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## Crossing the Disciplinary Boundary

Pedagogical Conjunctions in the Humanities and the Sciences

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# Crossing the Disciplinary Boundary: Pedagogical Conjunctions in the Humanities and the Sciences

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*Abstract: This paper discusses disciplinary and interdisciplinary challenges in the humanities and sciences and their pedagogical relationship. Despite compelling evidence of communications between the humanities and sciences, the disjunction of academic divides in humanities and sciences has long been the basis for debate. Even recent surveys of interdisciplinary research have revealed a lack of cross-disciplinary projects to bridge the gap between the humanities and sciences; meanwhile, there have been an increasing number of interdisciplinary studies and projects among the scientific sub-disciplines. If the question of social and political credibility and ongoing viability of science is also closely interlinked with a constant investigation of, and communication with, the humanities, it is important to address and investigate disciplinary and interdisciplinary challenges in the humanities and sciences and to create pedagogical and investigational bridges that look at their relationship to each other and to society. With cogent discussions about the value, meaning, and importance of science to human ideas and actions, and of the importance of human ideas and actions to science, our aim is to develop and implement interdisciplinary communications across the disciplinary boundaries. We discuss our experiences in successful design, execution, and evaluation of an undergraduate Honors Colloquium focused on nurturing transdisciplinary thought and action via historical and contemporary works and live interviews with professionals who have incorporated elements of interdisciplinarity into their own work. The value of this pedagogical model for the interdisciplinary and transdisciplinary dialogue is highlighted by student responses, including altered career and lifestyle paths.*

*Keywords: Cross-disciplinary, Pedagogy, Interdisciplinary, Transdisciplinary, Communications*

## Introduction

What concepts and themes are, or can be, shared by the Humanities and the Sciences? Are there common threads, or are the *Two Cultures* of C. P. Snow's 1959 "Rede Lecture"<sup>1</sup> still current (Snow 1959)? These questions began a year of discussions between Dr. Jungah Kim (Assistant Professor of English), and Dr. Kenneth L. Campbell (Professor of Biology) and led to a joint offering of a junior honors colloquium in the Honors College of the University of Massachusetts – Boston (UMB) entitled "Humanity and Humanness: A Debate between the Liberal Arts and the Sciences" in the spring of 2013. A strong positive student response to that initial offering led to a repetition in spring of 2015 in which Dr. Neal Bruss (Associate Professor of English) stepped in as co-instructor. This paper describes our experiences in offering the colloquia, the responses from the students and the guest speakers, and some empirical conclusions. It is a case study offered to others as an example to build upon or modify in their own contexts. These colloquia, provided to a small number of university honors students from diverse backgrounds, were not designed as a formal, *a priori* educational experiment nor were they intended as a vehicle to educate participants in either the Nature of Science (AAAS 1989; Lederman 2007) or the Nature of the Arts and Humanities. While some material in these areas was provided as part of the reading list (Gross and Levitt 1998; Hyun 2011, 2012; Kitcher 2010, 1998;

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1 Snow characterized British education in the post-World War II era as an imbalance that emphasized classical training for elites and lacked the scientific and technical training necessary to maintain economic progress. What science training there was attracted lower social ranks. The differences in educational content and social status together fostered the disrespect and poor communication producing Snow's "Two Cultures."

Lederman 1992; Weber 1946), there was no attempt to inculcate students uniformly, or in depth, in these arenas.

Dr. Kim came to UMB in the fall of 2011 as an Office of International and Transnational Affairs (OITA) Faculty Exchange Fellow. As part of a year-long report project she had to identify and work with a UMB faculty mentor. She came with an interest in exploring whether the Humanities and the Sciences shared values or remained separate and conflicting realms as described by Snow, earlier philosophers, Sokal, and others (Snow 1959; Arendt 1998; Critchley 2001; Kant 2010; Robbins and Ross 1996; Sokal 1996a, 1996b; Gross and Levitt 1998; Sontag 1978; Gostin 1985; Foucault 1988; Manninen 2008; Bentall 2009; Jennings 2010). She was directed by OITA to Dr. Campbell because of his experiences with social scientists. He recommended varied readings (Bronowski 1956; Wilson 1998; Kolata 1999; Sacks 1998; Skloot 2011; Mukherjee 2010a) and attendance at lectures on initiation of pregnancy with its associated ethical issues. The weekly two to three hour conversations from fall 2011 to late spring 2012 ranged across the tenets of Science and the Humanities, the nature of data and facts and their perception in the Sciences and the Humanities, the central values of Science and of the Arts and Humanities, past expressions of gaps or similarities between the Arts and Sciences, and the role of ethics in both realms. Included was a search for the best means to present the ideas discussed to students so as to give them enough background in both areas to understand arguments and discussions as well as to see the multi-faceted nature of most societal issues. The discussions supported Dr. Kim's OITA report led to a conference paper, *Transdisciplinary Approach to the Ideas of Humanness and Humanity* (Kim and Campbell 2012). It also initiated planning for the 2013 Honors Colloquium.

Drafting the 2013 colloquium led to consideration of cooperation and complementarity among disciplines and how and to what degree the disciplinary divide could and was being breached. This included examining what others really meant by terms such as *cross-disciplinary*, *interdisciplinary*, or *transdisciplinary*. Key definitions are shown in Table 1. Note the progression from mutual observations of the disciplines, *cross-disciplinary*, through integration and cooperation among disciplines, *interdisciplinary*, to hybridizations generating novel outcomes, *transdisciplinary*. It is apparent our initial offering started with a cross-disciplinary analysis of associations between the Humanities and the Sciences with much time devoted to the literature and viewpoints of each arena regarding the other. The last half of the course concentrated on medical, business, and social ethics and began moving toward interdisciplinarity and trans-disciplinarity during student group projects focused on multi-faceted problems with both scientific and humanistic components. Students who took that first offering left with widened perspectives and a willingness to go beyond their specific disciplines in considering questions or problems they might encounter beyond college; several even altered career paths to embrace those broader perspectives.

Table 1: Definitions of Key Terms Relating Disciplines

<i>Term</i>	<i>Definition</i>	<i>Source</i>
<i>Cross-disciplinary</i>	Of, relating to, or involving two or more disciplines: interdisciplinary.	1
	Viewing one discipline from the perspective of another.	2
<i>Interdisciplinary</i>	Any study by scholars from two or more distinct scientific disciplines; based on a conceptual model that links or integrates theoretical frameworks from those disciplines, uses study design and methodology not limited to any one field, and requires use of perspectives and skills of the involved disciplines throughout multiple phases of the research process.	3
	Pertaining to two or more disciplines or branches of learning; contributing to or benefiting from two or more disciplines.	4
	Research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research.	5
	Integrating knowledge and methods from different disciplines, using a real synthesis of approaches.	2
<i>Transdisciplinary</i>	Efforts by investigators from different disciplines working jointly to create new conceptual, theoretical, methodological, and translational innovations that integrate and move beyond discipline-specific approaches to address a common problem.	3
	Pertaining to more than one discipline or branch of learning; interdisciplinary.	4
	A unity of intellectual frameworks beyond the disciplinary perspectives.	2, 6, 7

Sources: 1. Merriam-Webster 2015; 2. Stember 1991; 3. Aboelela et al. 2007; 4. OUP 2015; 5. Committee on Facilitating Interdisciplinary Research 2004; 6. Piaget 1970; 7. Hyun 2011.

Before the 2013 course offering, and continuing afterward, Dr. Kim noted recent surveys of interdisciplinary research revealed a lack of cross-disciplinary projects, like our course, bridging the gap between the Humanities and the Sciences even while there were increasing numbers of inter-sub-disciplinary studies in science (Manathunga, Lant, and Mellick 2006; Moore 2000). Even more lacking were true transdisciplinary efforts between the Sciences and the Humanities. The 2015 colloquium attempted to provide some valid transdisciplinary exposure to some of UMB's best students by allowing them to interview professionals who had begun to build those bridges within their own careers. Additional examples from literature not used in 2013 were also added (McDonough, forthcoming; Tufte 2001, 1990, 1997, and 2006; Muir 1917; Olmsted 1902). The outcomes in 2015 strongly resembled the outcomes in 2013 with students expressing newly broadened perspectives, some altering career trajectories, and a better appreciation for the importance of all disciplines in addressing societal questions. Most telling was the repeatedly stated increase in respect for practitioners of disciplines other than their own, the observation that all disciplines had both common and unique methodologies or practices, the identification of passion as a driving force in pursuit of happy careers in both the Humanities and the Sciences, and student recognition of their "entitlement" to evaluation, enjoyment, and participation in areas beyond their major concentrations. The freedom for English majors to enjoy a lecture on physics and to ask intelligent questions about it, or for Biology majors to read, reread, and ultimately understand poetry or art on a personal level, suggests this second course was beginning to awaken and tap the reservoirs of interest and intellect necessary to build new, truly transdisciplinary, knowledge in the future. And, to do so in a way unlike the Great Books of the Western World curricula of the mid-twentieth century as a means to broaden student perspectives; the latter programs often lacked personal contact with authors of the ideas discussed (Brittanica 2015). You cannot interview a dead author, artist, or scientist so you cannot interrogate the thinking or personal background leading to a particular work or scientific discovery. Historical or psycho-analytical analyses may approach correct answers to such questions but they can never touch the basic emotions or passions that generated notable contributions. Unfortunately, these basic drives and the methods used in

producing the works are precisely what we need to understand to recreate or extend those earlier works. A course including interviews with all the leading lights of our age would be ideal; practically this can be approached using interviews of outstanding neighborhood examples who can impart their wisdom, thought patterns, and underlying drives to our students in a way that will influence those students in the future.

Honors Colloquium Demographics

Comparative demographics for the two colloquia are shown in Table 2. The 2013 colloquium included fourteen Honors College juniors self-enrolled from a broad spectrum of nine departmental majors including biology, business, music, and philosophy; the class had equal numbers of men and women. In 2015, the fifteen enrollees were from nine similarly wide-ranging majors. Interestingly, the gender balance was markedly different in 2015 with eleven women and four men.

Table 2: Student Demographics for Junior Honors Colloquium, 2013 and 2015

Year	# Students	Majors	# Majors	Humanity Majors	Science Majors	Male	Female
2013	14	Biochemistry; 4 Biology; Biology/Psychology; 2 Business; Chemistry; Computer Science/Physics; 2 Finance; Music; Philosophy/Sociology	9	6	8	7	7
2015	15	2 Biochemistry; 5 Biology; Communications/French; Economics; 2 English; Nursing; Political Science; Psychology; Sociology/Anthropology	9	6	9	4	11

Honors Colloquium 2013 and 2015

In 2013 the Honors Colloquium met once weekly for three hours over the sixteen week term. The syllabus included five required books (Critchley 2001; Kant 2010; Skloot 2011; Snow 1959; Bronowski 1956) and thirty-seven shorter articles (Hall 1963; Lovett et al. 2006; Benítez-Bribiesca 2009; De Melo-Martin 2010; Kitcher 2010; Charlton 2008; Hyun 2011, 2012; Weber 1946; Arendt 1998; Wilson 2005; Kitcher 1998; Sawyer 2010; Holder 2015; Moore; Lederman 1992; Foucault 1988; Bentall 2009; Gostin 1985; Gross and Levitt 1998; Sokal 1996a, 1996b; Robbins and Ross 1996; Jennings 2010; Cohen and Cosgrove 2010; Newbold 2005; Green 2002; Kolata 2008, 2012; Manninen 2008; Hindman and Smith 1999; Robson and Robson 2010; Akchurin and Kartzke 2004; Gross 1991; Mukherjee 2010b; Sontag 1978; Harmon 2007). We showed one film and were joined by three invited speakers. Students submitted a brief introductory narrative explaining their background, interests, intentions and hopes for the course and a similar, reflective, closing narrative in which they explained what they obtained from the course and what difference, if any, it made for their subsequent training or careers. The students also worked in small groups and developed a group oral presentation involving all group members as well as a final written paper covering the project and briefly indicating the role of each group member in production of that paper. Rebecca Skloot’s book *The Immortal Life of Henrietta Lacks* was read over the term and was used to initiate discussions with both social and biomedical facets (Skloot 2011).

Guest speakers during the term included: Dr. Eunsook Hyun, Professor and Associate Provost, Director of the OITA, UMB, an expert on transdisciplinary curricula in higher education; Dr. Bruce Jenkins, Head of Radiology, Massachusetts General Hospital, an expert on brain imaging with past experience as a rock musician; and S. Maria Sonin, Associate Director, Marketing and

Communications, Ethics and Compliance Officer Association, Waltham, MA, a previous UMB graduate in Biology who had successfully moved to work in business ethics.

Most sessions began with discussion of logistics of individual assignments or group projects and moved on to discussion of assigned readings, their background (presented by the instructors), and the concepts or questions individual or collective readings posed. We closed with twenty to thirty minutes of discussion of a segment of Skloot's book and how it fit into prior coverage. This format was altered during presentation of the film, *Starbuck*<sup>2</sup> which triggered much discussion on definitions of family, roles of fathers, understanding of how technology has changed reproduction, and on students' feelings about assisted reproduction (Petit and Scott 2011). The format also varied during guest presentations if the discussions consumed available class time and delved into unplanned areas such as career direction and choice or costs of medical treatment.

In 2015 the syllabus included the same five books plus one volume each by two of our guests (Critchley 2001; Kant 2010; Skloot 2011; Snow 1959; Bronowski 1956; McDonough Forthcoming; Valencius 2013). In addition, we used forty-nine articles (Hyun 2011, 2012; Benítez-Bribiesca 2009; De Melo-Martin 2010; Hall 1963; Kitcher 2010, 1998; Lederman 1992; Lovett et al. 2006; Weber 1946; *The Discovery of Fission* 2007; *The Discovery of Fission: Teacher's Guide* 2003; Fermi 2003; Holton 2003; Arendt 1998; Coll 2014; Jennings 2010; Charlton 2008; Cohen and Kupferschmidt 2014; Cohen and Cosgrove 2010; Halliday and Martin 1993; Harmon 2007; Kolata 2008, 2012; Mukherjee 2010b; Sawyer 2010; Sontag 1978; Manninen 2008; Rid and Emanuel 2014a, 2014b; Bentall 2009; Foucault 1988; Gostin 1985; Crookston 2013; Davies and Forsha 1991; Solnit 2013; Severny 2012; Tufte 2001; Wallis 2013; Bohannon 2014; Newbold 2005; Muir 1917; Valencius 2002; Akchurin and Kartzke 2004; Hindman and Smith 1999; Olmsted 1902; Robson and Robson 2010; Fish 2011; Fodor 1999). We showed the English remake of *Starbuck*, *Delivery Man*, and assigned another film, *Copenhagen*, as background for one speaker (Scott 2013; Frayn 2000; Davies 2002). The 2015 colloquium hosted eight speakers. One guest session was also a field trip to the Massachusetts Historical Society which provided a visit-specific display of artifacts. A second field trip, to the Arnold Arboretum or Mount Auburn Cemetery, bolstered discussion of urban planning and the ideas of Frederick Olmsted and John Muir; it was a student assigned visit (Olmsted 1902; Muir 1917).

Students again submitted a brief introductory narrative but weather delayed class meetings and submission by two weeks. In 2015 we diverged from the simple acceptance of an unfiltered narrative, used in 2013, to provide feedback on the opening narrative content along with questions to get students to address the assignment more deeply. All instructor questions were answered and contributed to the thoroughness of analysis during the closing narrative.

The last student assignment in 2015 was again a reflective, closing narrative in which they explained what they obtained from the course and what difference, if any, it made for their subsequent training or careers; we purposely did not provide them feedback so as not to influence the content of what they wrote. Dr. Bruss did, however, send each student a follow-up note commenting on, and usually praising, the students for their efforts.

Again, in 2015, the students worked in small groups and developed a group oral presentation and a final written paper involving all group members. Some emphasis was made in 2013 on acquisition and use of primary data in generating project results and conclusions. In 2015 more emphasis was placed on using primary sources such as interviews as project resources.

Rebecca Skloot's book *The Immortal Life of Henrietta Lacks* (2011) was again read and used to initiate interdisciplinary discussions. In 2015, however, weather-related class cancellations and long guest interviews restricted in-depth consideration of many problems and situations in Skloot's book. Moreover, in 2013 several external events increased the relevance of Skloot's story to Science and society as a whole; this generated a contrast between the two colloquia for that book. Specifically, in March 2013, a German research team published the sequence of the DNA from

<sup>2</sup> *Starbuck* is a French language, English subtitled, film about a man who donates sperm and ends up being sued by one hundred forty-two of the 533 offspring he sired as a result of mistakes at the sperm bank

Hela cells (Landry et al. 2013)<sup>3</sup>. In effect, they published the genome of Henrietta Lacks, much of which is shared by her descendants. When queried by Skloot, the team responded they had not sought permission to do the sequencing from the Lacks family and were unaware of Skloot's book (Skloot 2013). By the summer of 2013 the sequencing paper was retracted and the US National Institutes of Health (NIH) held a meeting to draft guidelines for future work on HeLa cells and the DNA they contain; a board involving ethicists and members of the Lacks family now rules on what work can be published that may have repercussions on members of Henrietta Lacks' family (Grant 2013). These events were nearly two years old in 2015.

In 2015, the guests included: Arthur Eisenkraft, Professor, Curriculum and Instruction, UMB, an expert on physics and STEM education; Jill McDonough, Graduate Program Director and Assistant Professor of English, UMB, a practicing poet partly focused on the use of drones in warfare; Danielle Bromwich, Assistant Professor of Philosophy, UMB, an ethicist whose work centers on medicine and epidemiology; Bruce Jenkins, Head of Radiology, Massachusetts General Hospital, the brain imaging expert invited in 2013 whose presentation in 2015 covered medical care costs and balancing career trajectories; Margaret Hart, Associate Professor of Art, UMB, an active practitioner of large exhibition and highly expressive personal art; S. Maria Sonin, the business ethicist, also invited in 2013, now Director of Events for *Compliance Week*, Boston, MA, whose work remains grounded in business compliance issues; Conevery Valencius, Associate Professor of History, an historian focused on the role of physical environment on the historical health and development of the people of the mid- and lower Mississippi River; and, Maria Brincker, Assistant Professor of Philosophy, UMB, an expert on artificial intelligence and concepts of brain function including autism spectrum disorders. Most speakers talked about the nature of their work, examples of it, and their work's relationship to social, practical, or even personal problems. Each of them then participated in an open-ended discussion during which students often explored the speaker's prior background, career choices, and the potential for others to engage in aspects of the speaker's work. All speakers expressed openness to discussion and future collaboration with, or mentoring of, the students involved. The intent in greatly increasing guest numbers in the second colloquium was to provide first-hand experiences and access to practitioners from many areas of the Sciences and the Humanities, to personify ideas and concepts that students may have only dealt with in the abstract, and to provide a means for students to personally become "entitled" to engage with a wide variety of subjects they may never have felt qualified to approach before. Instead of forcing the instructors to act as the principle sources of background and experience during 2015, we relied on the guests and ultimately attempted to link their varied presentations back to the themes of the course readings and the student-identified commonalities among the presenters.

Again in 2015, most sessions began with discussion of course logistics and moved on to discussion of assigned readings and the concepts or questions the readings posed. Less time was available in 2015 to provide the background and context of the readings as was done in 2013; this failing needs correction in any future similar offerings. For sessions not fully consumed by a guest visit, we closed with twenty to thirty minutes of discussion of assigned readings and/or a segment of Skloot's book and how it fit into prior coverage.

The vigorous discussion after showing *Starbuck* in 2013 and the availability of an English language remake of the film, *Delivery Man*, encouraged repeating the film in 2015 (Scott 2011, 2013). The subsequent discussion of family, roles of fathers, and modern reproductive technologies was less vigorous than in 2013 even though several 2015 students had personal experience with these issues. It is possible that, as with societal acceptance of homosexuality or single-sex marriage, we may now be moving across generational lines; the issues that were formerly controversial are now accepted as unproblematic facts unworthy of discussion.

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3 These cells originally derived from Henrietta Lacks' cervical cancer tumor in 1951 and subsequently were cultured in labs all over the world.



Figure 1: A typical moment during the *Humanity and Humanness* field trip to the Massachusetts Historical Society, examining historical sources and their use in Conevery Valencius' work on health perceptions in the history of the lower Mississippi valley.

The field trip to the Massachusetts Historical Society (MHS) was another departure from the 2013 format (Figure 1). Preliminary calls to the MHS verified the Society's willingness to host the class and to provide special access to materials in their collection. Several tables of items were displayed and explained before students were allowed to inspect them from close range. While travel time to and from the MHS halved actual class time, the exposure of the students to a novel and welcoming public venue containing materials unknown to most, was a stimulus that all the students remembered and many later mentioned in their closing narrative. Obviously, the use of class trips to such venues has a lasting impact and certainly should be exploited in future offerings of this or similar courses. Having scientists see, hear, or touch art, literature, or music provides a powerful incentive to see, hear, or touch more of it and to view themselves as capable and qualified to engage in meaningful discussions or considerations of art, literature, or music. Having humanists see, hear, and touch elements of scientific exploration, the natural world, or applied medicine, has a parallel effect; xenophobia diminishes, respect and relevance are increased.

When Dr. Eisenkraft assigned a first person account of the History of Nuclear Fission and provided the optional historical film *Copenhagen* about Bohr and Heisenberg, key personalities in atomic physics, as preliminary material for his visit, he provided access to his subject matter to everyone present, regardless of prior training (*The Discovery of Fission* 2007; Frayn 2000; Davies 2002). His use of comical cartoons filled with irony as well as actual scientific and historical facts, drew everyone into his presentation. And when he highlighted the importance of "beauty" in contrast to "truth" as an element defining a good scientific theory in the statements of noted scientists, he engaged both the humanists and those science students who had always thought of "truth" as paramount in science.

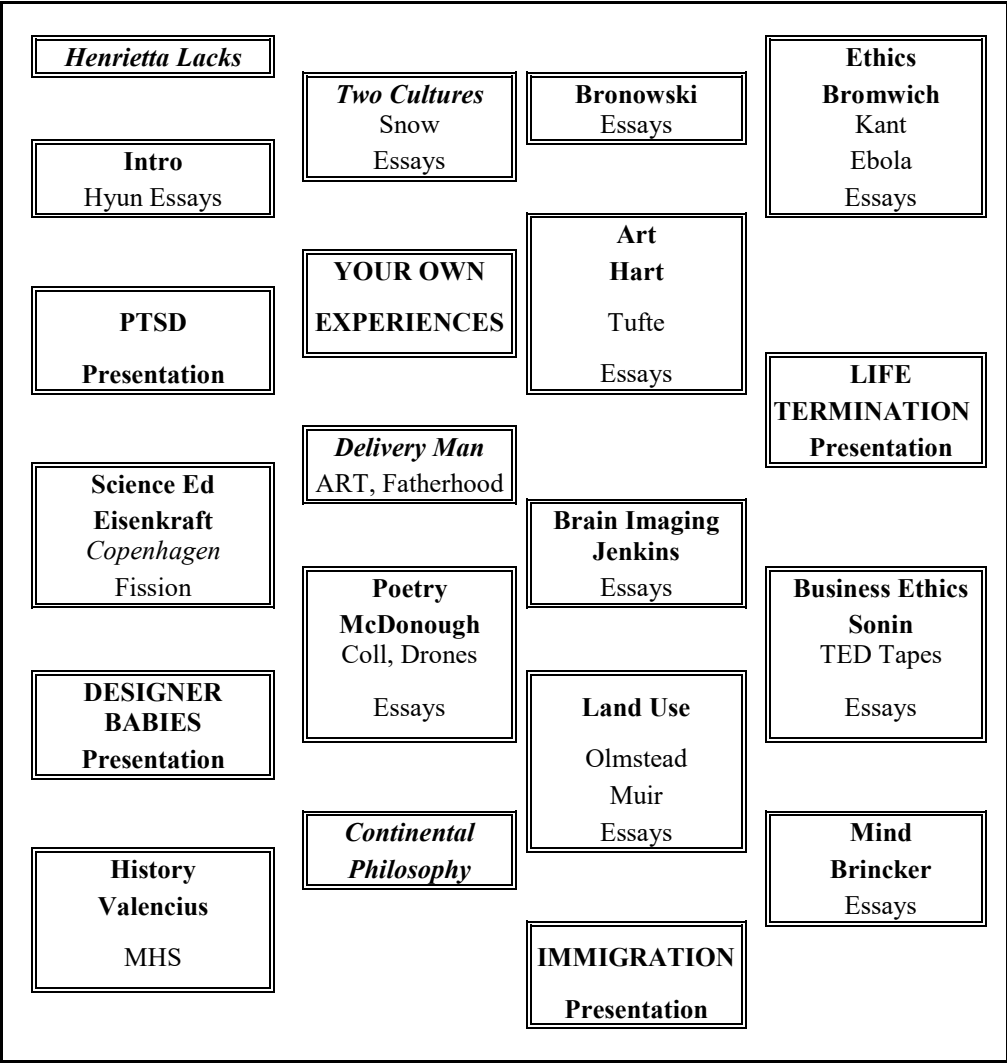
Guests in 2015 brought their work, their ideas, methodologies, approaches, and concepts, their experiences, their passions, and their practical attempts to engage problems of society and the environment. Things students may have only dealt with in the abstract. They brought their doubts, their assumptions, and their individual struggles with their work and their career pathways. They personified interdisciplinarity and trans-disciplinarity. They "made students uncomfortable" and nudged them out of their programmatic silos and forced them to engage in discussions across Snow's *Two Cultures* divide. What they did not bring were the biases of the proponents of Snow's *Two Cultures*. Rather, there was a uniform attempt to engage in the enlargement of knowledge, global experience of cultures and views, and exploration of means to understand and solve the problems of individuals, societies, and ecosystems, while also improving the quality of life for as many people as possible. Many of these presenters have built bridges across the *Two Cultures*

divide: poetry about artificial intelligence and drone warfare, personal art incorporating geometrical calculations, the principles of physics with sensitivity to the cultural diversity of the audience, the connection between elegance in the display of neural circuits and our capacity to understand what the functions of these circuits may be, the individualized soothing meanings of stereotypical movements in autistic individuals, the connections between perceptions of climate and surroundings and the actual well-being of human residents, the importance of fair play toward individuals and community interests in the success of commercial enterprises, or, the tension between the need for statistical rigor in evaluating human vaccines and the pressures to provide any hope for populations enduring an active epidemic. Combined with the messages of: Kant on the nature of humanity, Olmsted on the need for green spaces and natural scale in cities and towns to uplift and inspire human activities, Muir on the importance of natural beauty and wilderness in maintaining and enlivening the human spirit, Tufte on the importance of artful presentation of scientific data, Bronowski on the importance of human values in science, and Wilson on the connectedness of all sciences and human endeavors, there is a great deal of substance arguing powerfully for a dialogue and obliteration of the *Two Cultures* divide (Manninen 2008; Kant 2010; Olmsted 1902; Muir 1917; Tufte 1990, 1997, 2001, 2006; Bronowski 1956; Wilson 1998). There is also a wealth of information and experience for trainees to begin to understand and incorporate both scientific and humanistic facets into their own discussions and career planning.

In 2015 Dr. Bruss introduced a simple diagram listing the key colloquium players and readings (Figure 2). That map stimulated students to consider, discuss, and identify common threads of thought and meaning arising during the term. Students gradually pointed out the commonality of passion in the visitors, the dedication of these people to their work, regardless of area. They noted ties between technology, art, poetry, and science education. They underlined the social aspects of these areas with business and medical ethics, with the philosophical readings and with the book on Henrietta Lacks. They saw connections between the writings of an historian and their own group presentations. They grasped the nature of the existing gap between the Humanities and Sciences and the need for cross-disciplinary work which engenders respect for one discipline by the other. Simultaneously they saw the need for true trans-disciplinary work involving gaining an understanding of the methods and processes of multiple disciplines followed by their hybridization in a new disciplinary context to produce outcomes that could not be generated within, or across, the disciplinary boundaries. The class in 2013 clearly recognized the need for cooperation between disciplines to answer current global problems, but the class in 2015 began to fully embrace the idea that a synthesis of ideas and approaches to generate unique solutions was, indeed, what was needed.

## Student Projects

Both colloquia included group projects. Groups were self-selected by the students with the *proviso* that each group include a mix of student majors and that the instructors had final approval on group composition. Students scheduled group discussions to identify and outline a multi-faceted problem of recent concern. Progress on identification of a problem, and on sources of information, particularly subjects or professionals to interview, was monitored during class meetings. The usual problem was narrowing the project scope to dimensions manageable within ten to twelve weeks that would fit in a twenty to twenty-five page paper and a twenty to thirty minute in-class presentation. Requiring all students in each group to contribute to the group oral presentation and requiring each student's contribution to the final written report to be shown avoided the tendency of groups to rely on one member for most of the thinking and writing.



Note: Diagram for linking topics. This was used to stimulate discussion and thought concerning major threads linking presentations and topics covered during the Honors Colloquium, Humanity and Humanness in 2015.

Figure 2: Map of Honors Junior Colloquium, Spring 2015

Several students praised the opportunity to improve their oral presentation skills. Many enjoyed the opportunity to work with students from other disciplines or to work on aspects of projects distant from their disciplinary work. Stretching the boundaries of normal thought patterns, cooperation among group members of varied background and interests, and focus on the common goals of addressing large societal or ecological problems produced some very interesting reports, several of publication quality and most containing central considerations, findings, or conclusions worthy of consideration by bodies actually charged with addressing these issues. Table 3 summarizes each of the seven group reports produced in 2013 or 2015.

Table 3: Student Group Projects, Humanity and Humanness, 2013 and 2015

# of Students: Majors	Project	Synopses
2013		
4: Coastal Ecology; Finance; Music Education; Finance and Sociology	<i>The Link between Poverty and Environmental Degradation</i>	Environmental degradation and poverty on Chaco plain, Argentina and Formosa are contrasted with successes in Costa Rica; a study of sustainable development, wealth types, shifts from subsistence to market economies, effects of wealth and land management, and ecological economists' solutions. "[N]ot possible to pinpoint one...cause...not possible to place all the blame on one class, or one group. The issues ... must be acknowledged as...interconnected, and must be addressed as thus...capitalist ideologies...must be adjusted...to account for...finite resources....If we do not change the way...we see the world...we won't be able to understand what is happening, and we won't be able to begin to truly address the problems."
5: Biology; Biology and Psychology; Management; Physics and Computer Science; Sociology and Philosophy	<i>Fighting for The Right to Die</i>	Consideration and discussion of Question 2, Death with Dignity Law voted down in MA in 2012; pro- and con- arguments for passage, its relationships to civil rights, vulnerable groups, technological advances in life support, judicial review; role of psychological competence and assigned guardians, similar laws or practices in OR, WA, MT, Belgium, the Netherlands, Luxembourg, and Switzerland, medical costs, and availability of palliative care. Report favors laws like Question 2.
5: Biology; Management; Chemistry; Biology; Biology	<i>Gene Transfer: Advances and Ethics</i>	"overview of the development of gene transfer techniques, current and potential uses, and the bioethical considerations...raised regarding research methodologies, clinical applications, and current and future use of this technology...goal is to explain...technical information and conflicting opinions on gene transfer technology." Descriptive review; supports gene transfer.
2015		
5: Biology; Biology; Biology; English; Sociology and Anthropology	<i>Post-traumatic Stress Disorder in Veterans</i>	"what...PTSD is, why it is so prevalent in the military, what can be done to treat it, and what can be done to prevent it...[Aims] to look at current ways the government and military handle PTSD treatment and prevention in...service members and veterans...discussed in two parts, a critique of how the U.S. handles PTSD in veterans and a review of the programs enacted by the U.S....and the [UK]'s Military in preventing PTSD in active duty soldiers and reduction of the stigma around PTSD. The major project goal...is to increase the quality of life for current veterans with PTSD." Conclusions, increase: funding for VA, implementation of prevention programs, training and awareness to decrease PTSD stigma, % of affected in treatment; decrease: homelessness of affected vets, and suicide rates.
3: Economics; Political Science; Nursing	<i>Ying and Yang of Immigration</i>	Explores processes and reasoning behind Chinese immigration to the US and American emigration to China; considers economic and employment opportunities, healthcare accessibility, access to education, social issues and legal reforms in the US and China. Emphasizes attractiveness of current possibilities and amenities in the US or lack in China. Consideration in emigration to China: primarily monetary, social gains, and changes in laws (Exit and Entry Administration Law of the PRC). Situations now favor China to US immigration; Chinese law changes may alter this.
3: Biology; Biology; English	<i>Life Lines: A Look at Life Support</i>	Explores issues for "patients in comas or vegetative states...possessing little or no cognitive function and hav[ing] minimal awareness." Psychological, financial, and legal effects of terminating care emphasizing patients' families. Case studies of K. Quinlan, N. Cruzan, and T. Schiavo and a medical philosopher interview. Analysis demonstrates complexity of care termination decisions, finds most feasible solution: "discuss the options with trustworthy people, or make a will...Since death is certain, one should think of it as part of our lives and put in place evidence of our end of life wishes to avoid situations in which pulling the plug has to be decided by someone whose values are different from our own."
4: Communications; Biochemistry; Biochemistry; Psychology	<i>Designer Babies</i>	Costs and benefits of using genetic recombination to cure inherited diseases; technology explained, moral and scientific dilemmas explored. "main issue is...lack of knowledge publicly available concerning...advantages and consequences" Pro- and con- arguments; ethical consideration of embryo generation solely for engineering; cost and payment quandaries; and parental desire for particular embryo traits. Arguments unresolved; emphasize need for education to optimize decision-making and legislation "to provide laws or guidelines that allow this technology to be used to benefit society."

Student Backgrounds, Expectations, and Reported Results of Participation

Table 4 summarizes the backgrounds and expectations stated in students' opening narratives. Some expectations were restated in the closing narratives along with the students' self-reports of the results of their participation. To maintain student anonymity these narratives have been paraphrased or generalized. A notable shift in class composition, other than female dominance of the 2015 class, is the apparent increase in the number of students who were the first in their families to attend college. We see there is also a subtle shift in course expectation from active *personal growth* to passive *improved understanding* that may arise from the shift in class demographics or from the timing of submission of the opening narrative; this assignment was submitted in the second week of class in 2013 while in 2015 the assignment was submitted in the fourth week of the term after students had time to do more course readings.

Turning to the perceived results of course participation, one-third to two-thirds of each class reported the course changed their career plans, their lifestyle, or central beliefs. Both classes reported broadened perspectives on areas outside their major disciplines and more appreciation for commonalities across disciplines. They cited the necessity for input from both the Sciences and the Humanities in addressing social and ecological problems. Both classes underlined the importance of guests as sources of other viewpoints and information and both rated those visits as the most successful part of the course. The 2015 class regarded the field trips as key contributions to their intellectual growth and development. Importantly, the 2015 class also reported more thoughts linking basic concepts or philosophical theories to questions and opinions presented to them. Thus, while the stated course expectations for the 2013 class included desires for various forms of personal growth, it was the 2015 class that seemed to have experienced more actual instances of personal growth.

Table 4: Student Backgrounds, Expectations, and Self-reported Results, Humanity and Humanness  
*Synopsis of Opening and Closing Narratives*

<i>Year</i>	<i>Background</i>	<i>Course Expectations</i>	<i>Results of Participation</i>
2013	Honors students; diverse interests and backgrounds, mainly Middle class.	Seeking personal growth and learning via acceptance of challenges and engagement in interdisciplinary discussion.	<p>5/14 changed career directions, aims, lifestyle, or central beliefs.</p> <p>Commonly, changed perceptions of Humanities or Sciences, increased attention to trans-disciplinary topics, increased respect for the other arena, and increased awareness of need for trans-disciplinary solutions to problems.</p> <p>New awareness of commonality of process.</p> <p>All liked visitors' views.</p>
2015	Honors students; diverse interests and backgrounds, more blue-collar/first generation college than in 2013.	Seeking improved understanding, respect, and inter-disciplinary relationships between the Sciences and the Humanities, especially via discussions.	<p>9/15 changed career directions, aims, or attitudes.</p> <p>Usually perceived: need for trans-disciplinarity and its potential to solve problems, use of processes by both arenas, mutual respect for and presence of values in both Sciences and Humanities; saw similar problems in both areas.</p> <p>Felt broadened general perspective and instructor care.</p> <p>Universal accolades for visitors; saw passion and shared background with speakers which provided entre, entitlement, and enhanced self-confidence in interacting with non-major disciplines; decreased egocentric and major discipline focus and increase in concentration on larger problems.</p> <p>Many engaged with the universal questions of definition of "truth," "beauty," and "normality"; realized applicability of philosophy across both arts and sciences.</p>

The closing narratives are a rich insight into what these twenty-nine students thought, felt, and gained during the colloquia in 2013 and 2015; a few examples follow:

- 2013
  - "I feel less one-sided"
  - "I learned to see my field from a new lens, and I learned a lot about things that now seem very important, but had just never occurred to me before."
  - "Limiting a definition of humanity to either discipline would not do the label of humanness justice."
  - "I have come to believe that the gap which I perceived between [the Sciences and the Humanities] may merely be a lack of understanding of the necessity for unifying them."
  - "I have more questions than answers as this course ends...this is a great thing!"
  - "This class has shown me that morality as well as humanism has a 'science' all its own"

- 2015
  - “[T]his class has been humbling...I have learned more in this class than I have in all of my classes over the course of the last three years...this class was a breath of fresh air that taught a lot more than a textbook ever could.”
  - “The guest speakers...affected my view of transdisciplinarity...I even ended up finding a new career that I may like to pursue”
  - “[The] drive and passion I observed in these professionals...inspired me to follow my passion instead of striving to achieve an income.”
  - “The experience I had working with students in another college proved to me the importance of...using multiple disciplines in everything I do”
  - “I gained the understanding that I can approach other disciplines and immerse myself in them without feeling like an intruder...it has even changed the way I view my own major and way of thought.”
  - “It is just like being from different cultures... we might have different values, but we have values and that is what matters.”
  - “I look at science with a new set of eyes. Now I think of science as being as beautiful as a piece of music...Science has become breathtaking.”
  - “Seeing the artist [McDonough, Hart] made the art itself come alive and [awakened] a ... gratitude for art that I had not felt before...I feel entitled to art.”
  - “From this point forward, I will see science as beautiful, art as essential, and philosophy as one of the most important elements that make us human.”
  - “The images [McDonough’s poetry] started to talk for themselves...I realized that the separator between science and humanity is not so strict...that is different from what I expected.”
  - “[W]e have to construct our ethics based on diversity...Eisenkraft...doesn’t assume all students learning physics can understand his examples, because they may not grow up in the same backgrounds. He teaches science, but he tries to use [a] humanist mind to teach.”
  - “I learned that...Kant’s...universal moral law applies to everyone [including the mentally ill].”
  - “[Hart] puts her personal stories in the work of art...the work is...a story teller. It’s alive, it can talk.”
  - “I used to think we need to deal with people with autism as we are dealing with patients, but it’s because our minds are normalized that we can’t accept another definition of ‘normal’.”

It is difficult to see how the simple efforts expended on this course have had such profound effects on our brightest trainees. What is it about some personal interviews or discussions about the basic nature of “truth,” “beauty,” and “normal” in a group from multiple disciplines that is so powerful as to alter someone’s career objectives or their life-style?

## Course Ratings by Students

These courses received anonymous ratings from students along with written comments at the end of each term. The ratings and comments provide a means to check the consistency of the closing narrative comments.

Table 5 shows the numerical scores for each question in the University-provided course rating sheets for each term of the course offering. The rating scale for both years is the same, one is the highest score possible and five the lowest. The ratings agree with the statements in the closing narratives. While work load (2.86, 2.73) or reading and writing load (2.21, 3.00, 2.67) is rated as heavy by most students, class discussion rates highly (1.29, 1.60) as does achievement of Honors

Program Goals which were included in 2015 (1.72). Students gave good scores for the measures of course character (first six questions). Scores for individual questions varied < 0.6 points year to year and showed the same pattern overall in both years, even with changes in course content.

Student comments mirror the scores in Table 5 and comments in the closing narratives. Both classes lauded the guests and rated them and the field trips as the best parts of the course. Instructors garnered fewer kudos but were still applauded. As with the closing narratives, many students indicated the course was formative in their thinking or career plan: the course “changed my perspective on a lot of issues and made me think critically”; “This course forced me to rethink the ethics of many scientific practices”; “I have changed how I approach subjects and what I’ll do with my life”; “I have learned that the sciences and the humanities are interconnected.”

The evaluation comments also included suggestions for course adjustments, e.g., concerning course readings: “fewer readings or more discussion on them.” A pruning of the readings is needed if future offerings include many guests.

Together the student comments, student ratings, and closing narratives in 2013 are well aligned and in agreement. This is less so in 2015 but overall paints a remarkably positive picture of how this colloquium has reached its audience, expanded and altered their ways of thinking, and helped them to expand their life and career options.

Table 5: End of Term Student Ratings for Humanity and Humanness.

CAMPBELL, KIM, HONORS 380-01, SPRING 2013 (n = 14)		CAMPBELL, BRUSS, HONORS 380-02, SPRING 2015 (n = 15)	
<i>Question</i>	<i>Total Average (per question) 1 = Best, 5 = Worst</i>	<i>Question</i>	<i>Total Average (per question) 1 = Best, 5 = Worst</i>
Instructor style	2.07	Instructor style	2.27
Course organization	1.93	Course organization	2.33
Class discussion/questions	1.29	Class discussion/questions	1.60
Instructor helpfulness	1.71	Instructor helpfulness	2.13
Timely feedback	2.43	Timely feedback	1.90
Respect different views	1.43	Respect different views	2.00
Assignments	2.21	Reading assignments	3.00
		Written assignments	2.67
		In-class activities	2.27
		Rating of learning in course	1.83
		Usefulness of skills learned	2.00
Overall course rating	2.07	Overall course rating	2.27
Overall instructor rating	2.00	Overall instructor rating	2.47
<b>Above Overall Average:</b>	<b>1.90</b>	<b>Above Overall Average:</b>	<b>2.21</b>
Estimate of workload	2.86	Estimate of workload	2.73
		Interdisciplinary learning	1.20
		Connecting diverse majors	1.20
		Appreciation outside major	1.53
		Awareness of current events	1.93
		Local/global perspectives	1.60
		Previously unfamiliar topics	1.53
		Critical thinking/writing skills	2.40
		Close interaction with faculty	1.77
		Developing research skills	2.33
		<b>Honors Goals Average:</b>	<b>1.72</b>

## What Have We Learned?

Building this colloquium afforded its instructors an exceptional opportunity to engage in discourse and intellectual exchanges that enriched all of us and provided the gateway to explore how the Sciences and Humanities do and might interact. All of us have become more acquainted with the life habits of practitioners of our complementary “culture” and have felt enriched by sharing the effort of building and delivering the class. All of us have read farther from our normal literary boundaries than we thought probable for a single course, and we have learned and enjoyed it just as our students have. The opportunity to interact with our guests and to sit with a class of promising students as those speakers and students exchange information and viewpoints is a blessing. Freed by the colloquium’s discussion format from many grading tasks in more traditional courses, we have focused on the exchange of ideas and the pursuit of questions without firm answers, the kind of questions that inhabit much of the non-academic world.

The approaches used in 2013, heavy reliance on published literature but happenstance occurrences outside the classroom that made our key reading source a hot public topic, and in 2015, preponderant reliance on varied and passionate visitors and inclusion of off-site sessions, offer other lessons (Skloot 2011). While both versions worked to deliver the overall message, it was the more personal offering in 2015 that seemed more effective in getting students to recognize their potential for engaging in work spanning disciplines. By seeing examples of individuals who shared a journey much like their own but who ultimately embraced problems that included a level of mastery across the disciplinary divides, students began to feel entitled and qualified to engage in full discussions beyond their normal realms. They began to include aspects of their own personalities and persuasions into their pursuits and lifestyles as they had not dared to before, and to consider the prospects of working with others from different disciplines, as well as incorporating ideas and approaches from those other disciplines into their own work.

All our 2015 students remarked on vibrant memories of the field trips. Embedding parts of the learning experience into alternative venues fixes the memories of those experiences better than trying to impart similar information in a familiar environment. The increased alertness of all the senses in a new setting may have evolved to keep us safe, but it proves an extraordinarily powerful tool to imprint educational concepts or content. The virtual environment of film shares some of those characteristics; using that medium can convey some of our ideas and trigger key questions.

In both years students experienced a broadening of perspectives and a gain in respect for questions, products, and the work of other disciplines. These prerequisites for tackling multifaceted problems or engaging in collaborative work were successfully delivered by both styles of colloquium used. This may be the product of the open-ended discussions employed and our attempt to link current topics and issues to historical literary sources from a variety of areas. Giving students the freedom to ask and explore linkages and questions in a non-graded conversational environment took time to challenge ingrained viewpoints or strict disciplinary dogma, but eventually students did begin to question basic assumptions and to explore other arenas for alternative ways of thinking or doing.

## Educating Science and Dialogue Between The Liberal Arts and The Sciences

We began with two questions. Does the intellectual cultural divide still exist between the Sciences and the Humanities? And, are there current efforts or projects attempting to bridge that gap?

Two examples illustrate how Snow’s cultural divide persists. Dr. Kim, a humanist and junior faculty member, was to present a version of this paper at an international meeting. More senior humanists advised against this because of the low value of non-disciplinary work within her study area. Similarly, Dr. Campbell, a biologist, worked closely with anthropologists, demographers, and epidemiologists on questions of human fertility. At tenure, senior biologists stated his best evaluations were “only” from social scientists. Yet, the call of the National Academy of Science

to see more trans-disciplinary grant applications, to see more efforts at translational (bench to bedside) work—including projects addressing cultural diversity or patient satisfaction with health care and outcomes—and mandated inclusion of ethics training for scientists and physicians in all grants supporting graduate and post-graduate trainees, speaks to a realization of the need for bridging the cultural gap to achieve desired institutional and societal aims (Committee on Facilitating Interdisciplinary Research 2004; National Center for Advancing Translational Sciences 2015; Pilgrim 2011; Alegria et al. 2010; National Institutes of Health 2010; National Institutes of Health 2011).

Medical schools have also noted the importance of non-scientific knowledge and experience in patient, and patient family, interactions. A recent article touts an effort to introduce art to medical students as a means to humanize these highly competent, technically trained physicians (Crawford 2015). Ironically, the article dwells on the choice menus provided during the *sensitizing* visits and uses photos of trainees in lab coats viewing pieces of art in a gallery devoid of other humans. Arguably this effort comes so late in training these individuals that its effects on improving cultural sensitivity are marginal. Still, we should recognize the wisdom of trying to introduce trans-disciplinarity to what will be a very influential group following graduation and medical placement. Providing exposure and experiences bridging the disciplinary divides early in a student's career would appear more optimal. The profound effects of our modest efforts in the UMB Honors Program suggest such offerings do work and provide valuable fora that can help build the cross-disciplinary, interdisciplinary, and transdisciplinary attitudes and orientations needed to launch fruitful careers and new programs fully incorporating these modes of thinking.

In the 1950s and 1960s Richard McKeon and Ronald Crane built and headed the *Chicago School* of literary and humanities criticism (Crane 1967). Central to their neo-Aristotelian approach was the recognition that each form and branch of literature, art, and the humanities had its own set of methods, assumptions, and taboos, its own way of doing things, and its own way of viewing and depicting the world. This state of the real world required a similarly flexible and mobile platform from which any critic should view the work of a particular discipline or sub-discipline. It is clear that an analogous set of rules governs criticism, including grant application and manuscript reviewing, in the Sciences. Regardless of disciplinary or sub-disciplinary field, there are favored paradigms for framing and analyzing problems, favored assumptions or habits of assumption applied to possible solutions to problems, to choosing tools and methods to attack the problems, to approaching obstacles in addressing the problems, to generating and deciding on sufficiency of solutions of the problems, and ultimately, to reflecting on the adequacy and aesthetics of the solutions achieved. Siloed training may convey basic rules of logic, allowed assumptions, avenues of attack, available tools, and accepted and acceptable dogma, but it is totally inadequate to instill creative thinking, respect for other arenas, and optimism about collaboration beyond silo walls. Personal contact with unfamiliar people and places creates lasting impressions, respect for alternative ways of thinking, doing, and choosing problems to approach, provides license to engage in and enjoy matters beyond the normal realm, and fosters optimism and anticipation of collaboration and cooperation with individuals and groups from complementary or alternative arenas or cultures.

We have noted students testing the porosity of their disciplinary boundaries and considering hybrid career tracks after hearing from and speaking with professionals who have done something similar. We have found that an empirical approach that relies partially on historical background seems more fruitful in stimulating students to decide where the problems actually are, how those problems affect humans, and how discussion among individuals from different disciplines can be used to enrich conversation and communication. The approach also encourages students to build their abilities to form informed and ethical judgments about the consequences of their own work. Our pedagogical aim with the colloquium "Humanity and Humanness" has been for students to recognize and gain respect for the varied disciplines and sub-disciplines in Snow's *Two Cultures* and then to see the possibilities and recognize the ultimate necessity of bridging those cultures to

pursue the solution to human and global problems. The students appear to be internalizing and acting on our message.

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