

# Interdisciplinarity as Critical Inquiry: Visualizing the Art/Bioscience Interface

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Different disciplines rely on particular methods and assumptions in their knowledge practices. However, there may be significant costs in the conceptual and social boundaries that disciplines set as specialized communities. Engaging with the biological sciences, for example, has become a necessity in our everyday lives in ways unimaginable just a few years before, ranging from genetically modified organisms and new reproductive technologies to emerging diseases and issues of ecological sustainability. However, how can non-specialists be a part of this scientific knowledge and decision-making as a matter of personal agency given the complex and interwoven nature of these biological phenomena? A number of practices in contemporary art and design are engaging with biology and questions of participation in novel ways, including in the emerging area of 'BioArt'. Discussed here are examples of practices that challenge traditional assumptions about both art as well as biology, and raise important questions about the possibilities and prospects for certain forms of critical interdisciplinary engagement.

KEYWORDS BioArt, Interdisciplinary, Two cultures, Paradigm

## Introduction

Despite the wide recognition and extensive theorizing there has been on the commonalities between the arts and sciences as creative endeavours, just as much has been written about their distinguishing qualities. Sometimes these are formal distinctions in regard to methods and aims, while at other times they are primarily social in terms of how these communities generate, validate, and communicate the fruits of their creative labour. As someone teaching the natural sciences at a school of art, I have run into the full range of stereotypes and misunderstandings of what an artist or a scientist purportedly is, what they do, and what possibilities may exist for each.<sup>1</sup> To the extent that my own institution eschews undergraduate majors as well as

grades in the name of an open curriculum that fosters interdisciplinary inquiry, it is structured so that each student is obliged to take two 'sciences', two 'humanities' and other clearly numerated distribution requirements as part of a liberal arts education. An unfortunate consequence of this taxonomy can be the impression that such courses must be 'strictly science' or 'strictly history' in a way that reinforces a disciplinary divide and suspicion over the relevance of such classes in a school of art and design. Because of the way disciplinary authenticity is often delineated, the goals of an integrated education and opportunities for interdisciplinarity between art and science may be partially hindered by an expressed attempt to make students more 'well-rounded' in a traditional liberal arts fashion. Although it's true my students' perspectives and their art practices are just as much moving targets as the science I teach, it is hard not to feel Janus-faced in cheerleading the relevance, accessibility, and wonder of science to sceptical students of art while also playing advocate for the seriousness and intellectual value of contemporary art to scientists who often hold very dated or parochial views of art as an essentially aesthetic, if not primarily decorative, pursuit.

For these reasons, the art/science interface has become a personal case study in the promises and problematics of how we premise disciplinary knowledge and interdisciplinary engagement. My job begs a nagging question as to what roles different disciplines should and could play for each other in the long shadow of the infamous 'two cultures' of the arts and sciences (Snow 1960). Is it best that they leave each other more-or-less alone with the assumption that they are conceptually apples and oranges, or should they be invited to intervene and confront each other? Is the position of a scientist at an art school to act as the standard-bearer for science and make sure students absorb the canon of genes and gluons, or should the role of such an interfacing education be to encourage students to creatively and critically question what science is by using the tools of their own artistic disciplines? This of course presumes the identities of disciplines are fundamentally distinctive and anchored in certain ways. The extent to which this should be the case and how that is best organized is a consuming puzzle for many educators precisely for the fact that currently so much university-level education continues to operate under a two-culture mentality. The plan of academic and funding institutions as well as most curricula and departments makes it all too clear that most creative work is still conducted and recognized under the auspices of more-or-less traditional disciplinary structure. The call for interdisciplinarity initiatives and praise of its virtues are common, but the formats for cross/trans/multi/interdisciplinarity vary even more than the names we have for it. Indeed, in American academic circles, the notion of 'interdisciplinarity' is so ubiquitous and so diverse that it risks becoming both cliché and passé before even having had a chance to truly develop as an established intellectual framework, at least in this cultural cycle.<sup>2</sup>

One crucial question is what interdisciplinarity can be besides something that is incomplete or in-between already robust and well-established disciplines. It is in this context that I discuss two art/design practices here as examples of interdisciplinary engagement with the biological sciences that

may model some of the significant and valuable ways workers from one discipline can contribute to another, constructively challenging assumptions of biology rather than merely aestheticizing, accessorizing, or antagonizing it as a discipline. The modest aim here is to outline some of the basic considerations, and perhaps expectations, for what could be thought of as significant interdisciplinary engagement. While this has implications for many forms of what is known as 'BioArt', I will not attempt to provide any comprehensive overview or in-depth critical analysis of BioArt as a field, especially given the substantial literature that already exists on the topic (Anker and Nelkin 2003; Kac 2008; Mitchell 2010). Instead I focus on just a few examples from the wide range of relevant art and design practices to illustrate the broader issues at hand for interdisciplinarity.

### Disciplinary natives and immigrants

Whatever interdisciplinarity might be, disciplines are its raw material. At their most general, disciplines can be thought of as socially and institutionally recognized knowledge practices that involve characteristic sets of materials, tools, theories, or methods. In the case of the natural sciences, for example, certain assumptions (like materialism or entropy) and certain methods of research (like testing and repeatability) create the specific conditions that allow for phenomena of interest to be closely observed and studied. Historian of science Thomas Kuhn's concept of 'paradigms' is one model. He proposed that paradigms within science are cultural configurations made up of establish standards of practice and validity that play an active role in shaping what is recognized as relevant. In the Kuhnian metaphor, paradigms can be thought of as domains of possibility that shape the perspective of the scientist and set constraints on how things exist and relate to each other both physically and theoretically. Setting these standards is similar to deciding the rules of a puzzle that allow it to be solved. Without such rules, cause and effect, law-like behaviours, and other fundamental patterns that science seeks to discern could not be distinguished from — as psychologist William James (1890) put it — the 'blooming, buzzing confusion' that the world presents.

Of course, Kuhn's concept of paradigm is only one model based on particular historical cases and assumptions just as C.P. Snow's clearly distinguishable 'two cultures' is at best a simplification of what is in actuality a very complex and dynamic set of intellectual communities. Nevertheless, these two models have continued to resonate for so long because they describe the epistemically self-limiting tendencies of academic disciplines so aptly. But disciplinary assumptions and boundaries also inevitably carry a cost. One of the more commonly recognized trade-offs with disciplinary specialization is the ability to dig deep into one set of questions at the expense of breadth of perspective or synthesis with the other connected areas. This may not be of any real concern to the individual specialist focused first and foremost on the questions within their particular field. However, the discipline as a whole and its goals of knowledge-making may be fundamentally hindered if it becomes blind to poor assumptions, outdated categories, or methods that it has traditionally relied on but that may no longer suffice.

This is where both the creative and the critical possibilities of interdisciplinary practice are significant and nascent. It is not a matter of making 'more' knowledge in an additive sense as some forms of interdisciplinary would seem to suggest, but new understanding through what might be thought of as a kind of synthetic scrutiny towards what is already presumed to be well-known. Not burdened by the assumptions that natives of a discipline work under, disciplinary 'immigrants' from a different field can bring an important perspective to another through their own unique modes of inquiry and creation.<sup>3</sup> In fact, we might expect that any serious inquiry from one disciplinary perspective into another is likely to have a critical nature. This is because the categorical givens and values of natives to a discipline are likely to be sharply contrasting, or even contradictory, to those of immigrants. The outsider has the opportunity to make associations and draw connections that natives may be blind to because they aren't consistent with the accepted rules of the game that the discipline plays by and considers most relevant. In this way, the creativity of the immigrant in the context of an unfamiliar discipline may be based precisely on contravening and contesting the assumptions of natives. A key opportunity for criticality also lies in the freedom that immigrants may have from the social constraints that natives operate under. Given that the livelihood and status of a native relies so fundamentally on working within the norms of their paradigm, criticality may involve risks that a native may simply not be as willing or ready to take.

It would be a mistake, however, to think that the freedoms of the disciplinary immigrant are *carte blanche* to do or say anything. Indeed, this misunderstanding plagues many so-called interdisciplinary projects. If immigrants to a discipline don't bother to learn the rules, remain ignorant of founding assumptions, or work unintelligibly separate from the values or concerns of natives, then their creative contributions will not be recognizable as any sort of contribution at all. They will lack the credibility to be meaningful and risk being thought of as derivative (and perhaps even parasitic) of the other field, rather than an instance of interdisciplinary engagement. This is the very crucial and fine line that a number of contemporary BioArt practices must negotiate — the risk of a real or apparent charlatanism that borrows superficially from the forms of science on the one hand, and the opportunity of make new and important sense of scientific practices on the other. How then does an art/design practice successfully engage interdisciplinarily with the natural sciences in a way that is at once creative, critical, *and* contributory, while avoiding the potential pitfalls of the attempt?

## Image and meaning

One example of how it might happen is the Image and Meaning (IM) initiative. Started in 2001 by photographer Felice Frankel, IM brought together artists, scientists, educators, designers, and engineers to work on the challenges of visualizing scientific concepts and information that cross all of these disciplines. Through national meetings and a series of regional workshops, IM created spaces for art and science practitioners to work together on designing visualizations that seek to improve the communication

and deeper understanding of science. Scientists and artists participating in the IM workshops bring particular visualization problems from their own work for intensive discussion and collaborative critique. Importantly, because the range of topics includes anything from biological displays in science museums to cosmological data in research journals, all participants find themselves playing the role of a disciplinary immigrant. Having been a part of these workshops, I've seen how the process of critique is essentially a negotiation of assumptions, priorities, and shared context between the artist, designers, and scientists that lead to brainstorming sessions for highly relevant (and often very unexpected) solutions to visualization problems that participants contribute. The process is collaborative, not one in which designers are simply skilled labour. This is because the primary aim of IM is not to make science more palatable or aesthetically pleasing, but rather to help the science make more sense and communicate more meaning for researchers and public audiences alike. The stakes are high because the ability to convey scientific information and concepts in a way that is meaningful to others is in fact fundamental to what 'making knowledge' constitutes in an epistemic sense. As Frankel notes, 'visually representing an idea in science is not only a way of communicating to other people, but just as important, it is about thinking for the researcher about their work in a different way'.

Using interdisciplinarity as a working premise, IM nurtures possibilities for creativity and understanding in science that would not be evident from within the often single-channel view of isolated research science. An example from Frankel's own experience is illustrative of this process and its possibility:

So I made a photograph of, believe it or not, a yeast colony (it looks like a flower). But I decided to digitally remove the Petri dish because I think you see more of the morphology of this incredible yeast colony. I mean, you actually pay more attention in my opinion. Now this is a very serious question that we discuss all the time in science: how much can we manipulate an image in science... This is an ongoing conversation that is crucial and continues to be crucial whenever we represent anything in science. (*The New York Times* 2007)

Figure 1 shows the images she is talking about. Frankel's solution is both counterintuitive to the standards of science while at the same time being insightfully consistent with them. By removing the experimental context from view in the image — the Petri dish — many scientists could argue that she is leaving out an objectively important detail in terms of the environment in which the yeast grew. By the same token, however, Frankel's manipulation couldn't be more in line with the best of science's reductionist approach, for by removing the dish she removed what was a visually confounding factor to the clearer observation of the feature of interest — the shape of the yeast colonies themselves.

In making the visual analogy between the yeast colony and the petals of a flower, it is interesting to consider how Frankel can take creative advantage as a disciplinary immigrant to biology. Arguably, her scientifically 'untrained' eyes allowed her to intuitively give priority to visual form rather than to the experimental set-up that disciplinary natives would naturally assume as

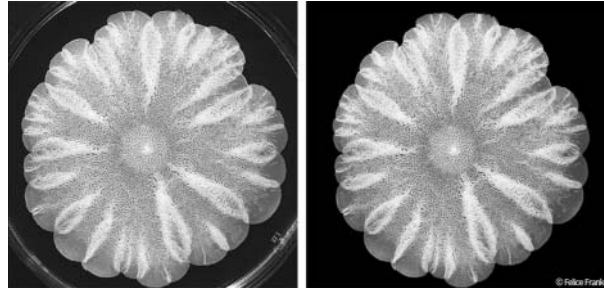


FIGURE 1 Photos of yeast colonies — original image (left), and altered image (right). Frankel believes such changes to the image actually enhance the communication of the scientific content of the image by focusing the viewer on the relevant characteristics of the yeast. Even though it means removing the ‘objective’ context of the Petri dish the yeast is growing in, objectivity in the sense of observational clarity is in fact improved.

significant, but in fact may not be relevant to the question at hand. We see that Frankel takes another discipline seriously enough to both learn and question the tacit rules of a paradigm while at the same time ‘breaking’ them in ways that actually help realize disciplinary goals that might otherwise be missed. Indeed, this kind of process is what was characteristic among participants at the Image and Meaning workshops and that matters not only in the development of scientific images as Figure 1 illustrates, but also in the development of the tools and technologies used to generate meaningful findings in the first place.

### Subjects and objects of science

If initiatives such as Image and Meaning provide an interdisciplinary route to increasing both the sophistication and permeability of scientific knowledge to multiple audiences, then what is the critical and creative role that artists and designers might further play in potentially *altering* the conceptual underpinnings of scientific practices? If disciplinary immigrants truly have the capability of questioning the basic categories and cast a reordering light on the assumptions of another discipline, then fundamental questions about how and why science is done in the first place should also be viable as targets of creative work that generates a critical perspective. Artist and writer Claire Pentecost has recently considered a ‘critical inventory’ of BioArt and the extent to which such work critically engages a ‘reorientation of values’ regarding scientific practices and institutions as opposed to simply further fetishizing its powers and technology (Pentecost 2008). By this measure, what kind of interdisciplinary art practices explore the mindsets of science in a way that effectively challenge its basic categories of meaning? Any such ‘mindset’ of science includes not only the assumptions of working scientists, but also more importantly those of non-scientists who daily and intimately engage with the issues of biology through the genetically modified foods they eat,



the medicines they take, and the biotechnological products they regularly buy. Pentecost's key question is what kind of art practices creates more 'access points' for public participation in the crucial debates of bioscience.

There are a number of artists exploring these possibilities through different strategies, including Caitlin Berrigan and her work around the Hepatitis C virus. Berrigan has the virus herself and has developed a body of work around her personal relationship with it as a means to examine our collective, medicalized view of infection. The standard understanding presents us with a straightforward narrative of the virus as an adversary that needs to be aggressively fought and completely conquered: The virus is a danger and foreign invader of the body, the kind of object that makes a person a host, as well as one that necessitates scientific solutions. In this framework the virus-carrier is both a patient and a prisoner, suffering while trying to fight something she can't even see, and for which outside scientific expertise is the only hope for remedying the disorder. Familiar, this is the metaphor of infectious disease that we accept and live by without second thought. But what might be gained if this system of relations and categories of meaning were shifted in a way to make our standard assumptions more visible and our usual metaphors less given?

In her piece *Viral Confections*, Berrigan creates sweet chocolate versions of the virus based on its molecular shape as known from biophysical research. The image of the virus that science has created and the actual virus that her body otherwise unwittingly produces are thus both transformed into an object Berrigan cognitantly crafts. She invites us to consume this candied proxy of infection by our own choice and therefore invert our accepted notion of who/what is in fact the 'biological agent' in this situation, and what personal agency might constitute. Rather than submitting to an all-out war against Hepatitis C, the artist considers the possibility of domesticating this (incurable) infection within herself. Reorienting the categories of relation further, she also builds large shelters shaped as the virus, large enough in fact to allow for both a physical and conceptual reversal in which people are the ones who now enter the virus. This new space inside the virus then hosts a conversation between Berrigan and public participants about her personal experience with the condition along with a detailed discussion about the medical facts and issues around this under-recognized health concern (Figure 2).

In this process, Berrigan as artist deftly traces the edges of our familiar metaphors and reconfigures them in ways that are recognizable and yet fundamentally different. The rendering of subjects, objects, agents and their inter-related roles is opened for reconsideration by her practice that is at once serious and humorous, educational and questioning, of how medical science and the public participate in our common health. The dominant metaphors of infection as aggression and illness as a battle are challenged by an alternative one that asks about the possibility of domestication, if not perhaps some form of symbiosis. As Berrigan writes in regard to this project:

Living with a chronic, virtually incurable virus can lead to a certain identity crisis in which one's occupied body is seen simultaneously as enemy and victim; friend and abuser. Weary of the rhetoric of war and fighting used to describe the illness,



FIGURE 2 Images from Caitlin Berrigan's *Viral Confections* (2007) and *Viral Shelters* (2008) project where the un-visibly small Hepatitis C virus is rendered visible as chocolate sweets that participants are invited to consume as well as large viral-shaped shelters that play host to the very people that built them. Inside, participants have in-depth conversations about the disease in what is both a form of collaborative biological visualization and health education. (Photos by Chelsea Tonelli Knight, Taylor Robbins, and Caitlin Berrigan)

I wanted to domesticate my untamed virus by offering it comfort, bread and circus. Instead of starvation, I offer it delicacies. Instead of deprivation, I offer it handmade garments. Instead of exile, I offer it whimsical shelter. These domestic objects are created in its image, based formally on the virus's protein structure. Perhaps the virus will be seduced by its own vanity? Or perhaps we can construct our own survival out of its image? (The Knit Virus)

### Revisualizing science

While at first there may seem to be little to connect the sculptures and performances of Berrigan and the photographs of Frankel, it should be clear how both are committed to activating greater public engagement with the biological sciences through creating visualizations and collaborations that



involve challenging science's working assumptions. In the case of Frankel's work, notions of objectivity rub against the communicative and empirical status of scientific images, while Berrigan's *Viral* projects challenge us to revisualize how we identify subjects/objects and the active/passive nature of their roles in the experience of illness as well as research science. As opposed to simply interrupting the possible interface, Frankel, Berrigan, and a number of other interdisciplinary workers at the art/science interface work to constructively *intervene* in the process of making scientific knowledge and succeed in creating a novel dialogue between scientists, artists, and the public that is collaborative. And it is clear that this process is multifaceted: While 'science' certainly involves the nuts and bolts of research work in the lab, generating data at the bench is only one very local aspect of the larger working of science as a process in which research questions and approaches are prioritized, debated, and ultimately supported. Which projects ever see the light of day and how their findings are interpreted and integrated into broader culture — vaccine to videogame — is science in action. The crucial questions of science and its daily practice are fundamentally just as much conceptual and cultural issues as they are technical.

The idea of symbiosis in infectious disease, for example, is still gaining attention as physicians begin to seriously incorporate evolutionary biology into the medical sciences in what many now call 'Darwinian Medicine' (Nesse and William 1996). This understanding is beginning to affect how doctors and epidemiologists approach the treatment of disease and the public health policies we implement. However, how we come to recognize what important changes should be made in the science which is done, and indeed which science is funded, is not an objective or self-evident matter. In regard to wider support for research guided by the conceptual framework of symbiosis, Lynn Margulis has argued that,

In contrast to mainstream zoological pursuits (e.g. parasitism and infestation . . .), the healthy, positive, perhaps even feminine connotations of symbiosis and mutualism have suggested that research on these topics is relatively unimportant. Indeed, this term – contentiousness has impeded research. Most of my colleagues would agree that mention of symbiosis in a grant application tends to deny funding. (Margulis 1990, 675)

If such claims are true, then the work of artists such as Berrigan can matter to the actual practice of science in substantive ways, even though many scientists may themselves fail to realize this intervention. In the molecular biology lab in which BioArtist Joe Davis has been granted space, for example, postdoctoral researchers sharing the lab have complained that Davis' artwork, 'is not evaluated with the same scrutiny as the scientific output of the post-docs here' (Nadis 2000). Such criticisms are significant in how they miss the crucial point of Davis' work, for if his work was in fact evaluated with the same scrutiny, it would then effectively *be* science, rather than an interdisciplinary exploration of art in science. Applying the same evaluative standard, as the postdoc researcher recommends, would take away the important freedom of perspective that a disciplinary immigrant such as Davis has to look at science differently and extra-paradigmatically. Would the bench space that

Davis occupies be 'better used' by a scientist, as another researcher in the lab claimed? For the purposes of science-as-usual, most certainly so, but for the purposes of raising otherwise unasked questions about the wider nature and meaning of the work within that lab, certainly not.

While some scientists at MIT believe Davis' presence plays a useful role, the dismissiveness evinced by a number of Davis' scientific co-workers only highlights the independent and challenging role an artist can play simply by being a participant in a novel context. Because of — and in spite of — the significant resistance scientific disciplines might show to this form of interdisciplinary engagement, the immigrant can provide an alternative perspective on a discipline that natives would otherwise be blind to, but nevertheless matter within wider culture outside the lab. For this reason, the Kuhnian model of paradigms may not be useful for understanding the important role interdisciplinarity can play. Kuhn recognizes 'crises' that result from anomalies that contradict explanation under a current paradigm that in turn can lead to 'revolutions' in scientific understanding and practice. In his model, however, recognition of crisis is both self-generated as well as internally validated within the discipline itself. Arguably though, many of the crises in science are ones that cannot be revealed through the internal framework of a scientific discipline and the logic of research. Nothing, for example, about the logic of nuclear science in-and-of-itself would present an anomaly to challenge how research in atomic power proceeded either before or following World War II. Nevertheless social, political, and ethical (extra-paradigmatic) consequences of the work proved to be very powerful forces influencing the attitudes of many nuclear scientists as to what research questions were the most relevant ones to pursue.

The real risk in interdisciplinarity of the kind described here is that natives may never actually be able to see the alternative perspective immigrants can provide, or even worse interpret through a lens that reinforces prejudices based on prior assumptions. As the BioArtist Mark Dion has commented:

I think one of the misunderstandings is that my work is somehow this relativistic critique of science. And I don't really think that's the case. I mean, I think that you can be critical of the way something is instrumentalized and at the same time still support the goals and motives of that field. Just because you are engaged with it in a critical way doesn't throw the whole thing out. I have a relationship to science as an ever-evolving way of thinking. Of course there are mistakes made, but I think that in general the goals of the scientific revolution and the enlightenment are still worth pursuing. (Art 21: Science and Aesthetics)

In the case of both Frankel and Berrigan, there is a commitment to communicating the core 'facts of science' with fidelity while also introducing manipulations that reorient us to the possibility of alternative metaphors and other connections beyond those typically made available by research science. In this way, contemporary art practices can operate much in the way some forms of science studies and sociology of science have in critically, but carefully, exploring the structure of scientific practices. The early work of investigators such as Stephen Wooglar and Bruno Latour and their embedded anthropological studies of how scientists work day-to-day are models of this

(Latour and Woolgar 1979; Latour 1987). Consistent with Latour's more recent line of work, we might describe certain forms of BioArt as seeking to move scientific practice beyond its 'matters of fact' to consider its possible 'matters of concern' (Latour 2004). However, in the process of doing something far more meaningful than simply dismissing science at one extreme or fetishizing its technology or artefacts at the other, there is still no guarantee that disciplinary natives will respond positively to these kinds of interdisciplinary engagements. As we have already seen, even if such interdisciplinarity does serve science in a broader sense, it may not serve individual scientists and their particular research agendas, and this defensiveness may create real barriers to the possibilities of interdisciplinary engagement.<sup>4</sup> Although daunting, such obstacles may be inherent in the prospects for a serious interdisciplinarity that goes beyond the superficial and has artists as immigrants struggling to help reveal matters of concern in the knowledge-making practices of biology.<sup>5</sup> After all, disciplines are not in the business of asking questions in ways that challenge their own authority or expertise. Meaningful attempts, as a form of critical inquiry, will likely be initially resisted.

A strictly disciplinary perspective is more than happy with the hackneyed notion of 'thinking outside the box' to the extent that it keeps anything that could disrupt its own order at a safe distance. More challenging is the work of artists and designers such as Frankel, Berrigan and others such as Natalie Jeremijenko, Brandon Ballangée, Mark Dion, and David Wilson for the very fact that they are committed to thinking *within* the box as a means to alternatively imagine it, and perhaps fold it in ways never before considered. Such interdisciplinary projects are meaningful not for anything they may contribute to the everyday practice of science at the level of laboratory technique, but rather to the broader and pivotal activity of science that includes what we choose to study, why to choose to study it, and the role that non-experts have in participating in those crucial decisions. The characteristically communicative and interpretive nature of the interventions by artists discussed here is consistent with this role and the possibility of creating the access points to bioscience that Pentecost and others have so clearly articulated the need for. Moving beyond the disciplinary *status quo* to reconsider how science is done and known will certainly be nothing less than a work of art.

## Notes

- <sup>1</sup> I will use the term 'art' and 'artist' in this paper to broadly refer to a range of both fine art as well as various design practices that may include architecture, graphic design, and related fields.
- <sup>2</sup> A series of recent articles in *The Chronicle of Higher Education*, a prominent American journal of academia, illustrate the crossroads at which interdisciplinarity currently finds itself (Jacobs 2009; Glenn and Fischer 2009; Lee 2010).
- <sup>3</sup> The somewhat laden metaphors of 'native' and 'immigrant' are used purposely to highlight the

significant cultural component to disciplinary borders. 'Immigrant' connotes someone who comes from a different context with their own set of perspectives, values, and skills that may diverge significantly from the place that they are entering, and indeed are likely to be perceived as 'foreign'. These workers come as more than just a tourist or transient, but rather with some level of commitment to the place to which they are immigrating to. Furthermore, there are social and political obstacles that an immigrant may face in trying to enter and acculturate to a place

with set procedures, norms, and an idiom that differs markedly from their own. Conversely, ‘natives’ of a discipline, like that of a country, may have ways of knowing and doing that they rarely reflect upon, occupying a place they may feel protective over, even to the extent of exhibiting clear prejudice towards those who wish to enter from the outside. In this way, the metaphor is used with the intention of implying the complex social, bureaucratic, linguistic economic, and even legal differences that manifest in cross-disciplinary exchange.

<sup>4</sup> Asked at a recent symposium to make comments about the art/science interaction, I talked about a few artists I believe make work that can contribute to rethinking of questions and methods in the sciences. A member of the audience interjected, saying the particular artists I mentioned in fact had no influence on science whatsoever. To the extent that I am a publishing scientist, I voiced my disagreement with his

claim only to then be immediately challenged as to how much research funding I secured last year. My answer of ‘zero’ was met by a dismissive laugh from the questioner — what right then did I have to speak on behalf of science? That I was later to discover that my inquisitor was himself an artist added a sad irony to how certain key assumptions — in this case, the status associated with research funding — can fundamentally and rigidly define disciplinary authenticity for the academic sciences.

<sup>5</sup> ‘That’s what I see as the job of contemporary artists: to function as critical foils to dominant culture. My job as an artist isn’t to satisfy the public. That’s not what I do. I don’t necessarily make people happy. I think the job of the artist is to go against the grain of dominant culture, to challenge perception, prejudice, and convention ... I think it’s really important that artists have an agitational function in culture. No one else seems to’. (Art 21: Neukon Vivarium).

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