

“The Origins and Goal of the Scientific Vocation”

Introduction

Science is a general field of study that has had a huge impact on the way humans live. For many of us, it is more than a career, garnering a mere paycheck to provide sustenance and housing for ourselves and our families. For those of us who are teachers, it is a career in which we can pass on our insights and passion to students in the hope they will be able to build their own career and discover their passion.

Science also impacts our world in immeasurable ways. Along with the ability to understand parts of the Universe using science, we have developed a remarkable ability to put science into practice. Putting science into practice is *technology* which makes our lives better by producing the medicines that heal our illnesses, by developing methods to improve food production, and helping us travel and communicate in ways that were unimaginable in the pre-science era. However, technology has brought out many challenges that impact our lives and will impact the future of humanity. The understanding of the structure of the atom in the early 20th century led to the development of the atomic bomb but also led to the development of nuclear energy which, if it can be properly harnessed and designed with necessary safety redundancies, is the best energy alternative to fossil fuels. The understanding of the structure of DNA has led to our ability to “control the code”;¹ yes, to read, interpret, understand and to manipulate the genetic code in organisms including humans. This will lead to new treatments of disease and may change the paradigm of medical treatment from general approaches to personalized medicine based on the way an individual’s genetic code functions. This paradigm shift also has powerful moral implications. Thus, science manifests itself in a way that impacts our individual lives and the future of humanity in a very profound and complicated way.

The aim of this conference was to combine reflection on scientific research as a vocation with reflection on the social implications of scientific research. To understand the humanistic dimensions of science leads to a better understanding of the impact of science and as teachers, we can communicate this in a very profound way to our students. During the conference, we discussed three hypotheses:

- 1) The choice of a scientific career is often connected with a deep and influential personal experience which inspires a vocational commitment to this career. With the conferees we explored these personal experiences by asking the question “how did you personally come upon your scientific vocation?”
- 2) The notion of “vocation” is connected to a strong sense of personal values that are oriented to seeking a greater good or providing a greater benefit to society as a whole. Accordingly, we asked, “What is the good, ‘the whole,’ that your scientific research is oriented towards?”

¹ “Controlling the Code”, Lisa M. Jarvis, Chemical and Engineering News, 90(16), April 16, 2012; <http://cen.acs.org/articles/90/i16/Controlling-Code.html>, accessed 26 April 2012 (accessible via institutional subscription).

- 3) Assuming that a good number of today's scientists have a vocational commitment to their careers, how can we advise future scientists in their search for their vocation?

This was a one-day conference attended by approximately 20 faculty from Seton Hall University and 20 faculty from colleges and universities in the northeast region, most of whom are NetVUE members including: College of St. Elizabeth, Felician College, Georgian Court University, Marywood University, Metropolitan College, Rutgers University, Immaculate Conception Seminary, St. Joseph College, St. Peter's College and Ursinus College. The tremendous contribution that the visiting attendees had on this conference is heartfully acknowledged. This wonderful mixture of faculty, administration, scientists, non-scientists from Seton Hall and beyond had the "right" chemistry to make a Spirit filled day.

Morning session

The morning session began with a plenary lecture by Sr. Ilia Delio, OSF entitled *The Origin and Goal of the Scientific Vocation*. The talk was followed by a break-out session aimed at discussing the Sr. Ilia's talk in the context of hypotheses 1 and 3. The "results" of the break-out session were reported to the group and Sr. Ilia and Fr. John Haughey made reflections on the "results". A copy of Sr. Ilia's essay is attached to this report; however, a few essential points are summarized below (hopefully, the reader will be so engaged by these points that he or she will be able to read Ilia's talk in a different light).

In the concluding sections of Sr. Ilia's talk, she focuses on Pierre Teilhard de Chardin and the meaning of vocation for a scientist. Vocation is easily considered in the context of religion but in the context of science it also means to be called or to be drawn..."as one is drawn into a particular scientific study, the experience of matter itself becomes a prayer."² Having been a paleontologist and a Jesuit priest, de Chardin had the insight to realize that we as a species are a "trifling" speck in the "immensity" of the Universe but we have an ability greater than any other living organism (or, so, it seems) to comprehend "the great cosmos."² Sr. Ilia adeptly captured the vocational direction of the scientist in the following:

To discover and know is to actually forward creation as a universe and to help complete it; this active engagement through knowledge deepens the spirit...The scientific vocation is a call to participate in evolving reality and to help reality become more unified in its many dimensions.²

However, she also cautions us:

The scientist seeks to know everything about something, an openness that knows no bounds. The tension, however, is the lure to become overpowered by specialization, mistaking for certainty, thus losing the spirit of unrestricted wonder and creativity.²

² From *The Origin and Goal of the Scientific Vocation*, Ilia Delio, OSF. see attached.

The break-out sessions discussed hypotheses 1 and 3, above. Since I was at Table D, I will first provide an analysis of what was discussed at this table and then I will address the reports from the session leaders. In regards to hypothesis #1 (how were you called to your scientific vocation?), I observed three types of calling:

- a) Childhood experience (e.g., one person had a difficult family situation and went sent to summer camp where he fell in love with nature and was drawn to science because it helped him make sense of the physical world). Three of the seven people fit in this category.
- b) Gradually revealed itself (e.g., one person started out wanting to become a scientist then drifted toward humanities and now has been called to a combination of humanities/sciences. You will see this person is like Sr. Ilia when you read her essay). One of the seven fit in this category.
- c) Genetics (e.g., there may be a scientific gene (nature) that predisposes one toward being a scientist and there is also an acknowledged impact of being brought up in a scientific environment at home (nature); however, most of the people in this category had at least one parent who was a scientist and one person suggested a predisposition due to ethnic identity). Three of the seven people fit into this category.

The feedback sessions revealed several other ways in which the calling occurred that are different from the above categories. These were:

- d) Aesthetic component (e.g., attracted to the beauty of the subject and an openness to see that there is a notion within ourselves to understand and integrate the whole).
- e) Fascination with discovery (e.g., the hunter-gatherer exploring for food, rewarded by the search and discovery process and found science to be a worthy home).
- f) Financial encouragement.
- g) Revealed itself via reading books.
- h) Interest sparked by a friend, a teacher, a professor who said “don’t count the pills; make the drugs.”
- i) Science as a way to help others (e.g., the wanting to make a difference to change the world or to work toward the betterment of the world). Along this line someone contributed the idea of being a scientist is that it enabled that person to “pay it forward.”
- j) No particular discernment (e.g., those who have followed many varied paths with multiple changes without direct intervention but “ended up where we are supposed to be.”)

In regards to hypothesis #3, the following suggestions were made by Table D in advising students to discern science as a vocation:

- a) Try to do something that you love but tempered with something you are good at.
- b) Broaden your vision as you may need to have a broader horizon and be prepared to accept the interdisciplinary nature of science.

- c) There is more than just your major; see what is out there.
- d) Are you following Mom and Dad's decision vs. your own interests and abilities?
- e) Don't listen to advice but be impressed by example and follow the example.

The feed-back discussion revealed the following additional insights:

- f) There is a sometimes a contrast in the professional interests in many science oriented students and intellectual ability.
- g) Whereas one should be wary of the expectation that science will answer all of the questions; one should seek ways to fill the holes in the whole.
- h) There is a concern about the careerist profile of many students especially with respect to the cost of education and students rightful concern of how to make a living. Can you make a living out of a vocation or does the living flow from the vocation?

From the feed-back discussion Sr. Ilia contributed three points:

- 1) There is an emphasis on relationality, i.e., being drawn to the sense of passion and happiness. What you are drawn to reveals your being.
- 2) There is a need for interiority: prayer and meditation vs. workaholism and being overly pragmatic.
- 3) Science as a vocation is not a given but a discernment. Vocation is neither genetic nor about money. It is about the discernment of the call.

Fr. John also contributed two points:

- 1) With respect to the issue of vocation, we must consider St. Paul 1 Cor 12:7.³

To each individual the manifestation of the Spirit is given for some benefit.

- 2) The Tree Reflection from Cardinal Avery Dulles, SJ.⁴

³ United States Conference of Catholic Bishops, Bible, <http://www.usccb.org/bible/1corinthians/12/>, accessed 25 April 2012.

⁴ Avery Dulles, *A History of Apologetics*, Ignatius Press, 2005. Courtesy of Google Books; http://books.google.com/books?id=Xli4W2pSZpQC&pg=PR10&dq=Tree+by+Avery+Dulles&hl=en&sa=X&ei=vcCZT_GTM50N6QGc59DtBg&ved=0CEIQ6AEwAg#v=onepage&q=Tree%20by%20Avery%20Dulles&f=false, accessed 26 April 2012.

As I wandered aimlessly, something impelled me to look contemplatively at a young tree. On its frail, supple branches were young buds attending eagerly the spring which was at hand. While my eye rested on them the thought came to me suddenly, with all the strength and novelty of a revelation, that these little buds in their innocence and meekness followed a rule, a law of which I as yet knew nothing. How could it be, I asked, that this delicate tree sprang up and developed and that all the enormous complexity of its cellular operations combined together to make it grow erectly and bring forth leaves and blossoms? The answer, the trite answer of the schools, was new to me: that its actions were ordered to an end by the only power capable of adapting means to ends—intelligence—and that the very fact that this intelligence worked toward an end implied purposiveness—in other words, a will. It was useless, then, to dismiss these phenomena by obscurantist talk about a mysterious force of “Nature.” The “nature” which was responsible for these events was distinguished by the possession of intellect and will, and intellect plus will makes personality. Mind, then, not matter, was as the origin of all things. Or rather not so much the “mind” of Anaxagoras as a Person of Whom I had had no previous intuition.¹

Afternoon Session

In the afternoon session, we followed the same format with Fr. John Haughey making the plenary presentation, break-out and feed-back sessions. However, as segue, the word “call” was frequently encountered in the morning session. I have followed the work of Fr. John for 15 years and I love the way he uses words. Each time I read his books or hear him present, I have learned to look for one or two words to take away. In this case, let me begin with the word “call”. As a noun “call” is a cry or a summons for attention.⁵ Some synonyms are: cry, visit, appeal, summons, calling, invitation; except for invitation, all of these synonyms can also function as verbs. “Call” as a verb is the act of communicating to gain attention such as crying for help or something more gentle like calling a friend to talk. As a noun, one receives the call; as a verb one calls. In terms of understanding science as a vocation, who is hearing the call? Who is calling?

The title of Fr. John’s talk was “*God Makes Stuff that Makes Itself*.”⁶ In other words, God makes things that are self-organizing. Humans have achieved a greater ability to make and organize things than any other

⁵ Dictionary.com, <http://www.dictionary.com>, accessed 25 April 2011.

⁶ “*God Makes Stuff that Makes Itself*”, John Haughey, SJ, presented at The Origins of the Scientific Vocation Regional NetVue Conference, Seton Hall University, 30 March 2012.

organism which is in large part due to the way God created us and for God's grace in giving us the ability to discover systematic ways to assemble and manufacture things. We, in turn, have developed an understanding that if we study something in more detail and figure out how it works, we can employ the natural mechanisms to make things that function in their own self-organizing manner. To paraphrase Fr. John:

*The more science learns the more humans can become co-makers with God...What God makes can unmake itself and what is wrong with this narrative is that co-making without God is dangerous. Co-creating is co-making with God's assistance.*⁶

Faculty play a critical role in co-creating. As we research and pass on our knowledge to students, we “assemble that which is disassembled.”⁶ Our jobs are all about “making whole of disassembled parts.”⁶ However, are our jobs merely jobs? Or, are they careers; or, are they vocations and, if so, what are the responsibilities of the vocation? “Vocation is not something particular to nuns and priests” said Fr. John. Vocation is making, co-making, co-creating and he asked us to understand “the good you are trying to do through your discipline.”

The Sunday before our conference we celebrated the Feast of the Annunciation of the Lord which “celebrates the angel Gabriel's appearance to the Virgin Mary ([Luke 1:26-38](#)), his announcement that the Blessed Virgin had been chosen to be the Mother of Our Lord, and Mary's *fiat*—her willing acceptance of God's holy plan.”⁷ However, Fr. John revealed that this announcement was not intended for Mary alone but for all people.

The Holy Spirit has been called the Cinderella of the three divine persons. Pneumatology is the study of the theology of the Spirit.⁸ The complexity of this word seems to agree with the Cinderella characterization of the Spirit. However, I did not know until Fr. John's presentation that it is the Spirit who is calling. When I heard this, I wrote in my notes “IDEA: Christianity must broaden its understanding of how the Spirit is leading us.” In relation to science, the Spirit is intimately involved in the process of discovery. However, science is not only about discovery. It is never the case that in our search, we blindly discover a pot of gold. First, we are figuratively blind. Second, the gold is rarely found in such a nicely prepared package. “*Chance favors the prepared mind*” is the guiding principle of the scientist.⁹

⁷ About.com Catholicism, <http://catholicism.about.com/od/holydaysandholidays/p/Annunciation.htm>, accessed 25 April 2012.

⁸ Wikipedia, <http://en.wikipedia.org/wiki/Pneumatology>, accessed 25 April 2012.

⁹ This quote is attributed to Louis Pasteur (*Dans les champs de l'observation le hasard ne favorise que les esprits prepares*). WikiQuotes, http://en.wikiquote.org/wiki/Louis_Pasteur, accessed 25 April 2012. Recently, at a Chemistry/Biochemistry seminar, the speaker proposed that the quote be re-worded to “change favors the perplexed mind.” Robert A. Copeland, 10 April 2012.

Fr. John shared a poem that he wrote that he generously gave permission to include in this report.¹⁰

Two Verbs

What does the Trinity do when it is off-work?
It ones – a verb!
Its one-ing started with Three and never stopped being
A trinity, the Trinity, the Trifecta of mutuality --
And – who knows? -- maybe even grows more one.
When the Trinity goes back to work their agenda--
“that all might be one as We are one” --resumes.

What do humans do when they are on target?
They between – a verb!
They connect this dot to that, this feeling to that meaning,
Always relating one thing to another
And sometimes humans even love one another.
Between is what theology needs to do with science
And science with theology – as surely as the bee needs the flower
And the flower the bee.
Apart, their sufficiency is imaginary.
Together they could pollinate the world with wonder.
Betweening would make us better at beholding the One-ing God has been about all along
while entertaining high hopes that we chips off the old block would follow our calling to
between.
The apogee of betweenings is the Mass,
or however their *creata* are made the *oblata*.
Which maybe – who knows? -- draws the un-oned into One.

As you contemplate this poem, think about the beautiful way Fr. John uses unusual words such as “one-ing”, “betweening”, “un-oned”. This is exactly what a scientist does in the process of making, understanding and communication a discovery. For example, *verbenindene*, I coined to describe a class of molecules we made at Seton Hall University (and I am proud to say that others have now used it!).¹¹ Unfortunately, this word demonstrates the tendency of scientists to use words that are so nuanced that very few people even within the scientific community understand them. In contrast theologians tend to invent new words to improve understanding and enhance communication to a broader audience. “*Betweening*” and “*one-ing*” are words that everyone can understand as they are words of uniting and making whole. This leads us to a better understanding of the conference and to the rationale why science is more than a career, to why it is a vocation.

¹⁰ *Two Verbs*, Courtesy of John C. Haughey, SJ, 2012, printed by permission of the author.

¹¹ *Synthesis of Verbenindenes: A New Class of Chiral Indenyl Ligands Derived from Verbenone*, Rupert, K. C., Liu, C. C., Nguyen, T. T., Whitener, M. A., Sowa, J. R., Jr., *Organometallics* **2002**, 21, 144-149. <http://dx.doi.org/10.1021/om010731n>

Fr. John stated “*What God makes can unmake itself*” and he pointed out that there is something wrong about this. What is wrong is that co-making without God is dangerous; we need to consider another word, co-creatorship which is co-making with God’s assistance. To quote:

*The Spirit of God as sent and has been sent means God is immanent, not transcendent.*⁶

Fr. John mentioned Galatians Ch. 5 and the relevant passage is given below (Gal 5:16-23):¹²

I say, then: live by the Spirit and you will certainly not gratify the desire of the flesh. For the flesh has desires against the Spirit, and the Spirit against the flesh; these are opposed to each other, so that you may not do what you want. But if you are guided by the Spirit, you are not under the law. Now the works of the flesh are obvious: immorality, impurity, licentiousness, idolatry, sorcery, hatreds, rivalry, jealousy, outbursts of fury, acts of selfishness, dissensions, factions, occasions of envy, drinking bouts, orgies, and the like. I warn you, as I warned you before, that those who do such things will not inherit the kingdom of God. In contrast, the fruit of the Spirit is love, joy, peace, patience, kindness, generosity, faithfulness, gentleness, self-control. Against such there is no law.

Fr. John used the word “*capacious*” in the sense that science keeps gaining more information about how the world works, but, he said “*the how does not know*” how to work itself. My nine year old daughter was interested in greyhound dogs last week and performed an internet search. She found an illustrated drawing of a Scottish greyhound with a note pointing to the chest which read “*capacious chest*”. She asked me what that means. “Well”, I said, “I just heard that word the other day at work. It means that the greyhound’s chest is big and can hold a lot.” Humans have capacious minds and hearts but not in the general sense of anatomically large, in the sense of capacity to absorb information and to synthesize the information to understand the whole. However, can the soul of the heart operate independently of the soul of the mind?

In the afternoon break-out and feed-back sessions, we were energized but it was also Friday afternoon and the weather was incredibly beautiful and the capacious windows of the Atrium were begging us to go outside. Thus, we focused our efforts on hypotheses #2 (“What is the good, ‘the whole,’ that your scientific research is oriented towards?”). It is the nature of vocation to bring out the good. The break-out session produced the following interesting comments:

- a) The process of learning and the satisfaction it brings is good in itself.
- b) Working with students in a way that we can add value helps us make “wholes”.
- c) Making them do the best that they can puts meaning and appreciation into their lives.
- d) Science may help us discern truth vs. fiction with respect to our relationship with God.

¹² United States Conference of Catholic Bishops, Bible, <http://www.usccb.org/bible/galatians/5>, accessed 26 April 2012.

- e) There is a tension about bringing about order which science does in its mechanism of organizing vs. individualism.
- f) Is there an area of the world where you can have an impact?
- g) Is everything as great as it is advertised to be? Things may be misperceived.
- h) There is a challenge to successfully balance the technical requirements of science with the need for intellectual and spiritual development. The Catholic milieu is an important and helpful way of encouraging this balance.
- i) Accepting the challenge to perform a method well within any field of study is a pursuit of the good.
- j) We want our young people to understand that there is something beyond themselves so they can become better and use their freedom wisely to understand themselves and relationship to others.
- k) Western society values individualism and power; however, how can we open students to the idea of more societies, to their model and how they view the world?
- l) How can we help people help others? However, we need also to understand how to help people to explore vs. exploit.
- m) It is critical to get beyond the narrow focus of science and appreciate the minutia to get to the bigger question.
- n) There is a concern about things that drive science that are backed by financial and political interests and the apparent influence of the “old boy network”.
- o) Can we be drawn to the notion of matter speaking and matter praying?
- p) Can we help our students understand the Spirit?
- q) Let’s advise students to start small with unconnected parts and become more interested in the connections and making the whole.

The responses from Fr. John and Sr. Ilia were also condensed into the concluding remarks for the conference:

Fr. John made two statements:

- 1) A conversation in Depth can make a new Whole.
- 2) The milieu of Seton Hall University is that of a unique place which enables its people to elicit the wholes and to seek to make wholes.

Sr. Ilia made two statements, one rhetorical question and one call to action:

- 1) Wholemaking is not an option! Science is disclosing a thoroughly relational Universe.

- 2) The Spirit is at work in wholemaking. The Spirit is at work in us when we are in the act of wholemaking.
- 3) Do we let students discover their wholes or place the whole in front of them?
- 4) The sustainability of the Earth is in Question! We need to catalyze the process of helping our current students and future generations hear the call of the Spirit and recognize the guiding hand of the Spirit as they search for their careers and discern their vocations.

In conclusion, the word of the conference is **Spirit**. The message of the conference is that if we are open to the idea of vocation being an essential part of our careers then we are open to the call of the **Spirit**.

Respectfully submitted,

John R. Sowa, Jr.