and political philosophy, but morals in particular.

7. Besides survival, what moral imperative do we have to protect the environment?

I think that comes down to a fundamental question, “Is there any objectivity to our moral ideals?” The answer to that is, “No. Either you empathize with humanity or you do not. If you empathize with humanity, you feel an imperative.” Now, that does not mean you cannot use reason against your

opponents. Most of them are, or would at least claim, that they share this bond with humanity and would try and make a case that what we are doing makes no difference.

That leads directly from ethics to science. If what we are doing makes no difference, then there is no moral choice, is there? However, if science shows there are important choices that could be made, then you have to take a stand. Either you possess humane ideals and think all human beings are worthy of moral concern. Or you think this will not happen for 20 years. I am 80 now, so I do not think I will live to see the consequences, and assume I have no grandchildren – so to hell with everyone. Moral imperatives arise out of moral commitments. If you have no commitment that gives you a bond with humanity, I cannot open your mouth and thrust one down your throat.

I wrote about this in a book called *Fate and Philosophy* that came out about three years ago. It is on three problems: ‘what is good?’, ‘what is possible?’, and ‘what exists?’ To me, that book is the most important book that I have ever written: *Fate and Philosophy*. It is my stand on fundamental philosophical problems, but it is written for the general public. I published a more specialized book, but more for a philosophical audience. It is entitled *How to Defend Humane Ideals*. It came out with Nebraska Press. It is a specialized look at this question of objectivity and ethics. However, *Fate and Philosophy* describes everything in more popular language.

I published a book in 2010 called the *Torchlight List*, and it is to encourage students to read widely, which most of them do not. Compared to my generation, even our best graduates do not read widely in literature and history. In the first chapter, I give some personal background.

8. In terms of geography, culture, and language, where does your family background reside? How do you find this influencing your development?

I was raised as an American-Irish Catholic. For my father like so many Irish Catholicism was a badge of patriotism. In terms of his beliefs, he only believed in the fundamentals, which means whatever he found convenient. (Laughs) He was a good man, but he did not care much about the infallibility of the pope. As I studied, I, lost my faith. I began to realize I only believed in God because everyone around me believed in God.

But my background was in Washington, D.C., I was born there. My father settled there as a newspaper man about the time of World War I. My mother came from upstate New York. She had been a school teacher. I was raised there with my brother and first cousins. At that time, the Irish extended family was still important, and my first cousins were really like brothers and sisters.

It influenced me in the sense that having been deeply committed to Catholicism's version of humane ideals, once I lost my faith, I began to wonder what sort of rational justification I could give for my ideals. That became a large part of my scholarly life. Note my book: *How to Defend Humane Ideals: Substitutes for Objectivity?*

As for Psychology, I got onto that through moral philosophy. I was writing what later became *How to Defend Humane Ideals*. I worked on it for many years. When I was writing a chapter on how to argue with racists, I stumbled on Arthur Jensen – who obviously was not a racist, but thought he had scientific evidence that blacks, on average, were genetically inferior. And then, of course, I thought, “Well, I have certainly got to look into that.” I wrote a book called *Race, IQ, and Jensen*, which came out in 1980, in which I put the contrary view.

In researching that book, I was looking at publishers' manuals and stumbled upon IQ gains over time. That, of course, became an avocation for me (laughs), for the next 30 years. You had to do more than acknowledge that the gains were there. You had to alter the

theory of intelligence to accommodate them. I did that in my book *What is Intelligence?*, which came out in 2007 with Cambridge. And I have published other books on this topic. It was all an accident. I had no idea I would be interested in the theory of intelligence. I came to it through moral philosophy.

9. Even with that background, and the deep influence of Catholicism, what do you consider a pivotal moment?

It was a pivotal moment for me leaving Catholicism. I won an essay contest at the age of 11. As an award, they gave me the *World Book Encyclopedia*. In reading it, I found there was a more scientific explanation of the world. The other thing was going to the University of Chicago, which gave me the ‘Great Books’ curriculum. It encouraged you to believe that if you are interested in fundamental problems, they were usually cross-disciplinary, and that if you were incisive enough, you could read across disciplines and get a good amateur competence. Of course, I needed that when I went into psychology because I had never taught a psychology course or read a psychology text. However, I was good at math. I saw no reason why I could not chart IQ gains over time, and make the changes in the theory of intelligence that were necessary.

I would say three things: strong moral commitments, the break with Catholicism, and the University of Chicago.

10. At present, you hold the position of Emeritus Professor at the University of Otago in Dunedin, New Zealand. What responsibilities and duties does this imply to you?

Yes, although I will be 80 in April, I will teach two courses this coming semester. Of course, I will have the rest of the year to do my writing.

Emeritus professor here means that you are still active. So even though I am retired, I am

employed by the University of Otago. You can be employed at many levels. Two courses is about a 4/5th load. They like my research. So I am Emeritus Professor jointly with political studies and psychology. I was head of the Political Studies Department for 30 years. We emphasized moral and political philosophy among other things. I teach one course in political studies entitled *The Good Society and the Market*. I teach another in psychology entitled *Justice, Race, and Class*.

11. With regards to your main area of research in psychology, intelligence and IQ mean different things. Intelligence stands for a general attribute. IQ stands for scores given based on tests designed to penetrate this attribute through inference of performance.

Yes, it may be either a better or worse measurement, of course. I mean, there is no measure that cannot be abused, and Arthur Jensen was well aware of that.

12. With that, how would you define intelligence? How would you differentiate it from IQ?

You have that more formally in my book *What is Intelligence?* I do not think it needs too careful a definition. It is essentially a matter that one person is more intelligent than another in a certain cultural setting. In the sense that when they confront important problems in that culture, they either learn to solve quicker or better. Arthur Jensen wrote a good article on this using Robinson Crusoe, who was on his island. Unless he had another person, he could not estimate his own intelligence. He could make statements about memory. For example, he either *forgot* things or he did not; he could *learn* things like manual dexterity. But only when Friday arrived did he say, "My heavens, Friday is learning everything I learned faster than I did, and he is better at it." (Laughs) That is a first step to saying who is more intelligent.

When cognitive problems are terribly important, if you can learn what you need to learn to solve those problems quicker, or in the same amount of time you solve them better, that, I think, is a good working definition of intelligence. Now, that still leaves it culturally relative. If you were in the Australian outback, the problem that would interest you is finding water when it is scarce. That would mean, your mapping ability is terribly important. Today, if you are not a London cab driver, you do not much care about mapping ability.

13. You have mentioned the late Dr. Arthur Jensen a few times. He published a well-cited and famous, or – by many individual's account – infamous, paper published in 1969 by the late entitled *How Much Can We Boost IQ and Scholastic Achievement?*, which sparked a controversy around the topic of race and IQ.

It created a storm of controversy. Rather than assembling evidence to attack the position, they attacked the man. That's why I wrote my book *Race, IQ, and Jensen*, which you will find saying, "This is ridiculous. There is no reason to think Arthur Jensen is a racist. Let's look at the evidence. We can either show he is wrong evidentially or he is not." I feel the evidence shows that it is more probable that blacks have genes roughly equivalent to whites for what we call 'intelligence'. If you want to see my most recent updating of that thesis, you would want to read, not only the old book *Race, IQ, and Jensen*, but also *Where have All The Liberals Gone?*. It came out with Cambridge in 2008, and it has four chapters on black Americans.

14. In addition, and following that controversy, those arguing for heredity more than environment provided further momentum for the opposing side with works by Dr. Charles Murray...

Yes, I know Charles Murray. Murray has never stated any definite position on the

genetic comparisons of the two racial groups. He has been much more cautious than Jensen. What he wrote, in the minds of many, influenced them to believe that he agreed with Jensen, but he has never stated that. He did bring forward many of Jensen's arguments saying, "We have to acknowledge there is a powerful case here.

The Bell Curve was not fundamentally about race, genes, and IQ. It was saying, "Let's look at the present situation and see how IQ effects your life prospects." There's no doubt that even if black and whites have the same genes for IQ, blacks are doing worse

academically. And he was exploring the consequences of an IQ test in predicting academic performance.

I had two debates with Murray. You can find them on the internet. One was in New York. Another was in Washington, D.C. Washington, D.C. hosted by the American Enterprise Institute. The one in New York was Cognos I think, but you can find them on the internet – if you type in 'Flynn, Murray, race, and IQ'. The second debate *was* better because we had rehearsed our arguments better.

*****References at end of part two*****

DR. JAMES FLYNN (PART TWO)²³²⁴



Dr. James Flynn has combined political and moral philosophy with psychology to clarify problems such as justifying humane ideals and whether it makes sense to rank races and classes by merit. Professor Flynn has been profiled in *Scientific American* and ran for the New Zealand Parliament in 1993 and 1996 as Alliance candidate for Dunedin North. Research Interests include humane ideals and ideological debate; classics of political philosophy; race, class and IQ. He was Head of Department from 1967 to 1996. He is best known for the “Flynn Effect”, that is, massive IQ gains over time.

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ABSTRACT

Second part of a two-part comprehensive interview with Emeritus Professor of Political Studies and Psychology at the University of Otago in Dunedin, New Zealand on the main subjects of his research: Jensen, Eysenck, and Rushton; black improvements in IQ corresponding to educational gains; moral commitment to the truth; environment, genetics, and the interplay in the development of IQ; activities associated with the highest level of general ability; TED talk entitled 'Why our IQ levels are higher than our grandparents'; differential IQs of generations based on the *Flynn Effect* occurring over significant periods of time; future work; meaning of the paraphrase 'system of jurisprudence uses the concept of praise and blame'; responsibility of academics to culture and society; moral and general influences; advice for young academics interested in moral and political philosophy; and worries and hopes for concepts in psychology having practical implications for the larger culture and societies in general.

Keywords: Academics, Dr. James Flynn, Emeritus Professor, environmental influence, Eysenck, genetics, Intelligence, IQ, Jensen, jurisprudence, moral imperatives, moral philosophy, New Zealand, political philosophy, Political Studies, Psychology, TED, University of Otago.

15. Recounting in the earliest part of this conversation about Jensen and Eysenck - and Rushton passing, what is the current state of this debate?

I think the current state of the debate is in my 2008 book, although stuff keeps coming out. But the current status of the debate must take this into account: I showed along with Bill Dickens that blacks had erased 5 points of the old 15-point IQ gap. Therefore, the improvement in the black environment is paying dividends. Even now, you could hardly claim blacks are living in an equivalent environment to whites. Maybe, the other 10 points will go. As scientists, we have to hedge our bets until the evidence is in, don't we?

I think that eventually blacks may close that gap.

16. A third of a standard deviation is quite a bit...

Yes, it is quite significant. They were one standard deviation behind. Now, they are two-thirds behind. This is reflected in the Nation's Report Card. They gained the same amount of ground in academic performance. I published an article in the journal *Intelligence* earlier this year. They gave a whole issue of *Intelligence* to the Flynn

Effect. In the summary article there, I point out the correspondence between the black IQ gains and the black educational gains.

Now, the bad news is that until blacks perform better for IQ, which predicts their performance at university, they will have grave difficulty matching whites. You cannot say, "These IQ gaps do not count." They count for a lot in terms of your life prospects. The good news is, there is no reason to think they are genetically crippled.

17. Even though as scientists we must stay open to the data, what do you consider a knockdown, or very strong, argument for your position?

I know of no "knockdown" argument. You do not have to be a scientist to be open to more data. (Laughs) But it helps to have a strong commitment – moral commitment, to the truth. It is easy for any of us, and this includes me as well as Jensen, to dig yourself into a hole where you have fought so long for a particular point of view on a controversial issue that your mind is closed without your being fully aware of it. So good science would say that would never happen, but it is good to also have a strong moral resolve and say, "I could be wrong."

One of the things, which impressed me most, about Arthur Jensen is his quoting Ghandi's, 'I will never say anything in public, which does not match what I believe private.' There are plenty of people on the left who have closed minds on the race and IQ issue. That is, their attachment to the notion of equality is so strong that they will not look at evidence.

It cuts both ways. You can either have progressive or regressive views, and essentially your reputation and your work become married to a position, so that you are not willing to look at further evidence. I would like to think that every social scientist has a professional concern about methodology but it also helps to have some moral stamina with regards to these things too.

18. For the long-running and ongoing discussion about environment, genetics, and their interplay in the development of IQ, within your and others' research, how much does the environment play a role in development of IQ compared to genetics?

That is a question that can only be answered differentially according to the cognitive ability. The environment plays a much more powerful role in vocabulary than in, say, arithmetic. Even when your genetic promise is fulfilled in arithmetic, that will not happen without a good environment. The best performance comes when high ability and high-quality environment reinforce one another.

Now, you also have to look at environment when it does not correlate with genes. That is what we look at when we want to assess how much your environmental background has handicapped you. Do not think that simply because your environment may someday match your genes, it has not done much to handicap you.

If your environment does not fully match genetic promise, and that can still be true of vocabulary at the age of 18, you will be

handicapped on the SAT. Maybe, at the age of 35, you have a match between your cognitive environment and vocabulary, but your life is pretty much on its own railway track by that time.

Further, there is every reason to believe that someone can upgrade their environment beyond their genetic promise even in later life. If you want to upgrade your cognitive competence at any age, exercise your mind by reading and thinking. This upgrading of your environment will pay dividends. It is very possible my old professor Leo Strauss did not think of anything else except political philosophy from the time he woke until the time he went to bed. I expect that he created an incredible mental environment, which is not advised if you wish to be sane, and that this probably upgraded his genetic talent even further. As practice upgrades a musician's talent, you can shoot above your genetic promise through cognitive exercise.

19. That does tie into a point, which I have thought about for some time. It deals with the highest levels of ability tending towards certain activities...

That depends, doesn't it? I think you should select the activities that are important for you? Let's say you are a person at about the 84th percentile for verbal intelligence. But let's say you want to write a great novel and that you immerse yourself in great literature and develop your vocabulary, seeking out friends that challenge you verbally. You could say, "That will not improve your intelligence. It only improves your capacity to write a great novel." So what, that is what you want, isn't it? You do not want to necessarily upgrade your intelligence for block design, ravens progressive matrices, or object assembly. You want to enhance your intelligence with a specific purpose in mind.

Yet, people are strange. They say, "How can I upgrade my IQ?" I ask them, "Why do you not want something more important? What keeps you up at night? What problems do

you want to solve? What do you really want to do? Why do you not upgrade that?" That is what is important for anyone who is not IQ-obsessed. All these people joining Mensa because they have high IQs. It might give you a sense of self-esteem, but I would trade 10 IQ points to be a better moral philosopher. And I actually know how to upgrade my environment as a moral philosopher. I know the things to read and think about to improve.

20. Back to the present, you did a TED Talk entitled ‘Why our IQ levels are higher than our grandparents’ a short time ago.

It has done pretty well, moving up to around 1,700,000 hits. It does about as well as academics do. It cannot compete with Stephen Hawking. It cannot compete with John Dawkins at Cambridge – who questions the existence of God, and everyone in the world listens to it. But for an academic talk, it did pretty well.

21. You stated, “If you scored people a century ago against modern norms they would have an average IQ of 70, if you score us against their norms we would have an IQ score of 130.” You ask, “Does this mean our ancestors were on the verge of mental retardation?” Conversely, you ask, “Or are we all on the verge of being gifted?” You offer a third alternative. For those that have not seen the video, what is that third alternative?

This is something everything goes crazy about. How could our ancestors be so stupid, or how could we be so intelligent? In the talk, I think I hit upon the solution. It is one thing to compare a 70 against current norms when that person has never been exposed to the modern world. It is another thing to score a 70 against current norms if you are living here and have been exposed to the modern world, and cannot make sense of it.

Yes, against current norms, people had a 70 back in 1900 because they did not live in a world that was visually rich, did not have the current level of formal education, lacked cognitive challenging work for 30% of people. So not being exposed to that modern world makes the IQ of 70 quite understandable. To compare it to someone who has an IQ of 70 today, who has been exposed to modernity, and does not have the innate talent to take it in, is such an obvious mistake. They were not feeble-minded. They were simply not modern.

Cognitive progress by generations over time has a tremendous influence. The environment – over a 100 years - has been enormously potent. When you say the environment is limited, you mean that its role today is limited in differentiating the two environments you and I have, when both of us are immersed in modernity. There is a different perspective there. Over time environment is virtually the only thing influential in terms of raising human competence. At a given time, if you and someone else came from much the same family, had much the same schooling, then genetic differences come into their own, but over time we have been upgraded by environment.

I made two mistakes in the TED talk. One was not meant to be there at all. I mentioned an Islamic father not who kills his daughter for being raped. In defense, he says, “It is not in the Quran.” I should have made him say, “It is not in our family code of honor” - because there is no passage in the Quran to that effect. But many people in Islamic countries have inherited a traditional morality that dictates family honor. The other mistake I made, and I cannot imagine how I made it, was attributing the final quote to Dickens rather than Kipling.

The pressure is unusual. I always speak extemporaneously, but here the time limits are strict. You have a text in advance. I find it

easier to either read a speech or to speak extemporaneously - instead of pretending to read extemporaneously and stick to a text. (Laughs) Here you must speak extemporaneously, but not deviate from a fixed text.

That reference to the Quran, I was not implying that the passage was in the Quran. I was merely implying that for someone to give up their inherited code of honor, they would need something like the Quran to override it. Since you are speaking quickly, you do not read in the necessary qualifications. I had a number of Islamic scholars saying, "There is no such passage in the Quran." I have had to e-mail them back saying, "I know that. I know that." I tell them I meant the code of honor, not the Quran, but one would need something like the Quran to override the code of honor.

22. What about future work?

In the future, I have other books, which I would like to write. I want to write a book on the way we mis-educate students for critical intelligence in higher education. I published a book in 2012 entitled *How to Improve Your Mind: 20 Keys to Unlock the Modern World*. It gives the education for critical intelligence which universities do not provide, but I still want to look at the universities in detail and show the way in which they are going astray.

Also, I feel insulted that I do not know in detail how to keep merchant bankers from bringing the world down into chaos every 20 years. I want to look at the behavioral problem involving the incentive system that would keep these guys from doing it.

Finally, I have a "law" book, which I want to write looking into the way the system of jurisprudence uses the concepts of praise and blame. Most immediately, I want to write on the way to teach political philosophy.

23. What do you mean by 'system of jurisprudence uses the concept of praise and blame'?

In my book *Fate and Philosophy*, it has a section on 'Free Will'. Half the time the law acts as if it believes in free will, "You did this. You were wicked. We are going to punish you for punishment's sake." Other times, it says, "No one is responsible for a divorce breaking down. We will have no-fault divorce." I am not necessarily saying there is an inconsistency in treating divorce that way. I may be better for the kids, but I would like to look at the use of praise and blame in the law – see if we can be consistent about it.

24. If any, what responsibility do academics and researchers have for contributing to society and culture?

They have to be people that care about society and culture. There is nothing about being an academic that gives you better empathy with humanity than a carpenter. But if they have that, they have an unusual responsibility to weigh in on areas where informed opinion can carry society with it. If most American academics had not lost faith in the Vietnam War, heaven knows the consequences would have been. If only people who are knowledgeable could come to a common opinion about climate change, we could do something about it.

Unfortunately at present, they are in sad disarray. Although, the more expert you are, the more likely you are to take it seriously. There are certain issues, foreign policy issues in particular - where the weight of opinion by the decision-makers is heavily influenced by the people who write the editorials in the New York Times.

25. Who most influenced you morally? Why them? Can you recommend any books or articles by them?

I have a list of them in *Fate and Philosophy* at the end of the book. I say, "You ought to try and be humane. Here are 20 people I admire." They range from Hillel to Jesus Christ to Martin Luther King to Eugene Victor Debs.

26. What advice do you have for young academics interested in moral and political philosophy?

They will not be interested in it, unless it becomes a near obsession for them. Educate yourself widely because you cannot solve the basic problems of moral and political philosophy without a good grounding in the social sciences. Also, reading literature widely is helpful.

27. What worries and hopes do you have for the study of concepts in psychology, e.g. 'Intelligence', having practical implications for the larger culture and societies in general?

Hard to tell, I am not a professional psychologist. I do not have too much insight into what psychologists are doing. I see no reason why psychology should not clarify the potentialities of human autonomy, despite the influence of genes. I have hopes that will happen, but a hope based on faith more than any survey of the work psychologists are doing.

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PAUL KRASSNER²⁵²⁶



Paul Krassner published *The Realist* (1958-2001), but when *People* magazine labeled him “father of the underground press,” he immediately demanded a paternity test. And when *Life* magazine published a favorable article about him, the FBI sent a poison-pen letter to the editor calling Krassner “a raving, unconfined nut.” “The FBI was right,” George Carlin responded. “This man is dangerous — and funny, and necessary.” While abortion was illegal, Krassner ran an underground referral service, and as an antiwar activist, he became a co-founder of the Yippies (Youth International Party). Krassner's one-person show won an award from the *L.A. Weekly*. He received an ACLU (*Upton Sinclair*) Award for dedication to freedom expression. At the Cannabis Cup in Amsterdam, he was inducted into the Counterculture Hall of Fame — “my ambition,” he claims, “since I was three years old.” He won a *Playboy Award* for satire and a Feminist Party Award and in 2010 the Oakland branch of the writers organization PEN honored him with their *Lifetime Achievement Award*. “I’m very happy to receive this award,” he concluded in his acceptance speech, “and even happier that it wasn’t posthumous.”

²⁵ Founder, Editor, & Contributor, *The Realist*.

²⁶ First Published on August 15, 2014.

ABSTRACT

A brief interview with Paul Krassner, the founder, editor, and contributor to *The Realist*. He discusses the following topics: youth and pivotal moments in life-trajectory; early life as a violin child prodigy, influence of Lenny Bruce, and entering the world of comedy; City College of New York to major in journalism; myths of the 60s counter-culture during and up to the present day; importance of Dr. Timothy Leary and Dr. Robert Anton Wilson to the counter-culture and mainstream culture; purpose of art and the role of artists in shaping, defining, and contributing to society and culture; extraterrestrial life; the 'Yippies'; controversial topics; Occupy Movement; and advice for youth.

Keywords: 'Yippies', art, child prodigy, City College of New York, contributor, counter-culture, Dr. Robert Anton Wilson, Dr. Timothy Leary, editor, founder, journalism, Lenny Bruce, Occupy Movement, Paul Krassner, The Realist, violin.

1. How was your youth? How did you come to this point? What do you consider the earliest pivotal moment in your life-trajectory?

My parents nurtured me with a sense of responsibility, honesty, thoughtfulness, healthiness and humor. I realized early on not to take things personally—that there were people who wanted to control me in some way—from my violin teacher who, when I told him I wanted to learn a certain song, said, “That’s not right for you,” to my crazy aunt who tried to kill me when I was nine years old. All in all, I felt like a Martian learning to pass as an Earthling. I became awed by the infinite coincidences that ultimately led to my existence, and enjoying that mystery has continued to this very day.

2. Early in life, you had talent for music. In particular, a gift for violin meriting the title of ‘child prodigy’. You began at age 3 and performed in Carnegie Hall at age 6. The youngest ever to perform there at the time. However, you have recounted this as a period of being ‘asleep’. Further, you have talked about the experience of having an itch in your left leg while performing a Vivaldi Concerto, scratching your left leg with your right leg during the Carnegie Hall performance, and having an experience of ‘awakening’ to the Carnegie Hall

audience laughing. Following this, Lenny Bruce entered the picture, who convinced you to drop the violin and begin comedy. What importance did he play in your development? How did he convince you? What ideas did Lenny have and embody that convinced you to enter comedy?

When it came to the violin, I had practiced myself right out of my childhood. But at Carnegie Hall I awoke to the sound of laughter. I wasn’t trying to make the audience laugh, I was merely trying to scratch an itch. Although I was considered to be a child prodigy, I only had a technique for playing the violin, but I had a *passion* for making people laugh. In high school I wrote, produced, directed and starred in the Senior Play. The local newspaper called me “a junior Orson Welles.” I had no idea who that was. When I started doing stand-up comedy as an adult, I used my violin as a prop. Lenny Bruce advised me that it was unnecessary. He didn’t have to convince me to begin comedy, I was already obsessed with it. While editing his autobiography, *How to Talk Dirty and Influence People*, I traveled around with him, and he inadvertently served as my mentor. Our viewpoints and satirical targets were totally in sync, ranging from obscenity laws to teachers’ low salary to nuclear testing.

3. You attended City College of New York to major in journalism. Why did you choose this field?

There were no courses in comedy—moreover, there were no comedy clubs with open-mike nights—but I also wanted to be a reporter.

4. In my contact with the current generation of students, my generation, many seem to have a different understanding of the ‘60s counter-cultural revolution’ than those currently living to tell their experience of the time. For instance, some slogans come to mind like ‘Turn on, tune in, and drop out’. Some research on, and casual use of, consciousness-altering substances come to mind such as psilocybin, LSD, marijuana, and lesser-known ones. However, this seems obfuscating at best and misleading at worst. What myths abounded during the 60s about the purpose of popular social movements across the spectrum of activity? What myths persist to this day?

Filtered through mainstream media, the ‘60s countercultural revolution has been reduced to a pair of images at both ends of the spectrum: a group of “flower children” at a party smoking joints; and cops indiscriminately, sadistically beating antiwar activists with billy clubs. Myths ranged from the notion that hippies didn’t take showers to the notion that they spat at soldiers returning from Vietnam. At the risk of revealing my self-serving streak, I hereby recommend my own memoir (available at paulkrassner.com), *Confessions of a Raving, Unconfined Nut: Misadventures in the Counterculture*, about which Pulitzer Prize winner Art Spiegelman wrote that “His true wacky, wackily true autobiography is the definitive book on the sixties.” As for current myths, remnants of misinformation and disinformation about drugs, gays, racism,

theology still remain, they are gradually evolving out of existence, but the most persistent myth is that men and women in the military who lost their lives in Afghanistan and Iraq have not died in vain. Support our troops. Huh?

5. Many major figures of the ‘counter-culture’ produced highly popular books. For instance, Dr. Timothy Leary and Dr. Robert Anton Wilson produced multiple influential books encapsulating many of their core ideas. For Dr. Leary, *Info-Psychology*, *Neuropolitique*, *The Game of Life*, and *Turn On, Tune In, Drop Out*; for Dr. Wilson, the *Illuminatus! Trilogy*, *Prometheus Rising*, *Cosmic Trigger* (I, II, and III), and *Email to the Universe*. You founded, edited, and contributed to *The Realist*. The first counter-culture magazine. In your view, what importance do their, and your, work mean to the mainstream culture? What about to the ‘counter-culture’?

Leary, Wilson and other contributors to *The Realist* were prescient about the future, and many of the seeds they planted are gradually blossoming in the present. In the sixties, there were civil rights sit-ins and marches, and now we have an African-American president. The women’s liberation movement was launched by the protest at the Miss America pageant in 1968, and it’s not unlikely that a female president will be elected in 2016. There were demonstrations for the decriminalization of marijuana then, and there are now medical marijuana dispensaries in twenty states, and the legalization of recreational marijuana in two states. I won’t be satisfied until there’s amnesty for all those nonviolent stoners who are serving time for drug offenses. They’re political prisoners.

LSD became unlawful in 1966, and in 2014 a study concluded that LSD can ease anxiety. In 1969, police raided a gay bar, the Stonewall Inn, and now more and more states are

legalizing same-sex marriages. Then there were vegetarians and vegans, but no such cookbooks. Now there are bookstores and online shelves filled with cookbooks for vegetarians and vegans. Then, organic farming. Now, organic farmers' markets. Then, challenging theological dogma. Now, widespread public skepticism. As a dolphin once told me, "If God is evolution, then how do you know He's finished?" Obviously, it was a male chauvinist dolphin. Speaking of which, dolphin researcher Dr. John Lilly corrected me. "If God is evolution," he said, "then how do you know *you're* finished?"

6. If any, what do you consider the purpose of art? More importantly, what role do artists play in shaping, defining, and contributing to society and culture?

Here's a couple of quotes about art and communication. Luis Bunuel: "I make films to give me something to do between birth and death." And Pablo Picasso: "Art is the lie that enables us to realize the truth." That's why artists supersede politicians. Except George Bush.

7. If you could have one question answered through a massive research project, what would you want answered?

Is there life on other planets, and if so, do they have civilizations?

8. You contributed to the American lexicon of terms like the Hippies, the Punks, and so on, through the term The Yippies. This invention described a sub-population of the USA: a coalition between the 'anti-war activists' and the 'hippie dropouts'. What purpose did this term serve?

I didn't coin hippies or punks. Yippie was a traditional shout of spontaneous joy. *We could be the Yippies!* It had just the right attitude. Yippies felt like an appropriate name for the radicalization of hippies. What a perfect media myth that would be. And then, working

backward, it hit me. *Youth*—this was essentially a movement of young people involved in a generational struggle. *International*—it was happening all over the world, from Mexico to France, from Germany to Japan. And *Party*—in both senses of the word. We would *be* a party and we would *have* a party. We would be the Youth International Party and we would be called the Yippies. The name provided its own power of persuasion.

Yippie was simply a label to describe a phenomenon that already existed—an organic coalition of psychedelic dropouts and political activists. In the process of cross-pollination, we had come to share an awareness that there was a linear connection between putting kids in prison for smoking marijuana in this country and burning them to death with napalm on the other side of the globe. It was the ultimate extension of dehumanization. Meanwhile, reporters had a *who* for their lead paragraphs. A headline in the *Chicago Daily News* summed it up: "Yipes! The Yippies Are Coming!" The myth was already becoming a reality. Yippie chapters were forming on campuses, and pot-head antiwar activists across the country realized what to call themselves.

9. What do you consider the three most controversial topics at present? What arguments do you consider most convincing for your views?

Chris Christie's role in sabotaging the world's largest bridge. The dictator of Syria murdering 100,000 civilians, including 10,000 children. Uganda's government legalizing the execution—literally—of homosexuals. But I'm unable to convince power-without-compassion.

10. In the current heated political climate, precarious economic conditions for many citizens, and social uncertainty regarding norms, individuals tend to feel uneasy. In fact, this tends to provide the appropriate ingredients for

popular social movements. Our current incarnation of such a movement arises in the Occupy Movement. What do you think of this movement? What do you attribute to the rapid popularity of the Occupy phenomena to, especially in the US?

I had been wavering between hope and dismay when the Occupy Movement came along. The Yippies had to perform stunts to get media coverage. A group of us went to the New York Stock Exchange, upstairs to the balcony, and threw \$200 worth of singles onto the floor below, watching the gang of manic brokers suddenly morph from yelling “Pork Bellies” into playing “Diving for Dollars.” Then we held a press conference outside, explaining the connection between the capitalist system and the war. So, a few decades later, when an Occupier held up a particular placard, “Wall Street Is War Street,” it gave me a sense of continuity and a feeling of optimism. Their spirit will continue with or without any aid from the media. Their weapons are imagination, dedication, truth and communal love.

11. Who most influenced you? Why them? Can you recommend any seminal books/articles by them?

Lyle Stuart was the courageous, uncompromising publisher of *The Independent*, an anti-censorship paper where I started out as an apprentice, wrote a column, “Freedom of Wit,” and eventually became the managing editor. I was influenced by radio personality Jean Shepherd, and he wrote a column, “Radio Free America,” for *The Realist*. J.D. Salinger’s *Catcher in the Rye* so resonated with my adolescence that I naïvely sent a letter to him, asking for permission to use his character in a novel I planned to write. Dalton Trumbo’s *Johnny Got His Gun* was my bible, not because of its antiwar theme, but for its insights to consciousness and the urge to communicate.

Aldous Huxley’s *Antic Hay* included my favorite literary phrase—“excruciating orgasms of self-assertion”—which served as a filter through which to perceive human behavior. Dr. Robert Spencer was a humane abortionist when it was illegal, and I ended up running an underground referral service, evolving from a satirist to an activist. I met Abbie Hoffman at protest demonstrations, and his article, “Revolution for the Hell of It,” landed on the front page of *The Realist*. Ken Kesey and I co-edited *The Last Supplement to the Whole Earth Catalog* and attended Grateful Dead concerts in Egypt. Mae Brussell was a brilliant researcher. I published in *The Realist* her documented analysis in which she delineated the conspiracy behind the Watergate break-in, while Richard Nixon and the mainstream media were still describing it as “a caper” and “a third-rate burglary.”

12. Where do you see the legacy of major figures like Lenny Bruce, Dr. Leary, Dr. Wilson, George Carlin, Richard Pryor, and yourself? In particular, where do you see the future of your work?

I believe that each one of the dead folks you mention will go on being remembered as pioneer iconoclasts. As for me, I’m working on my long awaited (by me) first novel, about a contemporary Lenny-type performer. My archives (translation: all the crap in my garage) will end up in a university library. NPR and AP already have my obituaries prepared. Meanwhile, I’ve been honored with the writers organization PEN’s Lifetime Achievement Award. Here’s how I concluded my acceptance speech: “The only thing I remember from college was in an anthropology course, and it was a definition of happiness—“having as little separation as possible between your work and your play”—and I’ve been very fortunate, being able to do that, and to get an award for it is really the icing on the cake, because the process was the goal. And also I know that, in my lifetime I’ve met so many people who deserve a lifetime achievement award, except that they didn’t do

it publicly. I do want to say how happy this award makes me, and the only thing that makes me happier is that it's not posthumous. Thank you."

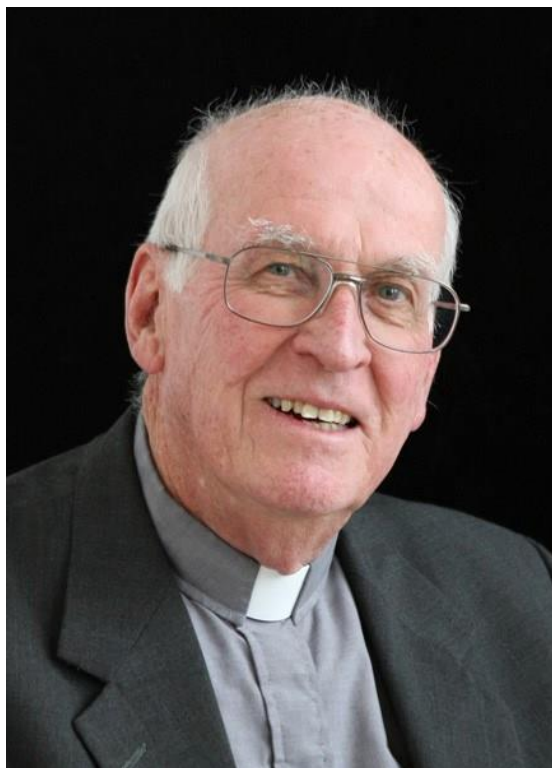
13. What advice do you have for youth?

Try not to take yourself as seriously as your causes.

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DR. & FR. GEORGE V. COYNE, S.J.²⁷²⁸



Father George V. Coyne, S.J. born January 19, 1933, in Baltimore, Maryland, completed his bachelor's degree in mathematics and his licentiate in philosophy at Fordham University in 1958. He obtained his doctorate in astronomy from Georgetown University in 1962. After several decades on the faculty at the University of Arizona (UA), Coyne became Director of the Vatican Observatory (VO) in 1978. He became the founding director of the VO Foundation (VOF) in 1986. In 1980 he established the VO Research Group in Tucson, AZ. During his time as Director he founded the VO Summer Schools, which over the years have introduced more than 300 students from more than 60 countries to professional astrophysics. He also initiated a series of conferences on the science-religion dialogue. He retired as Director of the VO in August 2006 and as President of the VOF in 2012. Upon his retirement from the VO in 2012 he assumed the McDevitt Distinguished Chair of Religious Philosophy at Le Moyne College of the Jesuits in Syracuse, New York. He is a member of the International Astronomical Union, the American Astronomical Society, the Astronomical Society of the Pacific, the American Physical Society and the Optical Society of America. He has been awarded the following Ph.D. degrees *honoris causa*: 1980, St. Peter's University, Jersey City, NJ; 1994, Loyola University, Chicago, IL; 1995, University of Padua, Padua, Italy; 1997, Pontifical Theological Academy, Jagellonian University, Cracow, Poland; 2005 Marquette University, Milwaukee, WI; 2007 Boston College, Boston, MA; 2009, Le Moyne College, Syracuse, NY; 2009, the College of the Holy Cross, Worcester, MA; 2010 Santa Clara University, Santa Clara, CA; 2014 Colgate University, Hamilton, NY. He was awarded the *Mendel Medal* by Villanova University in September 2008 and the *George Van Biesbroeck Prize* by the American Astronomical Society in January 2010.

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²⁸ First Published on August 22, 2014.

ABSTRACT

In this thorough and broad interview with Dr. & Fr. George V. Coyne, S.J., he discusses the following: youth, upbringing, and pivotal moments in his life; attraction to the Roman Catholic Faith from a young age; broad educational background in theology and science; thoughts on the Jesuits and the merger of scientific and theology knowledge; comments on the 1997 essay by the late Dr. Stephen Jay Gould, *Non-Overlapping Magisteria*; the purpose of science and theology, and the responsibility of scientists and theologians to contributing to society and culture; desired hypothetical research; falsehoods and truths surrounding the Catholic faith; and the future of the Roman Catholic faith in the middle and latter portions of this century.

Keywords: Catholic, Catholicism, culture, Dr. & Fr. George V. Coyne, Dr. Stephen Jay Gould, Jesuits, non-overlapping magisteria, Science, scientist, society, theologian, Theology.

1. How was your youth? How did you come to this point? What do you consider the earliest pivotal moment in your life-trajectory?

I had a very happy youth as the third oldest of 8 siblings growing up in a traditional and devout Catholic family. I attended Catholic elementary schools and a Jesuit High School, Loyola High School (LHS) Blakefield (Baltimore, MD). A religious nun who taught me in the 7th and 8th years of elementary school insisted that I take the entrance exam to LHS and she prepared me to do that by instructing me every Saturday afternoon for two months. No Saturday afternoon baseball or basketball for me! She happened to have the entrance exams for the past twenty years and they were the basis for my instruction. Needless to say, since there are only so many new questions one can ask, my drill master taught me to answer questions even before I was asked. Through dint of memory – and not intelligence – I won a full scholarship and my attendance at LHS proved to be a defining experience for my whole life.

I was taught by many young Jesuits at LHS and grew to admire their lives, especially two aspects: their total dedication to working for others and their obvious happiness at living together in a religious community. The common expression for a Jesuit is “Men for Others.” At graduation from high school, I entered the Jesuit seminary. During my first

year of studies in Latin and Greek literature, after two years of novitiate, I had the good fortune of being instructed by a Jesuit priest who, in addition to having a PhD in the classical languages, also had a MS in mathematics and an educated interest in astronomy. He noted my interest in astronomy and encouraged me to nurture that interest. His dedicated and passionate tutoring determined all of my future professional life.

2. Early in your life, what attracted you to the Roman Catholic Church and Faith?

I never had any serious doubts about my faith. I consider that faith has been a gift of God to me through my family and later on through my associates.

3. You joined the ‘Jesuits in 1951, earned a B.S. in Mathematics and your licentiate in philosophy from Fordham University in 1958, a Ph.D. in astronomy in 1962 from Georgetown University, and finally the licentiate in sacred theology from Woodstock College in 1965 upon ordination as a Roman Catholic Priest.’ How have you found this scientific and theological background of value?

Through all of that alternation among philosophy, theology and science I found it to be a joyful experience to seek to integrate my growing knowledge of all of them while not

yielding to the temptation to confuse one for the other. Let me explain by this excerpt of what I have written elsewhere:

The general background to the topic I wish to address is to what extent religious thought can make a contribution to our scientific understanding of the origins and evolution of life in the universe derived from astrophysics and cosmology. And, on the other hand, to what extent can what we know from science about life influence our religious attitudes. This twofold question poses the serious risk of transgressing upon the epistemological independence of the various disciplines: theology, philosophy, astrophysics and cosmology, and creating, thereby, more confusion than understanding. As the discussion proceeds we must maintain a consistent posture of preserving the integrity of each of the disciplines.

Too often discussions of the relationship between science and religion are carried out in very general terms. Such discourse can be quite unfruitful for two reasons: (1) As compared to the natural sciences religion contains a larger measure of the subjective, of human experiences not totally verifiable by objective reasons. Such subjective experiences are not, of course, limited to religion. They are present in many areas of our lives. Nor need these experiences, religious or otherwise, necessarily conflict with reason. They simply are not limited to rational explanation. They go beyond what can be rationally justified. (2) While for the natural sciences we have a rather acceptable idea of what we mean by science, the very notion of religion is ill-defined. Does it mean worship? Does it mean being a “good person”? Does it mean accepting certain moral dictates that go beyond what is commonly accepted as good and bad? Does it mean accepting those dictates out of personal conviction or out of loyalty to a certain tradition? Does it mean believing in certain doctrines? Does it mean accepting a certain authoritative and hierarchical structure, i.e. being affiliated with

a certain Church? To most of us religion would imply more of an affirmative than a negative answer to all of the above. And yet the situation is further complicated by the multiplicity of religions which differ among themselves, have even warred among themselves, over the responses given to such questions as the above. Even today, if we look at some of the main religious traditions: Islam, Judaism, Christianity, Buddhism, etc., we see not only vast differences among them, but enormous divisions within any one of the traditions.

The only way, therefore, that dialogue as a rational experience can take place is that, on the part of religion, the dialogue be limited to the rational foundations for religious belief. Even then, the only way that any such dialogue could have universal significance is that we could assume that there existed common rational foundations across all religious traditions and that is simply not the case. It seems, therefore, that any fruitful dialogue requires that the rational basis for certain specific religious beliefs in certain specific religious traditions be confronted with what is known from the natural sciences. The natural sciences, in particular, have made great advances by adhering rigidly to canons of what is scientifically true. In fact, in recent years the norms for judging the scientific truth of a given theory of life’s origins and evolution have been extended, it appears to me, in the direction of inviting dialogue with philosophy and theology. (Destiny of Life and Religious Attitudes, G.V. Coyne, in *Life as We Know It*, ed. J. Seckbach (Dordrecht: Springer Science 2005) 521-535, page 521 Introduction.

4. You stand amid the rare and rarefied class of Roman Catholic figures entitled ‘Cleric-Scientists’. What role do your fellows throughout Roman Catholic history play in the development of the definitions and integration of science and faith? In particular, the merger of both Catholic theology and scientific knowledge?

I must limit myself to speaking of the Jesuits (Society of Jesus) so as to make a manageable response. Here are a few reflections from some of my unpublished writings:

The presence of Jesuits in different fields of the natural sciences is an interesting phenomenon that has attracted academic and general attention and can be found in the literature. Jesuits are popularly known as religious persons who are involved in scientific work and they appear as such in some science fiction novels. A few years after its founding in 1540 by Saint Ignatius of Loyola, the Society of Jesus undertook its educational endeavor as the key instrument of its apostolic work. From the beginning, as a novelty for the time, a special attention was given in the first colleges to the teaching of mathematics and astronomy. This coincided with the origins of modern science and Jesuit professors were in contact with many of its key figures, such as Galileo, Kepler, Huygens and Newton. Jesuit missionaries introduced European mathematics and astronomy to China and India, made the first maps of the unknown regions of America, Asia and Africa, and brought to Europe the first news about the geography, animals and plants of those lands.

The presence of Jesuits in science has continued throughout their long history. In addition to a very pragmatic motivation, the basic foundation for such work is to be found in Ignatian spirituality. The core of this spirituality lies in the emphasis on finding God in all things, the union of prayer and work, the search for what leads to the greater glory of God, and the preference for work “on the frontiers”. This has often involved Jesuits in unconventional activities and situations, including scientific research. Jesuit scientists, who have reflected on their work, acknowledge this special affinity between the scientific vocation and their spirituality and are aware of the difficulty in combining this vocation with that of a Jesuit, of being at the same time priests and scientists. To conclude,

the Jesuit scientific tradition, in spite of all the problems encountered during its long history, is still alive and serves as a special characteristic in the Catholic Church.

A view of the evolutionary universe and of our place in it, as the sciences see it, and of God’s role in the universe, derived from the reflections of a religious believer upon that same science, may help us in a further understanding of Jesuit mission. We, in a special way, share in the creativity which God desired the universe to have. We are co-creators in God’s continuous creation of the universe. The Jesuit identity expressed by St. Ignatius’ vision of Jesuits as contemplatives in action is reinforced by our reflections on the nature of the universe. Co-creators in the universe can only realize their mission if they are constantly united to God, the source of all creativity. Jesuit identity is much more than what Jesuits and their partners do. It is bound intimately to the very nature of the universe which drives us as co-creators to the serve others in union with the Creator.

Ignatian mission is a participation in the intrinsically missionary nature of the Church, the concrete presence of the Creator among his co-creators. God is continually encountering the world in new and creative ways because the world he created is responsive to his continual encounter. Ignatius sent his men into that world and sought to free them of any encumbrance to a free and total commitment to the world in whatever way their talents would best serve the Church. And their mission was to evolve just as the universe itself is in evolution. But for any individual Jesuit, Jesuit partner or Jesuit institution the evolution of mission must be in consort with the intrinsically missionary Church. The wisdom of God in emptying himself to create a world which shares in his creativity requires that, since God is the one God of all creation, such participation in his creativity must be universal. It cannot favor any particular social, cultural, religious movement. While to

function any given mission must be limited, it cannot be exclusive.

5. In a 1997 essay *Non-Overlapping Magisteria* by the late Dr. Stephen Jay Gould, he re-defined the standard notion of tension between science and theology as not having any real area of conflict. Dr. Richard Dawkins critiqued Dr. Gould's synthesizing view based on arguments against the ability of the separation of religious and scientific matters. How do you view these matters? What do you consider the appropriate stance towards scientific and theological knowledge?

There is always a serious risk of transgressing upon the epistemological independence of the various disciplines: theology, philosophy, astrophysics, biology and cosmology, and creating, thereby, more confusion than understanding. It is, therefore, necessary to maintain a consistent posture of preserving the integrity of each of the disciplines, especially that between the natural sciences and theology. As compared to the natural sciences religion contains a larger measure of the subjective, of human experiences not totally verifiable by objective reasons. Such subjective experiences are not, of course, limited to religion. They are present in many areas of our lives. Nor need these experiences, religious or otherwise, necessarily conflict with reason. They simply are not limited to rational explanation. They go beyond what can be rationally justified.

In the natural sciences there are a number of criteria whereby an explanation is judged to be best. (See the response to number 6 below.) I suggest that one of those criteria is unifying explanatory power; i.e. not only are the observations at hand explained scientifically but the attempt to understand is also in harmony with all else that we know, even with that which we know outside of the natural sciences.

This last criterion is significant, since it appears to extend the semantics of the natural sciences towards the realm of other disciplines, especially to theology and Christian faith. Put in very simple terms this criterion is nothing else than a call for the unification of our knowledge. One could hardly be opposed to that. The problem arises with the application of this criterion. When is the unification not truly unifying but rather an adulteration of knowledge obtained by one discipline with the presuppositions inherent in another discipline. History is full of examples of such adulterations. It is for this reason that scientists have always hesitated to make use of this criterion. And yet, if applied cautiously, it could be a very creative one for the advancement of our knowledge and, therefore, of our faith.

The supposition is that there is a universal basis for our understanding and, since that basis cannot be self-contradictory, the understanding we have from one discipline should complement that which we have from all other disciplines. One is most faithful to one's own discipline, be it the natural sciences, the social sciences, philosophy, literature, theology, etc., if one accepts this universal basis. This means in practice that, while remaining faithful to the strict truth criteria of one's own discipline, we are open to accept the truth value of the conclusions of other disciplines. And this acceptance must not only be passive, in the sense that we do not deny those conclusions, but also active, in the sense that we integrate those conclusions into the conclusions derived from one's own proper discipline. This, of course, does not mean that there will be no conflict, even contradictions, between conclusions reached by various disciplines. But if one truly accepts the universal basis I have spoken of above, then those conflicts and contradictions must be seen as temporary and apparent. They themselves can serve as a spur to further knowledge, since the attempt to resolve the

differences will undoubtedly bring us to a richer unified understanding.

6. What do you consider the purpose of theology? What do you consider the purpose of science? More importantly, what role do theologians and scientists play in shaping, defining, and contributing to society and culture through working in their fields?

Theology is the search for a rational understanding of religious faith. It is, therefore, a science, but not a natural science. The classical definition of theology is “fides quaerens intellectum” (faith in search of understanding). However, religion, the very object of theology’s search, is ill-defined. Does it mean worship? Does it mean being a “good person”? Does it mean accepting certain moral dictates that go beyond what is commonly accepted as good and bad? Does it mean accepting those dictates out of personal conviction or out of loyalty to a certain tradition? Does it mean believing in certain doctrines? Does it mean accepting a certain authoritative and hierarchical structure, i.e. being affiliated with a certain Church? To most of us religion would imply more of an affirmative than a negative answer to all of the above. And yet the situation is further complicated by the multiplicity of religions which differ among themselves, have even warred among themselves, over the responses given to such questions as the above. Even today, if we look at some of the main religious traditions: Islam, Judaism, Christianity, Buddhism, etc., we see not only vast differences among them, but enormous divisions within any one of the traditions.

The only way, therefore, that dialogue as a rational experience can take place is that, on the part of religion, the dialogue be limited to the rational foundations for religious belief. Even then, the only way that any such dialogue could have universal significance is that we could assume that there existed common rational foundations across all

religious traditions and that is simply not the case. It seems, therefore, that any fruitful dialogue requires that the rational basis for certain specific religious beliefs in certain specific religious traditions be confronted with what is known from the natural sciences.

As to the natural sciences, skeptics, dubious of ever being able to find a widely accepted definition of science, say that science is what scientists do. The element of truth in this statement is that science is not a univocal concept. It varies from one discipline to another, even, for instance, among the so-called hard sciences. But there is also sufficient commonality among them that the name “science” can be legitimately given to each analogically. Scientists begin with controlled data, that is, data which any other trained professional could independently verify. The observed data is used to develop a model which best explains the data. The movement from observations to models is a continuously reciprocal process. The best model is used to determine what further observations must be made. The model is then revised with the new observations, etc. There is a constant going back and forth from observations to the model to the observations. It is important to note that in the very nature of this process of reciprocity there is an implicit acknowledgement that we do not possess the truth. The expectation is, however, is that we are continually approaching the truth.

How do we judge what is the best scientific model? There are a number of criteria whereby an explanation is judged to be best. A list of the principal criteria would include the following: (1) verifiability, i.e., there is, at least in principle, a way of judging whether the explanation fits the data; (2) predictability, i.e., from data on past or present events it is possible to predict future events and then observe to see that the future events actually occur; (3) simplicity or economy, i.e., the least assumptions are made to get the greatest explanatory power; (4)

beauty, i.e., the explanation has an aesthetic quality about it; although, especially for the natural sciences, this may appear to be a very subjective criterion, almost all great scientific discoveries have benefited from its application; (5) unifying explanatory power; i.e. not only are the observations at hand explained but the attempt to understand is also in harmony with all else that we know, even with that which we know outside of the natural sciences. (See the response to number 5 above.)

7. If you could have one question answered through a massive research project, what would you want answered?

The nature of dark matter and of dark energy.

8. One common mischaracterization, as you have noted, about the Catholic Church comes from viewing it as a monolith, especially in theological, intellectual, and scriptural thought. Regarding falsehoods about the Catholic Church, what few stand atop the list of those falsehoods? What truths dispel them?

By many the Catholic Church is seen as primarily hierarchical, an organizational structure: Pope, Vatican Congregations, Diocesan bishops, national conferences of bishops. The Church is clearly that but not primarily that. The Church is God's people on pilgrimage. The popular phrase is: "We are the Church." The hierarchical structure is at the service of God's people, as Pope Francis continues to emphasize and as, based on a solid Scriptural tradition, was so declared in very clear terms by Vatican Council II.

One is judged as a "good" Catholic by one's adherence to doctrinal and moral statements of the hierarchy and putting them into practice. Again, that is quite important but not primary. Primary is accepting God's love for us, received in a community, and spreading

that love as far as we can, beginning here and now.

9. Regarding the foundational claims of the Catholic Church such as the existence of God, the attributes of God, the moral structure of the universe, the revelations contained within the Old and New testaments, and so on, what do you consider the strongest arguments for their soundness?

Their coherence with all of human experience. See responses to numbers 5 and 6.

10. Where do you see the world of faith and science during middle and latter portions of this century? What brings you most worry for them? What brings you most hope?

Most worrisome are the divisions among the world's Abrahamic religions: Judaism, Islam and Christianity, not just on their beliefs but on their way of dealing among themselves.

Another worry concerns the growth of fundamentalism as most experienced by me within Christianity. We cannot, it seems, accept the richness of the Holy Scriptures for what they are.

To put it most generally, there is nothing like love and knowledge combined to sooth the troubled waters.

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