

Specialization: a healthy balance
by Geoffrey Woollard

An influential Spanish humanist of the past century outlined four distinct missions of the university¹. He argued the university should (1) conduct specialized research, (2) prepare the future business and political leaders of society, (3) teach the necessary prerequisite requirements for professional schools (medicine, law, dentistry, engineering), and (4) raise the intellectual and cultural tone of all society. In contrast to this, Cardinal John Henry Newman insists theology be present in the university among all the distinct disciplines; he advocates that liberal knowledge be present among the diverging faculties². Indeed, liberal knowledge, the knowledge that does not necessarily serve an immediate purpose, but never the less broadens the scope and potential of the mind is precisely what sets the university apart from other institutes of higher learning.

It has been lamented that the modern research university leads to fragmentation of knowledge through overspecialization³. In such a state research efforts prove stale. This is seen with the difficulties of a reductionistic approach in living systems, in place of a systems biology or integrative approach^{4,5}. As well, problems requiring more than one discipline remain unsolved as professional collaborations are not attempted. In place of more suitable disciplines, experimental science is put forward as the surest guide in questions beyond its scope⁶.

¹ Gasset, Jose Ortega Y. 1992. *Mission of the university*. Transaction Pub.

² Newman reader - idea of university. [cited 3/22/2009 2009]. Available from <http://www.newmanreader.org/works/idea/> (accessed 3/22/2009).

³ Ashley, Benedict M. 2006. *The way toward wisdom: An interdisciplinary and intercultural introduction to metaphysics*. Notre Dame, Ind. : University of Notre Dame Press.

⁴ Poon, C. S. 2007. Response to commentaries on homeostasis of exercise hyperpnea and optimal sensorimotor integration: The internal model paradigm". *Respiratory Physiology & Neurobiology* 159, (2) (Nov 15): 139-40

⁵ Kitano, H. 2002. Systems biology: A brief overview. *Science (New York, N.Y.)* 295, (5560) (Mar 1): 1662-4.

⁶ Dawkins, Richard. 2006. *The selfish gene*. Oxford : Oxford University Press

However, efforts to work in a more interdisciplinary manner are visible⁷. In this essay I hope to show that overspecialization can lead to a conflict between experimental science and revealed religion. Moreover, I will attempt to demonstrate that overspecialization is substantially hindering the success of the modern university in terms of raising the intellectual and cultural tone of society. I will first distinguish specialization from overspecialization. Next I will explain why overspecialization happens. Then I will show to what overspecialization gives rise. Finally I will suggest how to specialize while staying in touch with other disciplines.

When students meet they exchange names and ask, "What do you study?" But there is more to specializing than taking a concentration of courses in one area. Because we go beyond introductory survey courses in some areas, we have a more scientific knowledge (through causes) than popular. Since we examine the primary literature we know the historical background, foundations, methods, current areas of inquiry, and controversy in the field. We might even delve deep enough to further the progress of that field. In a certain sense, we see daily events through the lens of our specialization.

Overspecialization, however, excludes the methodologies of other areas, and insists all follow the logic of one specialty. Some examples: the mathematician who demands we proceed with the same routine of definition, axiom, proof, and theorem; the biologist who insists we design a positive and negative control; the physicist who objects that we derived no mathematical model. With overspecialization, the object of study extends to include all of reality. Historically, the overextension of psychology and economics by Freud and Marx proved fruitless for advancing their discipline.

⁷ The fourth annual multidisciplinary undergraduate research conference - UBC reports. [cited 3/22/2009 2009]. Available from <http://www.publicaffairs.ubc.ca/ubcreports/2005/05nov03/conference.html> (accessed 3/22/2009).

In February 2009, the National Geographic ran a pair of articles on Charles Darwin for his 200th birthday. The first sketched his life from the decade long voyage of the Beagle to publishing the *Origin of Species* and *Descent of Man*⁸. The second reported advances in modern cellular biology and genetics. The first discussed how exciting Darwin's ideas were to scientists at the time. Although the modern synthesis of genetics and cellular biology would not occur until the middle of the next century, Darwin's ideas allowed scientists to scratch the surface of the mystery of life. Now they could at least try to answer questions that had previously been tackled only philosophically. Philosophy supplies a deep understanding, but science gives utility and power. What makes something *alive* instead of just self-propelling, dynamic, organized, and changing? How did we come to use sounds and symbols to communicate information? Now the biologists were in on the discussion.

The second National Geographic article summarized some recent findings concerning the use of animal and human language and the FOXP2 gene⁹. Songbirds with this gene readily pick up their mother's chirps and whistles, but problems arise without it¹⁰. Since this same gene is dysregulated in a similar human pathology - developmental verbal dyspraxia, experimenting with songbirds may lead to cures¹¹. Bats echolocate with help from FOXP2¹², and certain mammals

⁸ Darwin's first clues — National Geographic Magazine. [cited 3/23/2009 2009]. Available from <http://ngm.nationalgeographic.com/2009/02/darwin/quammen-text> (accessed 3/23/2009).

⁹ Modern darwins — National Geographic Magazine. [cited 3/23/2009 2009]. Available from <http://ngm.nationalgeographic.com/2009/02/darwin-legacy/ridley-text> (accessed 3/23/2009).

¹⁰ Haesler, S., C. Rochefort, B. Georgi, P. Licznarski, P. Osten, and C. Scharff. 2007. Incomplete and inaccurate vocal imitation after knockdown of FOXP2 in songbird basal ganglia nucleus area X. *PLoS Biology* 5, (12) (Dec): e321

¹¹ Feuk, L., A. Kalervo, M. Lipsanen-Nyman, J. Skaug, K. Nakabayashi, B. Finucane, D. Hartung, et al. 2006. Absence of a paternally inherited FOXP2 gene in developmental verbal dyspraxia. *American Journal of Human Genetics* 79, (5) (Nov): 965-72.

¹² Li, Gang., J. Wang, S. J. Rossiter, G. Jones, and S. Zhang. 2007. Accelerated FOXP2 evolution in echolocating bats. *PLoS ONE* 2, (9) (Sep 19): e900.

vocalize with the aid of the same gene¹³, hence its title of language gene¹⁴. Darwin brought up the questions and laid a foundation, and for the past century excited experimentalists have rolled up their sleeves and attempted to address them in the manner proper to experimental life sciences. However, many have gotten off track, and turned philosophers without their realizing, and without training. For instance, this article treats human and animal language on the same level, and betrays a misunderstanding of the uniqueness of man.

In *The Origin of Species*, Darwin tactfully left unspoken how his theory would extend that commonality to include humankind. A decade later he confronted the matter head-on in *The Descent of Man*. He would be delighted to know that a certain gene, called *FOXP2*, is critical for the normal development of both speech in people and song in birds.

Just what exactly is different between human language and animal communication is ultimately not a question of experimental biology. Language is not a gene, but a phenomenon. To understand language adequately one must draw upon psychology, linguistics, philosophy, and semiotics¹⁵. But who expects us to specialize in all these areas in order to address the question of language? If the experimentalist is not interested or competent, are his findings useless? Should one distinguish the different philosophical categories of language in a biological journal? Time and energy limit a man. How can a discipline progress if burdened with scholarly nuances?

Newman pleaded: let the experimentalists pursue the truth. Pursue that one sole authority wherever it leads. We should pursue truth in the manner with which we are competent, but only

¹³ Webb, D. M., and J. Zhang. 2005. FOXP2 in song-learning birds and vocal-learning mammals. *The Journal of Heredity* 96, (3) (May-Jun): 212-6.

¹⁴ BBC NEWS | Science/Nature | first language gene discovered. [cited 3/22/2009 2009]. Available from <http://news.bbc.co.uk/2/hi/science/nature/2192969.stm> (accessed 3/22/2009)

¹⁵ Deely, John N. 2001. *Four ages of understanding: The first postmodern survey of philosophy from ancient times to the turn of the twenty-first century*. Toronto ; University of Toronto Press.

recognize that our approach is not the only way. The self-acclaimed secular humanist Richard Dawkins provides a pitiable example of this problem.

"Certainly science cannot prove what is right or wrong, but nor can theology. [...] Why is there anything rather than nothing?" is often cited as beyond the reach of science, but physics may one day answer it and if physics doesn't, nothing will.¹⁶

Newman would diagnose Dawkins with a case overspecialization. He misunderstands his own method of inquiry and that of theology. Physics studies that which can be seen directly or imaged with some indirect method, and then displayed in some visual representation or mathematical relation. Theology studies God himself who is infinitely greater than the inquirer. Physics is part of natural science, theology of supernatural. Physics proceeds by induction, from particular to principle. Physicists collect data and abstract patterns. Theology proceeds by deduction, from principle to principle. Theologians examine the deposit of revelation already revealed in its entirety, and progress is an organic development of our understanding of this deposit. In Newman's words, we solve new questions by consulting old answers. Physics is experimental, theology traditional; one is richer and progressive, the other surer and stationary. Physics has visions of the future, while theology remains loyal to the past. If both the theologian and scientists do not understand and respect these differences, hostility arises. One wants the other to 'do things his way', in a very childish manner.

Dawkins betrays ignorance of the scope of experimental science versus theology. What is within the realm of experiment and theoretical derivation? The changeable, detailed descriptions and categorizations of phenomena, drawing out principles, discovering mechanisms - all these are matter for natural science. However, the ultimate origin of space and time, what sustains and

¹⁶ Why I am a secular humanist. [cited 3/22/2009 2009]. Available from <http://www.simonyi.ox.ac.uk/dawkins/WorldOfDawkins-archive/Dawkins/Work/Interviews/1997-winterhumanist.shtml#dawkins> (accessed 3/22/2009).

governs them, is outside the experimental realm. Theology begins where science ends, the nature of God and his relation to creation, the interior life of man illuminated by revelation.

Besides misunderstanding the method of inquiry, a climate of intellectualism further exaggerates overspecialization. This observation was noted by Newman and still prevails today. Intellectualism is what happens when man is unable to look beyond himself and becomes a victim of intense and radically subjective self-contemplation. He becomes only interested with what is explicitly apparent and on the same level as himself. Newman warned that liberal knowledge tends to assemble a purely philosophical take on life, such that man is the measure of all things. In our time we see this is already a reality for many around us. This climate naturalizes the supernatural. Newman warned of fear diminishing to shame and self reproach, and duty to taste. In our day Dawkins reduces ethics and morality to a weigh scale.

I'd worry about the humanist label if it implied something uniquely special about being human. Evolution is a gradual process. Humanness is not an all-or-none quality that you either have or don't have. It is a complicated mixture of qualities that evolved gradually, which means that some people have higher doses than others, and some nonhumans have non-negligible doses as well. Absolutist moral judgments founded on the "rights" of all humans, as opposed to nonhumans, therefore seem to me less justifiable than more pragmatic judgments based, for example, on quantitative assessment of the ability to suffer.¹⁷

Since he is trained as a biologist, he looks at the dynamics of biological life in terms of graphs and tests for biological activity. He uses a mono-disciplinary approach to examine the realities of human life. Perhaps he has a certain need to latch onto an explanation and fit things into his schema. In this case the only explanation in sight is utterly incomplete.

This is the problem of overspecialization. Now that I have outlined its causes and given examples of its manifestations I will proceed to suggest some means for its prevention. In *The*

¹⁷ Ibid.

*Intellectual Life*¹⁸, A.G. Sertillanges outlined the spirit, conditions, and methods with which to carry out intellectual work. He offers 5 guidelines.

(1) *Ardor in research* leads us to leave no question unanswered. We guard against laziness, avoid it, and pursue the argument to its conclusion. We will either be satisfied with our knowledge and reap the benefits with little effort, or always study - with only death setting the limit.

(2) *Concentration* amplifies the powers of our mind like light through a magnifying glass. With it we discover the subtle connections and keep track of all the factors in play.

(3) *Submission to truth* saves us from a false attachment to receiving applause. We seek answers for their value and not for merit or praise. The most important thing should not be practicality, elegance, or efficiency, but truth.

(4) *A breadth of outlook* arises from the universality of truth, which leads us to see the problems of our specialty with relevance to the whole. The mind has a unique tendency to unify details to a synthesis, and a weakness to linger on details and lose unity. We cannot understand all of the details at first glance; rather, we need to organize the information in order to handle an overwhelming amount of material. Since the nature of genius is to see patterns, we should shake off false orthodoxy attached with stale formulae. When enthused with new findings we should wait for the hype to settle and then examine what truth has really been found.

(5) With a *sense of mystery* we admit we know little well and nothing entirely. God gives us questions and enigmas through nature, and we are humbled knowing our limitations. We are motivated to work until all will be made clear in heaven. This sense quenches unbridled

¹⁸ Sertillanges, A. G., and Mary E. Ryan. 1987. *The intellectual life: Its spirit, conditions, methods*. Catholic University of America Press

curiosity. And the curiosity of experimentalists needs quenching, especially in the case of research into human development. For example, consider adult skin cell derived stem cells (induced pluripotent stem cells). Initially this adult stem cell technological achievement was heralded as a way to by pass the destruction of embryos¹⁹. Yet some researchers are interested in hopes they can differentiate cells to sperm and ovum, then fertilize the gametes to produce a new human. With this subject they shall proceed to answer the concealed questions of embryology²⁰. Some questions about man that could be answered, but never should be.

When we apply the above spirit to our work, we take up the task of comparative study enthusiastically. Comparative study links our specialty with other disciplines and then with philosophy and theology. Because specialized disciplines are dependent and complementary to one another, they benefit from a foundation. Newman suggested that a liberal arts education is this foundation. He insisted that no university should be satisfied with only preparing students for demanding professions, or carrying out advanced research.

In the modern Canadian research university, this liberal arts foundation is not a reality. If we supplement our specialty with liberal arts electives it complicates things immensely. Yet what is the alternative? If we cultivates our specialization only, the results is overspecialization. Instead, we ought to enrich our specialty with at least a rudimentary understanding of the diverse branches of knowledge. Doing so enthuses us about our own specialty, and allows us to see it from the outside. Science lacks guidance, and needs help from other areas. Both experimental

¹⁹ Scientists bypass need for embryo to get stem cells - New York Times. [cited 3/23/2009 2009]. Available from http://www.nytimes.com/2007/11/21/science/21stem.html?pagewanted=1&_r=1 (accessed 3/23/2009).

²⁰ Levin, Yuval. 2009. Biotech: What to Expect. *First Things*, March 2009.

and theoretical sciences lose direction without the queen of science - philosophy. Natural knowledge goes astray without the divine science of theology.

How do we go about comparative study? By appealing to first causes knowledge can be unified. One such attempt is Benedict Ashley's *The Way Toward Wisdom*²¹. Indeed the sub title is *An Interdisciplinary and Intercultural Introduction to Metaphysics*. Ashley first mentions the fragmentation of knowledge in the modern university - for example, the two cultures of arts and science²², and even 'soft' sciences such as psychology and sociology versus 'hard' sciences like physics and chemistry. Ashley systematically outlines the foundations of natural science, the logical structure of any discipline, the properties that all *changeable* things have (quantity, quality, relation, action, receptivity, place, position, environment, time), the 4 types of 'causes' (*efficient* - by whom is it made, *material* - out of what is it made, *formal* - into what is it made, *final* - for what is it made). All roads meet in the land of metaphysics since it concerns the properties of all reality, and absolute principle of being.

Another less rigorous and more easily understandable work is Mortimer J. Adler's *Aristotle for Everyone*²³. He distinguishes the three types of thinking, and pairs them up with their respective reason and object. We think productively in order to make things with skill; we think practically in order to act good or bad; and we think theoretically to know for knowledge's sake.

One counter argument to all of this interdisciplinary study accuses the well-rounded man with being impractical and superficial. In the worst case, we know a lot about nothing, and in the

²¹ Ashley, Benedict M. 2006. *The way toward wisdom: An interdisciplinary and intercultural introduction to metaphysics*. Notre Dame, Ind. : University of Notre Dame Press.

²² Snow, C. P. 1993. *The two cultures*. London : Cambridge University Press.

²³ Adler, Mortimer Jerome. 1997. *Aristotle for everybody: Difficult thought made easy*. New York : Simon & Schuster.

best, we lack time for our true interests. While this interdisciplinary talk is well sounding and intentioned, time and effort is lost elsewhere. While we dabble in other disciplines, our colleagues outpace us. If we are preparing for professional schools, say medicine, the need to stick to some academic plan puts into retirement the day when we will ponder these deep questions.

My counter argument to this attitude draws on Karl Jaspers' *Idea of a University*. In classical German fashion, Jaspers focuses on the university as a centre for cutting-edge research. Certainly, his vision proved true for the majority of Canadian universities, where the chain of academia starts at undergraduate and ends at tenure. However, even he makes the point that without philosophy we lose interest in our area of study. The day-to-day drudgery corrodes the initial glimmer and we live for the weekend. Anyone in laboratory research can certainly sympathize with the frustration encountered when things 'don't work' for no apparent reason. If one takes a step back, engages in other disciplines, he can return to the task at hand with new enthusiasm. Indeed, I have seen one science-humanities project at my very own university:

[The idea is to] work on a project that used and focused on interdisciplinary thought - connections between the sciences and the humanities, directed specifically towards the undergraduate community. [...] By creating a synergistic forum that addresses topics such as climate change, sustainability, social inequity, GMOs and AIDS, we hope to stress the importance of multi-disciplinary learning, thus inspiring students to actively pursue university educations that will assist them in developing and promoting just, civil, and sustainable societies throughout the world.²⁴

This quote exemplifies the complicated problems of the day. Solutions require scientists that not only supply facts. They must also communicate the level of certainty of those facts, and integrate them with other findings. Solutions require proper communication among professionals with

²⁴ Terry » about terry. [cited 3/22/2009 2009]. Available from <http://www.terry.ubc.ca/index.php/about/> (accessed 3/22/2009).

diverse backgrounds. In this area, the humanities have much to offer. Solutions arise and are put into effect when they become popular, and it is not enough to know the answers, but to make them appealing and palpable.

I have shown that a healthy specialization pursues the truth with enthusiasm to unearth the truth that is yet uncovered. In the case of the FOXP2 gene, the community of researchers discovered the reliance of a microscopic cellular intermediary in human language. I also explained that overspecialization occurs through a fundamental misunderstanding of the method of inquiry and scope of each discipline. I provided Richard Dawkins' comments and the perceived conflict between science and theology as an example of the fruits of overspecialization. In this light, his comments are not so much provocative as unfortunate. The means to healthy specialization are ardor in research, concentration, submission to truth, breadth of outlook, and a sense of mystery, as relayed by Sertillanges. Finally, I suggested studying philosophy as a way to see the connections of ones discipline to others. If we take up this task, we will gain the framework for interdisciplinary work. As scientists we will regularly put aside our calculations and if humanists our books to make connections beyond our immediate specialty. We will submerge the atheistic dissatisfactions of Dawkins and other such characters with clarity that all can understand - with a authentic reality that is one, good, beautiful, and true.