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SYMPOSIUM ON PAUL RABINOW'S PROSPERITY, AMELIORATION, FLOURISHING: FROM A LOGIC OF PRACTICAL JUDGMENT TO RECONSTRUCTION--AN ACCOUNT OF HIS WORK WITH SYNBERC:

Prosperity, Amelioration, Flourishing: From a Logic of Practical Judgment to Reconstruction

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SUMMARY:

... Keywords: synthetic biology, SynBERC, Dewey, practical judgments, ethics, affect, human practices, equipment, flourishing, thumos

"The attempt to bring over from past objects the elements of a standard of valuing future consequences is a hopeless one." ... Following in the rhetorical footsteps of the manifesto-like proclamations of the preceding two decades in molecular biology, one version of the program reads as follows:

Synthetic Biology is focused on the intentional design of artificial biological systems, rather than on the understanding of natural biology. ... Certainly many of these scientists have made their accommodation with the ELSI mode. ... PROGRAM Our goal is to design new practices that bring the biosciences and the human sciences into a mutually collaborative and enriching relationship, a relationship designed to facilitate a remediation of the currently existing relations between knowledge and care in terms of mutual flourishing Put briefly, equipmental platforms function as the basis for the organization of the activities of specific equipment. ... However, Human Practices does not need to ask the question of what IP platforms exist and how can they be applied. ... CODA Having just presented a paper on synthetic biology in a 2006 conference at Johns Hopkins University on "Concepts of Life," I was brought to a heightened alertness when the commentator framed his remarks in terms of Seneca's fate--the Emperor Nero commanded Seneca to commit suicide, and Seneca complied.

HIGHLIGHT: Abstract. *In this essay Paul Rabinow critically accounts for his work in the "Human Practices" Thrust of SynBERC, and meditates on the disciplinary forces operating on that work, from both within and without the*

enterprise.

Keywords: *synthetic biology, SynBERC, Dewey, practical judgments, ethics, affect, human practices, equipment, flourishing, thumos*

"The attempt to bring over from past objects the elements of a standard of valuing future consequences is a hopeless one."--John Dewey n1

TEXT:

[*301] INTRODUCING SYNTHETIC BIOLOGY

Various "post-genomic" projects have defined their challenge as taking up the functional redesign of biological systems. One strategy devised to meet this goal is a heterogeneous collection of enterprises loosely grouped under the compelling label of *synthetic biology*. Synthetic biology began as a visionary if minimally defined project whose goals were nothing if not audacious. n2 Following in the rhetorical footsteps of the manifesto-like proclamations of the preceding two decades in molecular biology, one version of the program reads as follows:

[*302] Synthetic Biology is focused on the intentional design of artificial biological systems, rather than on the understanding of natural biology. It builds on our current understanding while simplifying some of the complex interactions characteristic of natural biology, including those working to (i) design and build biological parts, devices and integrated biological systems, (ii) develop technologies that enable such work, and (iii) place the scientific and engineering research within its current and future social context.

At the outset, the name was a basically a placeholder, or as some of its critics hold, a brand. Regardless, as its chief proponents understand synthetic biology as a process of modularization and standardization, it appears to us to be developing in and renovating a tradition nicely labeled the "Engineering Ideal in American Culture." n3 Synthetic biology aims at nothing less than the (eventual) regulation of living organisms in a precise and standardized fashion according to instrumental norms. Unlike the visionaries of the previous decades' genome sequencing projects, and their prophecies of the molecular as the "code of codes," synthetic biologists clearly have a feeling for the organism, albeit the organisms with which its practitioners intend to populate the near future. n4 Synthetic biology's pioneers work hard at conveying a feeling of palpable excitement that biological engineering will invent and implement technologies that will make better living things, although exactly what that would mean beyond efficiency and instrumental capacity-building is largely unexamined. In fact, the significance of the claim deserves attention as it opens up a series of topics calling for inquiry and deliberation.

Synthetic biology arose once genome mapping became standard, once new abilities to synthesize DNA expanded, and once it became plausible to direct the functioning of cells. Its initial projects addressed a part of the global crisis in public health--malaria. At the same time, a first ethical and professional concern that it has had to deal with arose from the risk of bioterrorism. Among its current challenges there is a cluster around the production of biofuels. In sum, synthetic biology can be understood as arising from, and as a response to, specific challenges: capacities, demands, and difficulties. Not all of these problems are radically new and not all of the solutions will be either. What they do call for is resourceful solutions and inventive ways of thinking, experimentation, and organization.

[*303] SYNBERC

In 2006 a group of researchers and engineers from an array of scientific disciplines proposed a five-year project to render synthetic biology a full-fledged engineering discipline. Representing major research universities--UC Berkeley, MIT, Harvard, UC San Francisco--as well as Prairie View A&M in Texas, the participants proposed to coordinate their research efforts through the development of a collaborative research center: the Synthetic Biology Engineering Research Center, or SynBERC (www.synberc.org).

This center, SynBERC, was designed, proposed, and funded as an effort to invent new venues and research strategies capable of producing resourceful solutions to real-world problems where existing venues and strategies appeared to be insufficient. As the Web site puts it with the typical bravado of an early-stage undertaking:

The richness and versatility of biological systems make them ideally suited to solve some of the world's most significant challenges, such as converting cheap, renewable resources into energy-rich molecules; producing high-quality, inexpensive drugs to fight disease; detecting and destroying chemical or biological agents; and remediating polluted sites.

In addition to its far-reaching research and technology objectives, SynBERC also represents an innovative assemblage of multiple scientific subdisciplines, diverse forms of funding, complex institutional collaborations, an orientation to the near future, intensive work with governmental and nongovernmental agencies, as well as focused legal innovation and imaginative use of media. More unusual still, from the start SynBERC has built in human practices as an integral and coequal if distinctive component.

The SynBERC initiative is designed around four core Thrusts: Parts, Devices, Chassis, and Human Practices. These Thrusts, in turn, are designed to meet specified goals. The goal of Thrusts 1 through 3 is to link evolved systems and designed systems, with emphasis on organizing and refining elements of biology through design rules. Thrust 4 examines synthetic biology within a frame of human practices. The name "Human Practices" was coined to differentiate the goals and strategies of this component from previous attempts [*304] to bring "science and society" together into one frame so as to anticipate and ameliorate science's "social consequences." The task of Human Practices is to pose and repose the question of the ways in which synthetic biology is contributing or failing to contribute to the promised near future through its eventual input into medicine, security, energy, and the environment. The purpose of such a task is to assess this form-giving through critical examination. The question of how synthetic biology will inflect these domains as it develops, not only after it achieves something, constitutes a central, if not unique, concern of Thrust 4.

The SynBERC Principal Investigators have claimed in their grant proposals, and made structurally explicit in the initial formulations of the organization of the Center, that the far-reaching promises of synthetic biology cannot be realized under existing conditions and organization of scientific research. If the PIs are correct in their assessment, and if in basic ways the promise of synthetic biology is dependent on new forms of collaboration, then the success of SynBERC will depend as much on organizational change and change of work habits as it will technical virtuosity.

Given the power differentials between the bioscientists and the human scientists, and the existing disciplinary structures of reward that shape and reinforce current practices, there is no guarantee that collaboration will be forthcoming. Indeed, there is evidence and experience to suggest that the habits and dispositions of elite scientists as well as the organization of their labs and objects will resist change, consciously and tacitly. Certainly many of these scientists have made their accommodation with the ELSI mode. They are ready to fill out safety forms, they are open to ethics discussions as long as these are periodic and nonintrusive, and they are open to regulation as long as this is downstream of their research. Some are even open to hypothetical discussions about well-meaning social concerns and consequences. In short, some are willing to *cooperate*.

The question remains open, however, whether elite scientists with all the demands on their time are ready to submit themselves to changes of a transformative sort in their habits and procedures. The question remains as to whether or not they are willing to contribute to developing *collaboration*. This question is a genuinely open one for us, and constitutes a key starting point of inquiry that we undertake in an experimental mode. By experimental mode we mean that we will monitor the progression or lack of progression of this design initiative, and analyze the results.

[*305] **PROGRAM**

Our goal is to design new practices that bring the biosciences and the human sciences into a mutually collaborative and enriching relationship, a relationship designed to facilitate a *remediation* of the currently existing relations between

knowledge and *care* in terms of mutual *flourishing*.ⁿ⁶ If successful, such practices should facilitate our current work in synthetic biology--understood as a Human Practices undertaking--through improved pedagogy and the invention of collaborative means of response.

Pedagogy: Pedagogy involves reflective processes by which one becomes capable of flourishing. Pedagogy is not equivalent to training, which involves reproduction of expert knowledge. Rather, it involves the development of a disposition to learn how one's practices and experiences form or deform one's existence and how the sciences, understood in the broadest terms, enrich or impoverish those dispositions.

Our inquiry is directed at the practices and experiences of the synthetic biology community. We are addressing the question: How is it that one does or does not flourish as a researcher, as a citizen, and as a human being? Flourishing here involves more than success in achieving projects; it extends to the kind of human being one is personally, vocationally, and communally. As a placeholder, we note here that *flourishing* is a translation of a classical term (*eudaemonia*) and as such a range of other possible words could be used: thriving, the good life, happiness, fulfillment, felicity, abundance, and the like. Above all, *eudaemonia* should not be confused with technical optimization, as we hold that our capacities are not already known and that we do not understand flourishing to be uncontrolled growth, progressivism, or the undirected maximization of existing capacities. Adequate pedagogy of a bioscientist in the twenty-first century entails active engagement with those adjacent to biological work: ethicists, anthropologists, political scientists, administrators, foundation and government funders, students, and so on. Contemporary scientists, whether their initial dispositions incline them in this direction or not, actually have no other option but to be engaged with multiple other practitioners. The only question is how best to engage, not whether one will engage. Pedagogy teaches that flourishing is a lifelong formative process, one that is collaborative, making space for the active contribution of all participants.

In our view, the means to inquire and explore to what extent these new relationships will be fruitful consist in the invention, design, and practice of [*306] what we refer to as *equipment*. Equipment is a technical term referring to a practice situated between the traditional terms of method and *technology*.

The Pathway to Equipment

We began this work intending to produce a diagnosis of a new "figure" or "diagram" or "rationality" taking shape in the world. Although the contours of what seemed to be emerging were vague, we had a strong sense, arising from a great deal of discussion, analysis, seminar work, and reading, that whatever the terms "biopower" and "biopolitics" might mean--and they were being used in a growing number of ways, most of which seemed to us misleading and misguided--the term or concept or brand were clearly not adequate for understanding contemporary reality. Furthermore, as an additional support for our unease with how these terms were being used, we knew that Michel Foucault, who coined the terms, never had intended them to serve the undisciplined and heterogeneous uses to which they are currently being put. Foucault's focus had been historical and conceptual and, at least in his later work, nontotalizing. Above all, concepts like "biopower" or "governmentality" had been conceived and put forth in a mode that was expressively capable of recursive rectification. Neither naming a unique meaning of Western or world history nor uncovering the nefarious workings of "governmentality" every-where can meet the criteria of recursive rectification.

Once we actually began working, after multiple delays and blockages, we concluded that it was currently premature to diagnose a new "figure" or "diagram" or "rationality." First, it became clear that what each of these terms means is far from clear. Second, we came to believe that while major changes in diverse empirical domains were unquestionably under way, it was not at all obvious that they had taken anything like a general and definitive form. Furthermore, we concluded that it was conceptually hazardous to assume that they ever would. Having reached an impasse, we decided to change strategies by shifting registers.

At first, we decided to move from characterizing a general diagram or rationality to attempting to distinguish the contours of the problematization to which that general diagram was presumably responding. Even there, however, after

two semesters' travail with multiple empirical projects laid out and discussed, it gradually came to seem likely that even the task of attempting to distinguish and characterize the parameters of an emergent problematization [*307] in a comprehensive manner was premature. Unlike the question of what figure comes "after" biopower, however, the challenge of specifying the vectors and contours of an emergent problem-space remains, in our view, a valid one. Consequently, we decided to return to the concrete: our site of inquiry. We shifted our efforts back to the challenge of figuring out how best to comprehend, invent, and practice the work we have taken up in SynBERC.

This course correction proved to be serendipitous in opening the way to discover a means of rectification. It led us to conclude that the first work to be done was to elaborate a diagnostic of equipment. Here, the following articulation by Max Weber provided helpful orientation as to how to proceed:

It is not the "actual" interconnections of "things" but the *conceptual* interconnections of *problems* which define the scope of the various sciences. A new 'science' emerges where new problems are pursued by new methods and truths are thereby discovered which open up significant new points of view. n7

Said another way, we shifted our attention from the attempt to characterize the "actual interconnections of things" to an attempt to distinguish "the conceptual interconnections of problems" with the hope that we would be "opening up significant new points of view." Such points of view, we came to think, would be significant to the degree that we could transform these perspectives into actual practices. The production of actual practices, after all, is what equipment, as we understand it, is about.

What Is Equipment?

We proceeded with an informed awareness that there is a still rather inchoate, if insistent, demand for new *equipment* to reconfigure and reconstruct the relations between and among the life sciences, the human sciences, and diverse citizenries both national and global. This conviction stems from the pragmatic situation in which we are working: the National Science Foundation funds our work. But the commonplace also resonates with a year's work with members of the Anthropology of the Contemporary Research Collaboratory (ARC) indicating that parallel questioning, and the need for new equipment, exists in other domains such as biosecurity, biocomplexity, etc.

Equipment, though conceptual in design and formulation, is pragmatic in use. Defined abstractly, equipment is a set of *truth claims*, *affects*, and *ethical orientations* designed and combined into a practice. n8 Equipment, which has historically [*308] taken different forms, enables practical responses to changing conditions brought about by specific problems, events, and general reconfigurations. n9

Equipment is a term (word + concept + referent) that, by definition, does not retain a constant meaning. Such variation is a source of its richness and flexibility. Mapping and analyzing its distributions would be the kind of work a much more extended genealogy would have to undertake; how to undertake such an enterprise within the anthropology of the contemporary as opposed to the history of the present is, currently, largely unexplored, lacking the requisite navigational concepts and methods.

Equipment takes different forms in the contemporary. This variability stems from the fact that the contemporary is neither a unified epoch nor a culture and consequently there is no reason to expect there would be a single form within it; as well as the fact that scholarly work in the history of the present has shown that there are multiple facets to even a settled problematization and thus, it follows, multiple solutions requiring, it would be logical to assume, diverse equipment.

The challenge of constructing contemporary equipment is threefold: (a) to provide a tool-kit of concepts that enable one to conduct inquiries into the contemporary world in its actuality; (b) to conduct those inquiries in a manner such that those concepts and those inquiries function so as to make the relations (connections and disjunctions) between *logos* and *ethos* apparent, and available, to oneself and to others--that is to say, to make those relations part of the inquiry itself as well as part of a way of life; (c) to take into account the *pathos* encountered and engendered by such an

undertaking, and to find a place for it within the form under construction.

In our technical vocabulary, these challenges consist in designing and synthesizing a form that can maintain a constantly available level of generality. Such forms must be able to function effectively to reconstruct specific problems while being plausibly applicable to a range of analogous problems. That is, the challenge is to compose a form of equipment that will be able to function as an *equipmental platform*.

Equipmental platforms are characterized by a constantly available generality. That is to say, platforms must be designed and synthesized in such a way as to be able to function effectively to reconstruct specific problems, while being plausibly applicable to a range of analogous problems. An equipmental platform can be distinguished from equipmental activities and from specific instances of equipment. An equipmental platform discriminates appropriate [*309] (i.e., coherent and co-operable) equipmental activities and functions as the basis for the organization of these activities. The kinds of activities it distinguishes and organizes are those activities that govern objects within a given contemporary figure. These activities taken as an integrated series are instantiated as specific instances of equipment. Put briefly, equipmental platforms function as the basis for the organization of the activities of specific equipment.

Equipmental platforms function in relation to contemporary figures in two important ways. First, platforms contribute to the determination of a problem within a broad field of problematization. Second, platforms contribute to the specification and design of possible solutions to this problem. Equipmental platforms, in short, function as a pragmatic means of transforming aspects (e.g., blockages, difficulties, disruptions of the play of true and false, etc.) a broader problematization into concrete problems such that these problems can be taken up as a set of possible solutions.

LOGIC OF PRACTICAL JUDGMENTS

It is here that we find some help from John Dewey. A step toward the design and development of equipment has involved extensive conceptual work. This conceptual work has led us to identify the importance of a logic of practical judgments, in which John Dewey has provided insight.

As early as 1903, in his article "The Logic of Practical Judgments," John Dewey confidently argued at length for an approach to the logic of practical judgment that does not consist in a formal set of procedures oriented to internal consistency and completeness, nor the conditions and constraints of a subjective state of mind. Rather, he argued that practical judgment is oriented to a reflective and reiterative practice of pragmatic intervention, modification, and subsequent intervention. n10 His battle with neo-Kantians, idealists, formalists, and above all (after the appearance of Dewey's *Logic* in 1938) with Bertrand Russell, provided the context as well as an incitation for careful fine-tuning of his core position during the course of the next half century. n11

The logic of practical judgment, for Dewey, was not a question of performing a mathematical operation but rather of undertaking a directed action in a given situation. A practical judgment (and its associated propositions), he argued, is "itself a factor in the completion of the situation, carrying it forward to [*310] its conclusion." It follows that a logical judgment does not exist in the domain of abstractions, it is not external to actions, events, and outcomes, but rather is "a determining factor in the outcome" of such processes and practices. n12

Thus, to partake of the logic of practical judgments, for Dewey, is to partake of strategic and experimental action as the mode in which thinking, evaluating, judging, and learning is actually undertaken. What is at stake in the logic of practical judgments is neither the establishment of universals nor the demonstration of the categories of an analytic, transcendental or otherwise. Taken up in this pragmatic and verificationist mode, a logical judgment is simultaneously an evaluation of a desired end as well as a claim about the means available for attaining that end. It follows that since practical judgments are actions, they can be evaluated neither in the abstract nor a priori. It is only once they are put into effect that they can be evaluated. Hence, logical judgments are not external to a case but are simultaneously both the means and the ends for deciding on the worth of a propositional judgment. Dewey writes, "The determination of ends-means (constituting the terms and relations of the practical proposition) is hypothetical until the course of action

indicated has been tried. The event or issue of such action is the truth or falsity of the judgment." n13 Later, in his 1938 *Logic*, Dewey called this mode of veridiction "warranted assertion."

Practical judgments, Dewey insists, are not subjective any more than value is; rather, they are pragmatic. Furthermore, not only are practical judgments not subjective, they do not "primarily concern themselves with the value of *objects*"; but with the course of action demanded to carry an incomplete situation to its fulfillment. n14 Being neither primarily subjective nor objective, practical judgments are engaged and experimental modes of intervention and evaluation of such a situation. Dewey, it is clear, was no relativist. This term, as Richard Rorty was fond of reminding us, was of concern above all to objectivists. Dewey, Rorty, and--it will surprise some to hear--Michel Foucault were concerned primarily with the pragmatics of thinking, not its dialectics or analytics.

Furthermore, and consistent with the above claims, the criteria for evaluating practical judgments are not formal or a priori. They are pragmatic and goal-driven. The logic of practical judgments is a "search for conditions which will render in the future similar cases *remediable* not hopeless. The whole case for the genuineness of practical judgments stands or falls with this principle. It is open to question. But decision as to its validity must rest upon empirical evidence." n15 Logical judgments make sense, cohere, and have value, [*311] only as part of inquiry, taken in the broad, engaged, and experimental sense that Dewey gives to the term.

Finally, not only is the logic of practical judgments pragmatic, the standards or metrics for evaluating such a logic are as well. It "is frequently assumed," Dewey writes, "that valuation is a process of applying some fixed or determinate value to the various competing goods of a situation; that valuation implies a prior standard of value and consists in comparing various goods with the standard as the supreme value." n16 Dewey resists such an understanding of standards because he insists on a standard that arises within the process of determination and remediation, "not outside of it, and hence not capable of being employed ready-made, therefore, to settle the valuing process." n17 For if the standard were already given, then "all that remains is its mechanical application to the case in hand. Genuine moral uncertainty is then impossible, where it seems to exist, it is only a name for moral unwillingness, due to inherent viciousness, to recognize and apply the rules already made and provided, or else for a moral corruption which has enfeebled man's power of moral apprehension." n18 Clearly such a position advocating fixed, external, and universally applicable moral standards is not adequate to the pragmatic demands of the underdetermined situations within which thinking takes place. The pragmatist response is that "the standard is a rule for conducting inquiry to its completion; it is a counsel to make examination of the operative factors complete, a warning against suppressing recognition of any of them." n19

All of this is helpful in advancing both analytic and diagnostic work. As noted, however, Dewey remained at a high level of abstraction in his philosophic work. It is entirely possible that an examination of his practical interventions in establishing schools and the like would demonstrate how these logical discussions could be put into operation. In the case of our Human Practices work and the demand to design and invent equipment, Dewey's logic has proved to be useful as an initial guide to orienting inquiry. However, we now find ourselves obliged to look elsewhere, largely to our own devices, to actually pursue the inquiry.

HUMAN PRACTICES

We do not think that what is distinctive and intriguing about developments in synthetic biology is that they are "revolutionary" or even "cutting-edge." [*312] These are modernist terms from a prior historical configuration that draws attention to what is "new" and "radically transformative" as the locus of significance. Our interest and attention is drawn to the combination and recombination of elements old and new into a stylized form whose defining diacritic is not its newness per se. Rather, in what has been described elsewhere as "the contemporary" as opposed to the modern, what counts as significant are the forms and possibilities that open up once the quest for the new is moderated and backgrounded (although not ignored). Hence, the basic rules of what counts as good science and engineering in synthetic biology are the traditional or standard ones. What objects are taken up and how they are combined and recombined are themselves part of a larger *Gedankenbild* that is part organizational, part conceptual, part technical--and

part equipmental. How such an assemblage might be put together, made to function effectively, cope with breakdown and unexpected occurrences, and discern and address emergent problems is what both intrigues us and concerns us.

Additionally, well-established modes of engagement are structured by specific metrics. Prominent metrics have included normalization and the protection of dignity. Normalization allows for the regulation and modulation of fields of statistical regularities, such as industrial safety. The metric of dignity facilitates emergency intervention into situations of rights abuse. While recognizing the worth and utility of these metrics, Human Practices is designed to discover if it can function according to a different metric--flourishing.

We were oriented towards a reconstructive effort because various research teams at the ARC had been engaged in intensive inquiry on emergent topic areas such as biosecurity and biocomplexity for the preceding two years. For example, we had observed in the latter how a rethinking of issues had contributed to a shift from biodiversity as a central approach to a range of environmental concerns, to the emergent field of biocomplexity. While the former approach was based on understanding and preserving species as an inherent good, the latter concentrated more on the types of milieu that would enable or encourage biological complexity to flourish. Hence a certain range of prior expertise, and prior disciplinary suppositions and ethical commitments, taken as settled and desirable could well slow or even block the understanding and collection of the data that will be required for the conception of sustainability at work in bio-complexity.

A similar example can be given with biosecurity. It has become clear through our research that recombinations and reconfigurations of existing [*313] expertise is required if a biodefense system is to be constructed that is adequate to emergent problems. Although previous Cold War experience can constitute a baseline for thinking about biosecurity today, we find ourselves in a radically different type of security situation. It follows that vastly different arrays of bioscientific understandings and technologies and new dispositions among security experts were just as vital as new dispositions and approaches among bioscientists, and, for that matter, potential aggressors.

As an integral component of the overall enterprise, Human Practices is positioned to take up problems in a way that experts-at-a-distance cannot. For example, problems in industry relations and intellectual property are certainly crucial to how synthetic biology will develop. However, Human Practices does not need to ask the question of what IP platforms exist and how can they be applied. Rather, Human Practices is in a position to pose the question of what kinds of objectives are really at stake in specific projects, how those stakes require rethinking about the interfaces among university labs, government funding, biotech interests, and the like. In this way, the problem of how to leverage existing resources, talents, and technologies in order to advance the aims of synthetic biology can appropriately be posed. Once posed, these problems can be collaboratively worked on. Such collaboration will require existing experts, to be sure. However, the expertise will need to be interfaced with emergent problems in such a way that experts will be required to think forward rather than reproduce existing insights. In sum, our work is oriented toward understanding how potentially viable design strategies emerge, how these strategies might inform synthetic biology, and what efforts are undertaken to integrate them into a comprehensive approach to the near future.

Such work involves *reconstruction*. We are giving reconstruction in Human Practices a specific technical meaning, similar to that put forward by John Dewey:

Reconstruction can be nothing less than the work of developing, of forming, of producing (in the literal sense of that word) the intellectual instrumentalities which will progressively direct inquiry into the deeply and inclusively human--that is to say moral--facts of the present scene and situation. n20

What is pertinent in Dewey's formulation is that science and ethics are interfaced and assembled in accordance with the demands of "progressively directed inquiry." Such inquiry is not primarily directed at real or imagined [*314] consequences or first-order deliverables. Rather, inquiry is directed at the possibility of the invention and implementation of equipment that facilitates forms of work and life.

CONCLUSION: PROSPERITY, AMELIORATION, FLOURISHING

Although Dewey's words convey a sense of conviction and plausibility, it has become apparent that, at this stage of our inquiry, we don't yet actually understand of what reconstruction consists in this case. Reflecting on and discussing this issue has raised the question of what is the metric of reconstruction? Or, approaching the topic from a different angle, what is the telos of reconstructive practice?

We have identified two candidates among the scientists with whom we are working: prosperity and amelioration. It is fair to say that all of the scientists involved are unabashedly, unashamedly, and unselfconsciously committed to prospering. To them to prosper means primarily devoting attention to advancing their careers. It also means, in many cases, striving for financial success through their involvement with start-up companies that they themselves have founded in the case of the more senior scientists or wish to found in the case of the more junior ones. It is part of the mandate of SynBERC as well as the other centers funded by the National Science Foundation that they become financially self-sufficient within ten years. Given that mandate, there is no contradiction between what the government decrees and what the scientists desire. By now within the American scientific establishment such norms are widely accepted. Bayh-Dole has long since become not only the law of the land but its norm.

A few of the more senior SynBERC scientists are aware that the security environment within which they are working must be addressed if their whole enterprise is to continue. Some understand that the stakes are significantly higher than the preservation of their own enterprise. Many, perhaps all, of the SynBERC scientists would affirm, if asked, and several are actively committed to, the goal of constructing technologies that would make major contributions to the amelioration of the environment (including climate change), of making therapeutic contributions to decreasing the toll of major diseases. [*315] None, to our knowledge, have expressed any deep concern that prosperity and amelioration might be conflicting or contradictory goals.

Beyond this consensus, a zone of ambiguity exists. Are the metrics of prosperity and amelioration sufficient? For the scientists, such a question is largely unexamined. But even for John Dewey there is a certain ambiguity present. For surely, the desire to prosper and to improve the human condition can be understood as part of "the deeply and inclusively human." Dewey glosses this phrase as "the moral." But does the moral, or the ethical, or the deeply and inclusively human require something more and different than what is provided by the pursuit of prosperity and amelioration?

Power Relations

Hence the question we confront today might be put as: what is the relation, or relationships, if any, between and among, prosperity, amelioration, and flourishing? This question brings us back to issues of power relations that have been skirted in what preceded. As with most power relations, those within SynBERC are unequal. The basic inequality between the other PIs and the Human Practices members operates without examination, bolstered by the inertia of past dispositions and the larger structures of the university that take for granted the autonomy of the biosciences as well as their primacy given their prosperity and assumed contributions to ameliorating health, the environment, etc. Said straightforwardly: Human Practices is in a dominated position.

If the inequality of the power relations--who makes decisions, how priorities are established, how decisions are implemented, who gets to make threats that can be carried out--follows more general American standards, how this situation inflects the forms that relations of cooperation and coordination take is unthematized and consequently unexplored. That topic has become a focus of our practices and our reflections. We have identified three modes currently available--representing experts, science and society, and second-order participants--and are attempting to invent an appropriate practice for Mode Three. n21 One further comment on power relations is in order here. In an important paper, "The Subject and Power," offered to Bert Dreyfus and myself as an epilogue to our book on his work, Michel Foucault proposed a distinction between three types of power relations: exploitation, domination, [*316] and subjectivation. In light of these distinctions, it is pertinent to point out that while Human Practices is subordinated

within SynBERC, it is not exploited. Given our modest material needs, we have been allotted ample resources and have been left alone to do whatever work we deem to be important. Consequently, the challenge of inventing a form for a mode of subjectivation that could lead to flourishing has been granted some leeway, a measure of maneuvering room. Given these conditions, the question then becomes: how to maneuver so as to enhance flourishing? As of late 2007, we have no clear answer to that challenge.

CODA

Having just presented a paper on synthetic biology in a 2006 conference at Johns Hopkins University on "Concepts of Life," I was brought to a heightened alertness when the commentator framed his remarks in terms of Seneca's fate--the Emperor Nero commanded Seneca to commit suicide, and Seneca complied. There was a moral and existential lesson that, the erudite commentator proposed, I seemed to be ignoring. At my peril. With all due politeness but with a cutting civility, Sylvain Perdigon (at the time a graduate student in anthropology at Johns Hopkins returning for a pause in his fieldwork in Palestinian refugee camps in Lebanon but equally a product, as the saying goes, of the elite French educational system) was warning about what he took to be my complicity with Power as well as what he took to be my dismissive attitude displayed toward the substance and affect of critics of biotechnology. Such a mode of subjectivation, his allegory was designed to lead the audience to imagine, could lead to tragic consequences.

Let us remember that Seneca's fate arose from his efforts to put philosophy directly into the political arena. Seneca, perhaps the richest citizen in Rome, was drawn to and repelled by his position as a close advisor to the notorious Emperor Nero. In his letters, Seneca repeatedly rehearsed the then stereo-typed consolatory tropes of withdrawing from public life, in his case not simply retreating to a villa in the countryside as many other rich Roman citizens did once they fell from power, but, rather, Seneca imagined, an exodus to Greece where he could return to the study of philosophy and rhetoric at the schools of his youth. And, he hoped, to refreshment, rejuvenation, and renewal at the wellsprings of youthful virtue of the Republic in its better days. [*317] Seneca, however, stoic that he was, resisted the temptation to withdraw and remained in Rome. Another mode of consolation was writing: in addition to his letters and moral treatises, Seneca wrote tragedies. These tragedies treat of brutal and violent affairs. Scholars continue to debate the degree to which they are fantasies and the degree to which they are a form of political realism. In one, *Octavio*, a philosopher named Seneca counsels an Emperor named Nero against bloody retribution. Eventually Nero turned against his advisor and ordered him to commit suicide. Seneca acquiesced to the Emperor's demand but implored Nero to release his wife from her duty after she failed in her attempt to precede her husband in the path of honor--a request that was granted.

The tone of our Frenchman's commentary skated between that of a caution and that of an admonition. The caution seemed appropriate while the admonition or rebuke was puzzling. One could take it to say that anthropologists ought to study those upon whom power is exercised and to concentrate upon the practices of repair and resistance that arise in response, whether in defiance or in existential inventiveness. As the department of anthropology at Johns Hopkins, following the lead of Veena Das, is the exemplar of the social suffering mode of anthropology, such advice was neither unexpected nor unappreciated. The dominant mode of subjectivation in American anthropology today is to study the dominated and exploited, or to show how those whom one studies dominate and exploit, while retaining what Foucault has referred to as "the speaker's benefit," a position of expose or rebuke or denunciation or uplift from a position exterior to the situation. While apparently gratifying, such a mode of subjectivation, it seems to me, was unlikely to lead, if not incapable of leading, toward reconstruction or even practical judgment in Dewey's sense of the term. Hence, if the path of inquiry was seeking practical judgments, it followed that if one accepted the rebuke at face value--work with the powerful at your own moral and existential peril--then there was little I could think of to respond except that, like Seneca, and other practitioners of ancient equipment, I would keep the maxim in mind.

Although it seems not to be in the stars that the leaders of the synthetic biology center at Berkeley will ask for my suicide or that of my wife, nonetheless Monsieur Perdigon's caution was a propos and, actually, in the spirit of Seneca himself. In fact, the PIs of Human Practices have been threatened in an email with replacement, in what can be legitimately taken as a petty example of authoritarian power, unless we "got along with each other." Upon reflection,

[*318] and acknowledging our desire to prosper, we are now getting along. But the threat stirred my anger especially as scientific PIs who had contributed little or nothing to the overall success of the Center have received no admonishment. After this event, my affect shifted to a cold vehemence aimed at surviving as well as achieving a more just recognition of our substantial efforts and contributions.

As a means to developing a more satisfactory mode of subjectivation within this situation of domination but not exploitation, I pose the question of what affect is appropriate in such a situation? Surely anger, or more accurately the Greek *thumos* is a plausible candidate. Why so? And here we leave Seneca aside (despite his treatise on anger) and turn instead to Aristotle who treats *thumos* in his treatises on rhetoric and ethics. *Thumos* is the capacity of the soul to manifest anger and zeal. *Thumos* is closely connected to the value one sets on oneself as well as the manner in which others respond to that self-esteem. These conditions lead directly to considerations of justice, politics, and ethics. For example, in the *Rhetoric*, Aristotle says:

Anger may be defined as an impulse accompanied by distress, to a conspicuous revenge for a conspicuous slight directed without justification towards what concerns one-self or towards what concerns one's friends. n22

In Book IV of the *Nicomachean Ethics* he writes:

The man who is angry at the right things and with the right people, and further, as he ought, when he ought, and as long as he ought, is praised. This will be a good-tempered man. n23

As with the other virtues the mean is flanked by two equally negative extremes, one an excess, the other a deficit. The excess term is "irascibility," but there is no term for the deficit:

Such a man is thought not to feel things nor to be pained by them, and, since he does not get angry, he is thought unlikely to defend himself; and to endure being insulted and put up with insults to one's friends is slavish. n24

The French Hegel scholar Alexandre Kojève equates *thumos* with the Hegelian concept of "the desire for recognition." *Thumos* is the drive to assign value and the consequent legitimate desire for recognition. This striving [*319] for value is an activity that entails another consciousness to share or reject the valuation put forth in practice or asserted in discourse. The arousal of anger when such recognition is ignored or denied is perfectly appropriate. This intimate relationship between self-evaluation and anger is captured nicely in the English word *indignation*.

Other authors have attempted to make *thumos* a marker of the ethical limits to the current excess of the desirable and/or the calculative in consumer capitalism. These criticisms of contemporary capitalism are on the mark and do not need rehearsing here. The surge of indignation, however, and even its channeling into a sustained affect is, of course, only a beginning. The forging of affect is a component in the construction of contemporary equipment. That being said, the task of imagining and inventing the ethical and veridictional components to contemporary equipment and giving them form remains a challenge. A challenge that must be taken up, it seems to me, if we are to move toward a larger comprehension of the marginalized telos of flourishing and a practice of reconstruction.

Legal Topics:

For related research and practice materials, see the following legal topics:

Civil Procedure
Judgments
General Overview
Copyright Law
Subject Matter
Literary Works
Scope of Protection
Patent
Law
Claims & Specifications
Claim Language
Multiplicity

FOOTNOTES:

n1 John Dewey, "The Logic of Practical Judgment," in *Essays in Experimental Logic* (1916) (Mineola, N.Y.: Dover Publications, 2004), 241.

n2 The "we" in this paper refers above all to my collaboration with Gaymon Bennett.

n3 The phrase is from Phillip Pauly, *Controlling Life: Jacques Loeb and the Engineering Ideal in Biology* (Oxford: Oxford University Press, 1987).

n4 Daniel Kevles & Leroy Hood, *The Code of Codes: Scientific and Social Issues in the Human Genome Project* (Cambridge: Harvard University Press, 1993); Evelyn Fox-Keller, *A Feeling for the Organism: The Life and Work of Barbara McClintock* (New York: Times Books, 1984).

n5 For more details, see www.synberc.org. This article only treats the efforts of the fundamental modules of Thrust 4.

n6 Each of these italicized terms will be taken up analytically in other papers.

n7 Max Weber, "Objectivity in the Social Sciences," in *The Methodology of the Social Sciences*, trans. & ed. Edward A. Shils & Henry A. Finch (New York: The Free Press, 1949), 68.

n8 For "practice," see Alasdair MacIntyre, *After Virtue: A Study in Moral Theory* (Notre Dame, Ind.: Notre Dame University Press, 1981).

n9 Paul Rabinow & Gaymon Bennett, "From Bio-Ethics to Human Practices or Assembling Contemporary Equipment," unpublished manuscript (2007).

n10 John Dewey, "Logic of Judgments of Practice," in *Essays in Experimental Logic*, *supra* note 1 at 120.

n11 Tom Burke, *Dewey's New Logic: A Reply to Russell* (Chicago: University of Chicago Press, 1994).

n12 Dewey, *supra* note to at 216.

n13 Dewey, *supra* note to at 221. On this point, see Burke, *supra* note it at ch. 6.1, "Warranted Assertibility and Truth."

n14 Dewey, *supra* note to at 231.

n15 *Id.* at 218.

n16 *Id.* at 236.

n17 *Id.* at 238.

n18 *Id.* at 239.

n19 *Id.* at 242.

n20 John Dewey, *Reconstruction in Philosophy* (Boston: Beacon Press, 1948), xxvii.

n21 Paul Rabinow & Gaymon Bennett, "The Work of Equipment: Three Modes," unpublished manuscript (2007).

n22 Aristotle *Rhetoric* 2.2.

n23 Aristotle *Ethics* 4.5.

n24 *Id.*



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SYMPOSIUM ON PAUL RABINOW'S PROSPERITY, AMELIORATION, FLOURISHING: FROM A LOGIC OF PRACTICAL JUDGMENT TO RECONSTRUCTION--AN ACCOUNT OF HIS WORK WITH SYNBERC: Norms and Irony in the Biosciences: Ameliorating Critique in Synthetic Biology

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NAME: Gary Edmond and David Mercer n1

SUMMARY:

... This essay responds to Paul Rabinow's contention that recent transformations in the practices and norms of the biosciences, exemplified in the emerging field of synthetic biology, demand corresponding changes to the forms of knowledge and practices used by humanities scholars and policymakers wishing to understand and engage with them. ... In practical terms, one of the main goals of Human Practices, following from Rabinow's recognition of the emergent qualities of synthetic biology and skepticism about traditional "science and society" approaches, is for human scientists through various processes of evaluation, facilitation, engagement, and collaboration, to encourage SynBERC's bioscientists to become highly reflective about their practices. ... Accepting that "preparedness" might subsume specific regulatory proposals, by offering a broad orientation in which specific regulations might be incorporated, it is far from obvious how this approach (and nomenclature) affords anything more concrete or viable than conventional approaches to uncertainty--such as those described in Synthetic Genomics --however familiar or flawed these might be. ... We aim to undertake this by: (A) unpacking the way Rabinow links "upstream engagement" with the engineering ideal in American Culture ; (B) hypothesizing about what his visions for engagement might mean in practical settings involving interactions between law and the new biosciences; (C) interrogating "flourishing" and its apparently parochial implications; and finally, (D) noting that Rabinow's model of upstream engagement may not only be flawed in terms of its putative consequences but may not even be susceptible to instantiation. ... Rabinow's implicit rejoinder to the problem of the human scientist passively constrained in the frame of synthetic biology's engineering ideology is for their collaboration with bioscientists and engineers to facilitate processes of critical self- and social-reflection by these bioscientists about their work and its implications.

HIGHLIGHT: Abstract. *This essay responds to Paul Rabinow's contention that recent transformations in the practices and norms of the biosciences, exemplified in the emerging field of synthetic biology, demand corresponding changes to*

the forms of knowledge and practices used by humanities scholars and policymakers wishing to understand and engage with them. Rabinow's "Human Practices" approach embeds humanities scholars and social scientists with scientists in the course of ongoing research endeavors (so-called upstream engagement). This approach aspires to develop new ways of conceptualizing scientific and engineering practices, and to promote philosophical awareness among scientists and engineers--about what constitutes "the good life"--in ways that are coupled with scientific self-regulation. We wonder, drawing upon research traditions in the history & philosophy of science (HPS) and science & technology studies (STS), whether such an approach is likely to have much impact on the practices of synthetic biology. As our essay endeavors to explain, we doubt whether the environment(s) in which synthetic biology is being practiced will compel scientists to embark on these types of philosophical, social, and ethical reflections, or make them inclined to constructively engage with humanities scholars and social scientists. We also allude to the possible dangers of diluting external regulation and existing forms of accountability for scientists and engineers. Our essay concludes in a register skeptical of Rabinow's ironic response to the actual difficulties encountered in putting his philosophy into practice. This, we contend, indicates that more robust and reflective engagement with existing theoretical and empirical studies of science, engineering, and expertise would be at least as illuminating, if not, perhaps, as original.

Keywords: *biopower, expertise, technology regulation, interdisciplinary collaboration, life sciences, law and science, human practices, collaboratory, engineering ethos*

TEXT:

[*446] I. INTRODUCTION

Paul Rabinow is widely respected for the subtlety and sophistication of his scholarship, as a leading interpreter of the late Michel Foucault, for his anthropological studies of the biosciences, and for his attempts to articulate what might broadly be defined as the implications of biopower. n2 In this essay we respond to Rabinow's contention that recent transformations in the practices and norms of the biosciences demand corresponding changes to the forms of knowledge and practices used by humanities scholars and policymakers engaging with the biosciences. More specifically, our commentary assesses Rabinow's account of the emergence of the new field of *synthetic biology* and his participation in one of its flagship projects, namely SynBERC (the Synthetic Biology Engineering Research Center). n3

There is, it is fair to say, some disagreement over the parameters of "synthetic biology" and residual disquiet over the appropriateness of the terminology. Generally, though, the *field* is understood to have "the deliberate design of biological systems and living organisms using engineering principles" at its core. n4 Some of the definitional issues, and some of the continuing controversy, are undoubtedly attributable to the relative novelty of the subject matters and approaches. n5 Chronologically, it is significant that the first international conference on synthetic biology was held as recently as 2004. n6 The SynBERC collaboration itself grew out of an application for funding to the National Science Foundation (NSF) shortly after this meeting when a group of scientists and engineers proposed to establish a program for research and development in synthetic biology in 2006. The grant proposal was successful and SynBERC was formed as an NSF Engineering Center. In addition to financial support from the NSF, SynBERC receives funding from a variety of public, private, and charitable sources. These include the state of California--where SynBERC forms part of the California Institute for Quantitative Biosciences--and a variety of venture capitalists and charitable trusts, including the Bill and Melinda Gates Foundation. n7 SynBERC's multi-institutional and multi-jurisdictional character is structurally entrenched. Participant researchers are based in the University of California campuses at Berkeley, San Francisco, and Santa Cruz, as well as at Harvard University, MIT, and Prairie View A & M University.

[*447] II. FLOURISHING AND THE DECONSTRUCTION OF PRACTICAL JUDGMENT

Rabinow has described the emergence of synthetic biology, along with his own participation in the SynBERC initiative, on a number of occasions. Understandably, here we focus primarily on the essay "Prosperity, Amelioration, Flourishing: From a Logic of Practical Judgment to Reconstruction" (reproduced earlier in this volume). n8

One of the prominent features of Rabinow's approach to synthetic biology is a desire to capture and identify

features of the emergent, and consequently not entirely settled, practices of synthetic biology. Part of Rabinow's ambitious approach is to simultaneously theorize and document his participation in SynBERC and the practice of synthetic biology. To a considerable degree these activities seem to involve the supplanting (i.e., discarding or ignoring) of traditional and implicitly inadequate vocabularies of bioethics, technology assessment, and science policy. We would include work by sociologists, anthropologists, and historians of science and technology among the alternative approaches that seem to be either trivialized or ignored. The purported novelty of synthetic biology and the implicit irrelevance of earlier scholarly endeavors encourage Rabinow to use qualifications and caveats, specialized neologisms, concepts borrowed from diverse fields of inquiry, allusions to classical scholarship, and lashings of irony. In consequence, his assessments are fraught with ambiguity and metaphoric tension. Whether such an approach is necessary, desirable, or even defensible, as a precursor to a potentially more enlightened understanding of contemporary bioscientific initiatives, or a reflection of the difficulties he appears to encounter articulating a clear intellectual and genuinely collaborative role for his vision of a Human Practices program of interventions into synthetic biology, is one of the issues we aim to explore. n9

Rabinow opens his essay with an interpretation of the primary features of synthetic biology. Here, he places emphasis on the fact that synthetic biology is not merely another form of science but rather a form of "biological engineering [that] will invent and implement technologies that will make better living things." n10 Its practitioners, unlike the visionaries of genome sequencing projects, seem to value processes of standardization and modularization ahead of achieving abstract theoretical understandings. And synthetic biology is:

[*448] developing in and renovating a tradition nicely labelled the "Engineering Ideal in American Culture." Synthetic biology aims at nothing less than the (eventual) regulation of living organisms in a precise and standardized fashion according to instrumental norms. n11

Rabinow recognizes that moving beyond this orientation towards efficiency and instrumental capacity building "opens up a series of topics calling for inquiry and deliberation." n12 Topics associated with intellectual property and ethics, but especially those falling loosely beneath the rubric of risk--such as biosecurity, which Rabinow suggests are of concern to scientists and engineers--rank highly in his account.

Consistent with the call to move beyond contemporary forms of regulation, technology assessment, and STS (Science and Technology Studies) and ELSI (Ethical Legal and Social Impacts) theorizing about engineering and the sciences, Rabinow tends to dismiss more "traditional" ethical concerns, such as possible challenges posed by the new genetic sciences to the "qualitative distinctiveness of life." We are told, in an earlier essay by Rabinow, that:

DNA itself is universal; if there are questions to be posed about the qualitative distinctiveness of living beings such questions must be posed at a different level. The specificity of species does not lie at the molecular level. The vision of the molecularization of life is, as they say, "so 90s." n13

Rabinow's vision for the human sciences, contributing to understanding and addressing these "topics," is governed by an overriding commitment to the idea that the life sciences will embrace a particular style of engineering ideology that entails inevitable changes to the relationship between the human and life sciences. n14 (At a later point, we return to consider whether uncritical commitment to this metaphor may have subverted Rabinow's ability to develop a coherent Human Practices program capable of anticipating and ameliorating synthetic biology's social consequences.)

Moving more directly to SynBERC, Rabinow explains that the project is "designed around four core *Thrusts*." n15 Three of the Thrusts, namely Parts, Devices, and Chassis, are ostensibly technical: Parts is preoccupied with the "computational design and construction of cellular parts that can be assembled into 'devices'"; Devices involves "assembling cellular 'parts' into 'devices' that can be re-used in a combination of systems"; and Chassis engages in "building parts, devices, and systems that work inside living cells." n16 In combination [*449] they aim "to link evolved systems and designed systems, with emphasis on organizing and refining elements of biology through design rules." n17

The fourth Thrust, in which Rabinow participates as a codirector, is described as Human Practices. Rabinow contends that this Thrust offers something quite different from the goals and strategies offered by more conventional attempts "to bring 'science and society' together into one frame so as to anticipate and ameliorate science's 'social consequences.'" n18 He continues:

The task of Human Practices is to pose and repose the question of the ways in which synthetic biology is contributing or failing to contribute to the promised near future through its eventual input into medicine, security, energy, and the environment. The purpose of such a task is to assess this form-giving through critical examination. n19

More specifically, Rabinow identifies the goals of Human Practices as bringing:

the biosciences and the human sciences into a mutually collaborative and enriching relationship, a relationship designed to facilitate a *remediation* of the currently existing relations between *knowledge* and *care* in terms of mutual *flourishing*. If successful, such practices should facilitate our current work in synthetic biology--understood as a Human Practices undertaking--through improved pedagogy and the invention of collaborative means of response. n20

Pedagogy is not interpreted in the ordinary senses of training or teaching but is instead implicated in Rabinow's concept of *flourishing*.

Pedagogy involves reflective processes by which one becomes capable of flourishing. . . . it involves the development of a disposition to learn how one's practices and experiences form or deform one's existence and how the sciences, understood in the broadest terms, enrich or impoverish those dispositions. n21

"Flourishing" is defined through reference to the classical term *eudaemonia*. Drawn from Aristotle's discussion of ethics, "eudaemonia" refers to the good life--happiness, fulfillment, and felicity. According to Rabinow, the SynBERC scientists are keen to prosper through career development, financial rewards, and the recognition associated with their research success. In practical terms, one of the main goals of Human Practices, following from Rabinow's recognition of the emergent qualities of synthetic biology and skepticism about traditional "science and society" approaches, is for human [*450] scientists through various processes of evaluation, facilitation, engagement, and collaboration, to encourage SynBERC's bioscientists to become highly reflective about their practices. It is out of this collaboration and reflection that the new practices constituting the discipline of synthetic biology will emerge. It is through consideration of how their practices enhance the good life that scientists and engineers (and human scientists) are enabled to flourish.

Although Rabinow acknowledges that the elite scientists and engineers engaged in Thrusts 1 through 3 (i.e. Parts, Devices, and Chassis) may not wish to collaborate, there is a sense in which resistance is unlikely to be sustainable:

Adequate pedagogy of a bioscientist in the twenty-first century entails active engagement with those adjacent to biological work: ethicists, anthropologists, political scientists, administrators, foundation and government funders, students, and so on. Contemporary scientists, whether their initial dispositions incline them in this direction or not, actually have no other option but to be engaged with multiple other practitioners. The only question is how best to engage, not whether one will engage. Pedagogy teaches that flourishing is a lifelong formative process, one that is collaborative, making space for the active contribution of all participants. n22

This is consistent with Rabinow's teleological belief that the biosciences are destined to embody a highly conventionalized engineering ethos.

We have not endeavored to reproduce all of the details of Rabinow's theoretical architecture or the complex relationships between the various concepts developed in an attempt to capture the subtleties of Human Practice praxis. Nevertheless, before proceeding it is useful to introduce the concept of *equipment*. Basically, "equipment" refers to the

"truth claims, affects, and ethical orientations" that will be needed "to reconfigure and reconstruct the relations between and among the life sciences, the human sciences, and diverse citizenries both national and global." n23 Rabinow seems to appreciate that constructing equipment will be challenging.

III. PREPARING FOR THE GOVERNANCE OF SYNTHETIC BIOLOGY (BY HUMAN PRACTICES)

Looking beyond the broad programmatic rhetoric promoted by Rabinow, we can obtain an impression of the kinds of contributions that Human Practices [*451] might make to synthetic biology and, more specifically, compare them with more conventional approaches (including those associated with "science and society" and STS). Earlier we drew attention to the centrality of--and to some extent preoccupation with--risk and biosecurity issues associated with synthetic biology. Those engaged in the Human Practices Thrust have discussed security issues elsewhere, and these more detailed expositions help us to understand Rabinow's approach.

In an *Anthropology of the Contemporary Research Collaboratory* (ARC) concept note entitled "Response to *Synthetic Genomics: Options for Governance*," Rabinow and his colleagues, Gaymon Bennett and Anthony Stavrianakis, begin to explain how Human Practices might contribute to the governance of synthetic genomics. n24 In so doing they seek to distinguish their approach from more conventional orientations (and, at least implicitly, alternative approaches not considered) by critically reviewing a key report funded by the Sloan foundation: *Synthetic Genomics: Options for Governance* (hereinafter *Synthetic Genomics* or the Report). n25 According to Rabinow and his colleagues, *Synthetic Genomics* aimed "to formulate governance options that attempt to minimize safety and security risks from the use of synthetic genomics while allowing its development as a technology with great potential for social benefit." n26 The Report identified three broad sets of factors influencing security challenges from synthetic biology. They are technical innovation, the political environment, and uncertainty.

Rabinow, Bennett, and Stavrianakis contend that *Synthetic Genomics* addresses biosecurity issues within the frameworks of *safety* and *security*. Their critique, which follows, highlights the weaknesses of such framing choices. They explain how the *safety framework* in *Synthetic Genomics* inadequately addresses the problem of potential dangers by proposing the development of technical safeguards and procedures such as licensing and screening those who have access to DNA synthesis.

Rabinow, Bennett, and Stavrianakis suggest that:

[t]hese measures are valuable as far as they go. However, given the kinds of problems identified in the [*Synthetic Genomics*] report, it should be clear that they are not sufficient. The report acknowledges that rogue scientists have ready access to the "know-how" if not the materials and technologies of DNA synthesis; what's more, these scientists may not form part of the community that would adhere to best practices. Neither challenges related to new political environments nor challenges introduced by uncertainty can be adequately addressed through the introduction of technical safeguards. n27

[*452] The other approach to biosafety advanced in *Synthetic Genomics* is described as a *security framework*. The *Synthetic Genomics* report suggests that a security framework, in conjunction with the safety framework, provides a superior set of resources for dealing with biosafety. While Rabinow and his colleagues appear to recognize some overlap between these categorizations--for, notwithstanding technological preoccupation, safety frameworks involve licensing and regulation, which are implicitly linked to the broader political contexts in which the technologies operate--they argue for the supremacy of security frameworks because they more explicitly incorporate concerns relevant to the political environment. Examples might include the emergence of malicious and unpredictable actors, and the potential for new media to facilitate unprecedented access to scientific knowledge and technical know-how. Moreover, uncertainties may originate in foreign states and beyond the scope of traditional modes of regulation. The implications of such developments may be similarly promiscuous.

Nevertheless, Rabinow and his colleagues remain critical. For, although the security framework outlined in

Synthetic Genomics may reveal uncertainties and risks, it endeavors to address them within the context of traditional governance frameworks and offers "no concrete proposals for developing frameworks" to confront them. n28 In contrast, Rabinow, Bennett, and Stavrianakis suggest that uncertainty requires a new approach, transcending the safety and security frameworks advanced in *Synthetic Genomics*. They propose, as an alternative, *preparedness*, and endeavor to explain how such an approach might be realized through Human Practices.

According to Rabinow, Bennett, and Stavrianakis:

As a technical term, preparedness is a way of thinking about and responding to significant problems that are likely to occur (e.g. a bio-terrorist attack or the spread of a deadly virus), but whose probability cannot be feasibly calculated, and whose specific form cannot be determined in advance. In the face of uncertainty, a logic of preparedness highlights the need for vigilant observation, regular forward thinking, and ongoing adaptation. As with matters of security, the [*Synthetic Genomics*] report identifies challenges of preparedness, but offers no concrete proposals for dealing with such challenges. n29

In linking "preparedness" to other aspects of Human Practices, such as collaboration, Rabinow's strategy for dealing with biosecurity issues would appear to involve reshaping scientific culture so it becomes more vigilant and more [*453] capable of managing uncertainty. Accepting that "preparedness" might subsume specific regulatory proposals, by offering a broad orientation in which specific regulations might be incorporated, it is far from obvious how this approach (and nomenclature) affords anything more concrete or viable than conventional approaches to uncertainty--such as those described in *Synthetic Genomics*--however familiar or flawed these might be.

Within the architecture of Human Practices, preparedness accords with Rabinow's commitment to the self-regulation (or internal regulation) of synthetic biology. Bioscientists, appropriately imbued via pedagogy and collaboration with human scientists, should have a sufficiently well-developed sense of flourishing to be trusted to undertake biological research with a sense of preparedness that would appropriately anticipate biosecurity issues and risks. Whether such a sense of flourishing would imbue bioscientists with the requisite skills to successfully undertake such a role is an obvious question. And such processes are likely to be far more demanding--to the extent that they are even possible or useful--than Rabinow implies.

In a recent Hastings Center report ethicist Michael Selgelid drew attention to some of the basic problems with proposals for scientific self-regulation in relation to bioterrorism:

Scientists might be best able to recognize a discovery's scientific or technical implications for making particular biological weapons, but they have no special expertise to determine the identity, abilities, or intentions of potential bioterrorists. And scientists have no special expertise to assess what the *security*--as opposed to health--implications of attack with particular biological weapons would be. n30

Amidst the criticisms of existing safety and security frameworks, Rabinow notes that part of their weaknesses stems from the inability to deal with (so-called "rogue") scientists not bound by scientific norms, and their failure to offer "concrete proposals." This last apprehension seems to be broadly based. The critique of *Synthetic Genomics* is, in consequence, exemplary. But this begs the question of how "preparedness" offers any substantial advance over existing approaches and known weaknesses. Interestingly, recourse to "preparedness" places the very norms and ethical sensibilities that are currently under considerable pressure from deregulation, privatization, commercialization (in the West), and the breakdown of governance structures through the fracturing of the states once composing the Soviet bloc in the East, under even [*454] greater strain. n31 Though sensitized to the need for policymakers to attend to developments and practices "upstream," Rabinow's approach implies a retreat from serious "downstream" engagement with science and scientific outputs and places considerable faith in surprisingly idealized bioscientific norms (more below). In this way the approach, thus far, seems naive in relation to both theorization and the possibility of constructing tangible spaces for effective upstream engagement.

The promotion of "preparedness" implies a strong capacity for collaboration between human scientists and bioscientists. Such collaborations, as Rabinow's own experience and frustration demonstrate (of this, more below), are fraught with difficulties. Moreover, in deference to his bioscientific collaborators, Rabinow and his Human Practices colleagues appear ill-prepared, and perhaps more poorly positioned, to prescribe, even in the most elementary terms, what types of regulation(s) and collaboration might assist with "preparedness" (and safety and security) and how they might facilitate "flourishing," along with the depth of collaboration required to generate the level of knowledge and competence needed to credibly regulate synthetic biological endeavors.

IV. UPSTREAM WITHOUT A PADDLE?

At this juncture we propose to consider how Rabinow's model of Human Practices might influence the development of synthetic biology and anticipate or ameliorate its social consequences. We aim to undertake this by: (A) unpacking the way Rabinow links "upstream engagement" with the *engineering ideal in American Culture*; (B) hypothesizing about what his visions for engagement might mean in practical settings involving interactions between law and the new biosciences; (C) interrogating "flourishing" and its apparently parochial implications; and finally, (D) noting that Rabinow's model of upstream engagement may not only be flawed in terms of its putative consequences but may not even be susceptible to instantiation.

A. Engineering Ideology in America

Proffering favorable parallels between the *engineering ideal* in American culture and the emergence of synthetic biology (along with a thinly veiled [*455] ironic allusion, to Fox Keller, that bioscientists will have a "feeling" for their organisms), from the outset Rabinow provides hints about his vision of the role of the analyst and its relationship to an engineering ethos. n32 On its face, the engineering ideology apparently motivating synthetic biology (and SynBERC) seems to leave limited scope for engagement with alternative conceptualizations of knowledge claims, or different interpretations of the direction of research, let alone provide the space or resources with which to contest the trajectories of technological innovation.

In a discussion paper endeavoring to explain the context for synthetic biology's embrace of the American engineering ideal, Rabinow drew upon the work of historian Philip Pauly:

It was early in the century that a move away from the holism of the living organism and its milieu as a privileged and distinctive site of bio-science initiated a century long process that Philip Pauly has aptly called "biological modernism." Pauly identifies a key aspect of this process of the entry into the life sciences of what he calls the American engineering ideal of "just do it," and figure out later what it means or why it works. n33

For Rabinow, the analyst appears to pay for his participation by becoming embedded--albeit upstream insofar as he is actually participating in the early phases of technical development--in a seemingly linear process of technological innovation and application. Unlike other recent attempts to facilitate upstream engagement in science projects and research--such as through nanotech juries and consensus conferences, which aim to shape the direction of research/knowledge--the engineering ethos implies an engagement with the assessment and/or amelioration of the impacts of *existing* products and prototypes. n34

An example that helps to illustrate the tendency for such an approach to drift into the realms of technological determinism and the promotion of "technological fixes" arises out of the claims made for one of SynBERC's most celebrated projects, the cheaper manufacture of a relatively scarce antimalaria medicine, artemisinin. Research and development funding for this project has been supplied by the Bill and Melinda Gates Foundation. While we do not quibble with the contention that the production of cheaper artemisinin via synthetic biology could save lives, particularly in developing countries, approaching the problem of malaria treatment/management from within an engineering framework may trivialize some of the broader social and economic factors involved in managing and

treating the disease.

[*456] In an overview of the ethics of synthetic biology, produced for the IDEA League Summer School, at Delft University of Technology, some of the social problems with such a narrow vision of the processes involved in technical innovation are brought into view:

Although a cheap drug against malaria would indeed save a lot of lives especially in poor Southern countries, it is the question whether the money invested in synthetic biology to create yeast strain to produce artemisinic acid . . . is the best and most efficient way of combating mortality of malaria. Farmers in East Asia and in some parts of Africa are growing wormwood or *artemisia annua* for drug production in developed countries and the farmers of wormwood would be out of business. There might be alternative ways of preventing people from dying from malaria, for example ways to prevent people from being bitten by malaria carrying mosquitoes. n35

Moreover, the synthetic production of artemisinin is likely to operate in conformity with existing patterns of subservience and dependency. For it is unlikely, under existing trade regimes and intellectual property agreements, that developing countries will be able to manufacture or purchase synthetically produced artemisinin at affordable rates. n36

Historically, and especially in the U.S. context, the "engineering ideal" signifies not only industrial technical experimentation, self-regulation, and rapid technical innovation, but simultaneously represents periodic failures, conflicts, lawsuits, and recriminations about paths both taken and avoided. n37 Rabinow's implicit rejoinder to the problem of the human scientist passively constrained in the frame of synthetic biology's engineering ideology is for their collaboration with bioscientists and engineers to facilitate processes of critical self- and social-reflection by these bioscientists about their work and its implications. Rabinow's analysis invests a high level of confidence in research scientists and engineers with a range of financial, professional, and personal interests in their research. n38 With something of a Saint Simonian view of benevolent technocracy, he suggests that the self-interests (especially prosperity) of bioscientists will have an easy correspondence with broader social ideals of prosperity (and flourishing). n39

B. The "Collaboratory" in the Courtroom

Having examined some of the broader issues of Rabinow's vision we can move to consider some of the implications for synthetic biology in legal [*457] contexts. This focus, well suited to an essay for a law and literature audience, may help us to consider the value of Rabinow's proposal for retheorizing evidence law, intellectual property, and even the regulation of biomedical and bioscientific research. We pay particular attention to possible implications of Rabinow's models of intense collaboration, which would, if successfully adopted (through the collaboratory), encourage the dissolution of traditional boundaries of expertise. n40

One point of departure is to consider the impact of new models of scientific practice and new models of collaboration on something as apparently mundane as admissibility jurisprudence. Significantly, scientific and technical evidence have, in recent decades, been credited with creating serious problems for courts in virtually all Western jurisdictions, but especially in Anglo-American adversarial legal cultures. n41 It is interesting to consider what the approach(es) promoted by Rabinow might offer to those involved in determining whether expert evidence should be admitted in legal proceedings, as well as how to understand bioscientific research and practice when applying intellectual property laws and/or adjudicating property rights (associated with new entities, processes and techniques).

While helping to draw attention to the complexity of bioscientific practice and collaboration, in pragmatic legal contexts the kinds of Human Practices approach being promoted would tend to substantially complicate practice with little conceptual or practical clarity and apparently few institutional benefits. n42 We accept that Rabinow's recognition of the multidisciplinary and even interdisciplinary dimensions of contemporary bioscience might capture some of the complexity of scientific practice and new types of institutionalization, but it is unlikely that U.S. courts would be particularly responsive to his extensive unfamiliar and idiosyncratic vocabulary to describe these new relationships.

n43

Furthermore, embedding social scientists or humanities scholars (such as Rabinow) with unclear (and even contested) status--regarding the nature and quality of their contribution to the production of synthetic biological knowledge/artifacts--would also be problematic in courts that may be confronted with the task of assessing or weighing the value of competing expert knowledge claims in the assessment of property rights, scientific outputs, or risks. U.S. courts have generally been reluctant to receive social scientists and humanists--even those with specialized research interests and experience in studying expertise, science, and technology--as expert witnesses where [*458] scientists, engineers, and technicians are available. n44 Human Practices personnel would probably have their participation in legal contexts, in disputes over ownership or regulation, limited to lay or eyewitness testimony. It would tend to be restricted to the provision of information about things like the dates when something was "discovered," observations about who "participated" in relevant work (based on ethnographic research or interactions with researchers), and possibly field notes to the extent that any of these might inform the reconstruction of events coproduced by the lawyers and scientists. n45

Things don't improve dramatically when we turn to intellectual property rights and the regulation and promotion of science and technology. If anything, property rights tend to reflect power relations and, in scientific research at least, will tend to indicate the perceived utility of Human Practices (and social scientists and humanists) to those involved in bioscientific research. Here, notwithstanding the fact that scientists and engineers have for decades confronted a range of formalized ethical, funding, regulatory, and legal hurdles, property rights have primarily been invested in scientists, engineers, and their institutions. The other major group to obtain property interests are those actually supplying the capital. Unlike other participants, those in the Human Practices Thrust may have to flourish and prosper largely (or entirely) without direct access to property rights and profits. For the inclusion of additional *participants* threatens to dilute any dividends by extending them to those whose input may be perceived as anything from limited or trivial to unnecessary and imposed. Unavoidably, ideas about flourishing and prosperity are indexed to perceptions about the utility of contributions. Of interest, even those currently central to the socioeconomic organization of bioscientific research, such as intellectual property lawyers, and to a lesser extent ethicists (and ethics panels), have obtained few of the financial benefits beyond, respectively, substantial fees and new types of employment, engagement, and status.

As for regulation, the new conceptual apparatus and innovative multidisciplinary collaborations seem set to circumvent traditional forms of appraisal and/or preempt intrusive constraints (imposed by *outsiders*, particularly those "downstream"). Instructively, recent criticisms of biomedical research suggest that commercial sponsorship, and recourse to private research institutions (rather than universities and academic health centers) to conduct clinical trials, along with the suppression of *unfavorable* results, has afforded Pharma much greater control over the approval of drugs and therapeutics. n46 Notably, [*459] assessments of what counts as "unfavorable" tend to be as sensitive to marketing potential, profits, and corporate image as to efficacy and safety.

In recent decades there has been widespread condemnation of the deregulation of biomedical research--along with the fees and negotiation associated with the consensus regulation of pharmaceuticals and therapeutic goods. n47 One of the primary issues is concern that consensus regulation has made regulators familiar with and even financially dependent on those they are responsible for regulating. A considerable portion of the FDA budget, for example, is dependent on the fees paid by those whose products are being assessed. Regulators, in consequence, have been funneled into an asymmetrical, yet increasingly dependent, relationship. Research scientists are also exposed to conflicts of interests through their direct relations with private corporations and ownership of shares and/or property rights in the products they are developing. n48 Such conflicts of interest and the influence of private (i.e., for-profit) sponsors have created serious difficulties for medical practitioners and the technically competent staffs administering the leading biomedical journals. n49 Are there grounds for believing that embedded anthropologists (or other human scientists), whose prospects may be dependent upon the success of bioscientific research groups, will afford more effective forms of participation and regulation (regardless of whether they have an enhanced appreciation of the ways the research is being undertaken)? Will the participation of potentially interested nonscientists improve safety and security or will it facilitate further deregulation?

We can obtain some sense of the difficulties not only of regulation, but even of collaboration and participation, if we consider research into biofuels or the creation of new types of biological weapons. We can, for example, imagine some scientists and human scientists believing that attempts to develop biofuels may be inappropriate given the food implications for many of those living in developing countries. (This resonates with the earlier reference to artemisinin.) Principled objections to new types of biological weapons probably require even less explanation. Yet, if a human scientist was opposed to the use of biofuels or weapons research on principle (or for any reason—including conflicts of interest), would she be able to meaningfully participate in the collaboratory? If so, is her role one of "sabotage," or should she participate in an attempt to persuade? Based on Rabinow's experience in SynBERC, we wonder whether those with critical perspectives would ever be granted genuine opportunities to collaborate or flourish.

[*460] Here the possibility of participation and engagement might be illuminated by the experiences of jurors in death penalty cases. Typically, only those who believe in the death penalty and would, in principle, be willing to convict can serve on a jury in capital trials. It might not be considered insignificant that those who believe in the death penalty seem to be far more ready to convict. Jurors less committed to capital punishment, along with criminal defendants, often find it more difficult to flourish in these pro-death contexts. This leads us to ponder whether those embedded in synthetic biology collaborations—whether scientists or nonscientists—are typically positively disposed to the kinds of research and practice undertaken. And, if so, what effects will such dispositions exert on the potential for, and interest in, upstream regulation. To the extent that those involved in Human Practices are conflicted through property rights, rewards, ideological alignments, and even continuing employment, the hope of meaningful regulation, the interests of broader publics, and responses to critics would all seem to be at risk.

C. Flourishing in Perspective

Another problem, indexed to both the regulation and the success of synthetic biology and Human Practices, relates to "flourishing" and its reach. Most of the discussion of flourishing (and prosperity) in Rabinow's essay is directly linked to individual scientists and engineers with the hope that any localized success will somehow flow on to human scientists and trickle down to the broader U.S. society. There seems to be little concern about, or consideration of, the implications of these new types of organizations and interactions—euphemistically characterized as collaborations—for individuals and communities beyond the collaboratory.

In the way it manifests in Rabinow's writings, flourishing seems to be a particularly parochial concept. It is perhaps unremarkable to find that there is less discussion of the apparently important biosecurity dimensions, the implications of this work and what they might mean for those endeavoring to flourish in foreign domains or U.S. veterans' hospitals. We are left to wonder about the respective application of flourishing to those involved in producing biological weapons and those upon whom they are aimed (or might be aimed). We might also wonder about the appropriateness of a term such as "flourishing" to represent the success and prosperity of those involved in the generation of products, such as genetically modified foods, that have been opposed (on [*461] whatever grounds) by citizens in many liberal democracies. Though not considered, there may be tensions between localized flourishing within scientific research collectives and the vibrancy of participatory democracy. n50

One of the curious features of Rabinow's work is the failure to theorize the relationship between parochial forms of prosperity, flourishing, and security and their implications for the prosperity, flourishing, and security of more remote national and international communities and individuals. On what basis does Rabinow, or his bioscientific collaborators, represent or accommodate the interests of others or their hopes, aspirations, and visions for the good life?

D. Collaboratory Life: Collaboration or Capture?

Notwithstanding their putative inevitability, the kinds of multidisciplinary collaborations advanced in Rabinow's writings seem to be fraught with practical difficulties. Unfortunately, these practical problems tend to be treated in an ironic or playful register. This response tends to supplant any systematic endeavor to consider their implications for the collaboratory or the development of pragmatic ways of addressing them.

From the outset, it would appear that even though synthetic biologists may acknowledge some of the social implications of their work, they maintain a conspicuous preference for forms of self-regulation. n51 Through reference to the origins of SynBERC, Rabinow and Bennett provide glimpses into strains that pre-date the Human Practices initiative. Even before Human Practices was conceived, there were tensions in the attempt to incorporate ethical, legal, and political considerations into SynBERC's broader scientific and technical agenda.

Rabinow was not in fact the first human scientist attached to the consortium. The NSF awarding the SynBERC grant was contingent upon the inclusion of an ethics component. To satisfy this condition, Stephen Maurer, a lawyer and adjunct professor in economics at Berkeley, entered the project. This first generation of human science engagement in SynBERC was short-lived. Maurer proposed mechanisms to monitor "experiments of concern" and procedures for the community of synthetic biologists to vote on a set of controls to govern their relationship with the emerging DNA synthesis industry. These proposals were ultimately published in a report funded by the Sloan Foundation but were not incorporated into SynBERC's operations. n52 According to Rabinow [*462] and Bennett, the ethics component of SynBERC broke down amid personality conflicts and disagreements over who would set the terms for governance and regulation. n53 In the wake of this breakdown Rabinow and Ken Oye, a professor of political science at MIT, were invited to take (over) responsibility for the ethics/human sciences component of SynBERC. n54

Prior to his involvement with SynBERC, Rabinow was attentive to synthetic biology through his anthropological studies. He had, not insignificantly, been an invited speaker at the first two international synthetic biology conferences at MIT in 2004 and Berkeley in 2006. n55 Rabinow recounts how the invitation to join SynBERC offered an exciting opportunity to reinterpret the mandate from the NSF to incorporate ethical and social issues into its operations:

[I]t would be an exciting challenge to try to think through and put into practice a "post ELSI" [Ethical Legal and Social Impacts] program. What this implied is that the mandated ethical, legal, and social implications program of the Human Genome Sequencing Initiative could not serve as a model for the future. Essentially the ELSI model (to simplify but not betray) had a mandate to work outside and downstream of the technical and scientific work. ELSI's directive was to deal with consequences, specifically "social consequences." There was a broad agreement that at SynBERC (as well as at the NSF funded nano-technology centers) the ethics work should be conducted alongside and collaboratively with the engineering programs. n56

It would appear that Rabinow's more overt attempts at upstream engagement have also encountered difficulties. Rabinow notes that participation in the SynBERC collaboration has not always been smooth and that the power relations between the elite bioscientists, engineers, and human scientists place the last in a position of (continuing) subservience and vulnerability. We are told, for example, that "the PIs of Human Practices have been threatened in an e-mail with replacement, in what can be legitimately taken as a petty example of authoritarian power, unless we 'got along.'" Moving into a more ironic register, Rabinow suggests that "[u]pon reflection, and acknowledging our desire to prosper, we are now getting along." n57 By way of conclusion Rabinow indicates that he has developed an indignant resolve--"a cold vehemence"--to survive and gain "a more just recognition" of the "substantial efforts and contributions" delivered by the Human Practices strand of SynBERC. n58

[*463] Perhaps a little obliquely, Rabinow acknowledges the considerable difficulties he has encountered communicating his Human Practices vision to the scientists involved in SynBERC's other Thrusts. Indeed, continued engagement seems to be contingent on compromising the breadth of his original vision. Even though Rabinow's vision for participation is more abstract than many other attempts at upstream engagement in science, is less prescriptive, and carries fewer obvious agendas (e.g., most commonly some notion of participatory democracy), he would appear to confront problems similar to other attempts at engagement with the sciences by social scientists and humanists. n59 Residing discourses are strongly shaped by rationalist or pragmatic orientations. Even though Rabinow's efforts acknowledge the pragmatic dimensions of undertaking bioscientific research, he appears to have difficulty articulating precisely what he can offer as a social scientist/humanist. Moreover, by conceding that so much of what is at stake depends on emergent and contingent properties and activities, he is left defending a space for involvement without a

clear or prescriptive account of what the human scientist can actually do if such a space is secured. There is, in addition, little reflection on the costs or constraints of inclusion.

Aside from the frustrations caused by his subservient position in the power relations at SynBERC, we are tempted to suggest that Rabinow is suffering from an inability to characterize his professional identity. n60 While the scientists and engineers in the other Thrusts may well have hybrid identities as scientist/entrepreneur, be conversant with ethics and regulatory requirements and even with the broader political implications of their research, they nevertheless gain significant legitimacy and power from their primary identity and work qua scientists and engineers. n61 If SynBERC abandoned its Human Practices strand/prentensions it would still produce outcomes and outcomes that may not be conspicuously different. There are questions about whether Thrust 4 makes a difference to the social desirability of research and results, or the direction of research, or any substantial difference at all.

It is interesting to note that the difficulties experienced by Rabinow's largely experimental Human Practices approach are not altogether new or, perhaps, so surprising. In "Prosperity, Amelioration, Flourishing" he acknowledges drawing inspiration from the philosophy of John Dewey. Rabinow alludes to Dewey's contention that for political action to be effective it needs to be experimental and emergent, reaching beyond tradition and custom. Anticipating Rabinow's own difficulties, Dewey's "movement" was [*464] not favored by the scientists of his own time. Political philosopher Stephen Turner explains:

John Dewey, in such works as *Human Nature and Conduct*, pronounced the experimental method to be the greatest of human achievements, and he promoted the idea of its application to human affairs, replacing "custom" and attainment of traditions, such as constitutional traditions, as a basis for political action. Yet Dewey distinguished the techniques of science from the spirit: he wanted the spirit, and its creativity, in politics, but not the techniques or the experts that employed them, or the experts themselves, who he dismissed as specialists and technicians whose work needed to be "humanized." This reasoning, and the movement it represented, was not attractive to scientists themselves. n62

V. CONCLUSION

Though not readily accessible to many readers, several basic ideas can be distilled from Rabinow's rich assortment of distinctions, categories, and programmatic analysis. Rabinow appears to believe that synthetic biology should adopt a sophisticated form of self-regulation, predicated upon a reconfiguring of the norms, methods, and practices of bioscientists--though he uses the more elaborate concept of "equipment" to capture these processes. Reconfiguring is presented as a process of learning, somehow precipitated by collaboration between human scientists and bioscientists. In places Rabinow suggests that such collaboration and pedagogy are integral features of the engineering ethos of the new biosciences and, if not inevitable, then highly likely to eventuate. He never explains, however, why such collaborations are in fact inevitable and, in seeming contradiction, at times expresses frustration because attempts to facilitate or participate in these forms of collaboration are actually difficult. A convincing case for why synthetic biology needs such "equipment" is not provided, nor how new norms, methods, and practices can be reinforced and reproduced in the communities engaged in synthetic biological research and practice. It is not always obvious why pragmatic and entrepreneurial scientists and engineers should be inclined to engage, or engage earnestly, with those in Human Practices.

In this area, despite his obvious debts to Michel Foucault and the subtle and reflexive vocabulary Rabinow uses to describe matters of epistemology, (perhaps unwittingly) he appears to have much in common with the sociologist [*465] Robert Merton. During the 1930s and 1940s Merton offered what has become a highly influential account of scientific norms and their social functions. This early work--influenced by Weber, though written largely in response to the rise of Fascism in Europe and concerns about its impact on scientific research--suggested that norms such as *universalism, communism, disinterestedness, and organized skepticism* were central to scientific activity and progress. n63

Since they were originally proposed, Merton's norms have been subjected to considerable criticism. Those engaged in the empirical study of scientists and engineers--particularly historians and those involved in ethnographic studies of scientists, engineers, and their laboratories--have not generated evidence to support the contention that Mertonian-style norms guide (or have guided) the practices of scientists. n64 Rather, their currency seems to be more easily linked to various prefigured epistemologies of science (i.e., Mertonian norms should exist if science's objectivity is to be guaranteed) and they have been invoked as part of the public ideology of science. Interestingly, while idealized norms do not seem to be an essential feature of scientific practice, recent commercialization of many areas of biomedical science has introduced conspicuous tensions (e.g., private sponsorship and conflicts of interest) that make their maintenance even as part of the aspirational public culture of science ever more challenging. n65

Rabinow's ideas about "prosperity" and "flourishing" distinguish his work from the simplistic models associated with Merton's early sociological offerings. Nevertheless, Rabinow's essay resonates with a Merton-type program. For his theoretical stance routinely implies or assumes the existence of ideal norms and social practices that are necessary (or intrinsic) to the successful practice of synthetic biology. Rabinow and those committed to the Mertonian framework gain greater warrant for their claims by insisting that the normative structure they have identified (for science) is intrinsic to science's survival rather than a code of practice or desirable state of affairs.

Understandably, Rabinow wishes to go beyond merely suggesting the desirability of upstream engagement in synthetic biology. However, he seems to warrant the involvement of Human Practices on the basis that it is somehow intrinsic or necessary to the evolution of new norms. In adopting such a posture Rabinow inherits extensive criticism of scientific norms. In particular, the contention that most normative systems have limited correspondence with the behavior of scientists; are not necessary for scientific success (for Rabinow "flourishing" and "prospering"); and raise questions about whether they [*466] should even be encouraged as desirable forms of behavior. Interestingly, notwithstanding extensive and persuasive critiques, Merton's norms of science have, as descriptions and aspirational ideals, achieved some resonance with the historical rhetoric and vocabulary of scientists. By contrast, it is less likely that Rabinow's complex vocabulary will be as accessible to practicing scientists, regardless of whether or not his nomenclature represents an improved approach to the practice and understanding of bioscientific research. n66

We hope that Rabinow will continue his path of reflection in relation to the difficulties of successful collaboration and consider whether he has adequately characterized the features of the emerging engineering ethos of synthetic biology. While Rabinow may have successfully identified the entrepreneurial vigor and multidisciplinary of synthetic biology, he may have failed to appreciate that the scientists and engineers may not require the type of contributions he aspires to provide. It may well be that rather than critique from the inside, the emerging engineering ethos associated with synthetic biology may require more intensified forms of (traditional models of) technology assessment and regulation. The capacity to evaluate the directions of new types of research at arm's length may well be a precondition to maximizing its social benefits so as to flourish rather than flounder. Instead of dealing with the failure of collaboration ironically, it may be that there is a need to retheorize engagement and/or consider the renewed importance of external forms of regulation.

Legal Topics:

For related research and practice materials, see the following legal topics:

Copyright Law
Subject Matter
Literary Works
Scope of Protection
Evidence
Scientific Evidence
DNA
Securities
Law
Self-Regulating Entities
General Overview

FOOTNOTES:

n1 The authors would like to thank Elizabeth Silk for her research assistance.

n2 Rabinow has received a number of prestigious awards for his work including the *Chevalier de l'Ordre des Lettres* from the French Government (1998) and the University of Chicago Alumni Association Professional Achievement Award (2000). On his contributions to biopower, see Paul Rabinow & Nikolas Rose, "Biopower Today," 1 *BioSocieties* 195 (2006); Paul Rabinow & Carlo Caduff, "Life--After Canguilhem," 23 *Theory, Culture & Society* 329 (2006); Peter Shorett, Paul Rabinow & Paul R. Billings, "Commentary: The Changing Norms of the Life Sciences," 21 *Nature Biotechnology* 123 (Feb. 2003).

n3 The SynBERC Web site is at <http://www.synberc.org/>.

n4 Andrew Balmer & Paul Martin, *Synthetic Biology: Social and Ethical Challenges* (Nottinghamshire: Institute for Science & Society, 2008), 7; Parliamentary Office of Science & Technology, Synthetic Biology Postnote 298 (Jan. 2008), www.parliament.uk/documents/upload/postpn298.pdf. For a comprehensive overview of the social aspects of the emerging field of synthetic biology see the SYNBIOSAFE [Safety and Ethical Aspects of Synthetic Biology] Web site at <http://www.synbiosafe.eu/>. The SYNBIOSAFE Web site is sponsored by the European Union and coordinated by Markus Schmidt of the Organization for International Dialogue and Conflict Management, Austria.

n5 Jonathan Tucker & Raymond Zilinskas, "The Promise and Perils of Synthetic Biology," 12 *The New Atlantis* 15 (Spring 2006).

n6 The First International Meeting on Synthetic Biology was held at MIT (June 10-12, 2004).

n7 Alan Moses, "Intelligent Design: Playing with the Building Blocks of Biology," 8 *Berkeley Science Review* 34 (2005).

n8 Several other essays of relevance are available online. See Paul Rabinow, "Test Case. Trust but No Confidence: Benign Indifference or Malign Neglect in Synthetic Biology," *Connexions*, Dec. 9, 2008, available at <http://cnx.org/content/m18828/1.1/> (accessed Sept. 1, 2009); Gaymon Bennett & Paul Rabinow, "Invitation: Synthetic Biology and Human Practices: A Problem," *Connexions*, Dec. 9, 2008, available at <http://cnx.org/content/m18812/1.2/> (accessed Sept. 1, 2009).

n9 It is worth noting that narratives about origins, paradigmatic shifts, and future directions of emerging scientific disciplines can play important political roles in shaping both the assessment of their implications and their ongoing development. Some interesting parallels can be drawn with accounts about the "revolutionary" developments in nanotechnology. See, e.g., Cyrus Mody, *Why History Matters in Understanding the Social Issues of Nanotechnology and Other Converging Technologies* (Philadelphia: Chemical Heritage Foundation, 2008); Arie Rip, "Folk Theories of Nanotechnologists," 15 *Science as Culture* 349 (2006); Christopher Coenen,

"Utopian Aspects of the Debate on Converging Technologies," in *Assessing Societal Implications of Converging Technological Development*, ed. Gerhard Banse, Armin Grunwald, Imre Hronszky & Gordon Nelson (Berlin: ITAS preprint, 2007), available at <http://www.itas.fzk.de/deu/lit/epp/2007/coen07-pre01.pdf> (accessed Sept. 21, 2009).

n10 Paul Rabinow, "Prosperity, Amelioration, Flourishing: From a Logic of Practical Judgment to Reconstruction," 21 *Law & Literature* 302 (2009).

n11 *Id.*

n12 *Id.*

n13 Paul Rabinow, "The Biological Modern," *ARC Concept Note* No. 6 (Feb. 2, 2006), 12 (emphasis in original) available at <http://anthropos-lab.net/wp/publications/2007/08/conceptnoten06.pdf> (accessed Sept. 21, 2009).

n14 Where we refer to human sciences it is our intention to include both social scientists and humanities scholars.

n15 Rabinow, *supra* note 10, at 303 (emphasis added).

n16 See SynBERC, *supra* note 3.

n17 Rabinow, *supra* note 10, at 303.

n18 Rabinow, *supra* note 10, at 303-04. Taking Dewey's advice literally, Rabinow makes little attempt to engage or even reference extensive literatures on the sociology and anthropology of science, technology, and engineering. Consider Sheila Jasanoff, Gerald Markle, James Petersen & Trevor Pinch, eds., *Handbook of Science and Technology Studies* (Thousand Oaks: Sage, 1995) and Edward Hackett, Olga Amsterdamska, Michael Lynch & Judy Wajcman, eds., *The Handbook of Science and Technology Studies* (Cambridge, MA: MIT Press, 2007).

n19 Rabinow, *supra* note 10, at 304 (footnote omitted).

n20 *Id.* at 305 (emphasis in original).

n21 *Id.* There are now undergraduate courses in synthetic biology and competitions where students are challenged to build functional devices out of biological parts. See Erika Check, "Designs on Life," 438 *Nature* 417 (November 2005).

n22 Rabinow, *supra* note 10, at 305.

n23 *Id.* at 307.

n24 Paul Rabinow, Gaymon Bennett & Anthony Stavrianakis, "Response to Synthetic Genomics: Options for Governance," *ARC Concept Note* No. 10, (Dec. 5, 2006), available at <http://anthropos-lab.net/wp/publications/2007/08/conceptnoten010.pdf> (accessed Sept. 21, 2009).

n25 Michelle Garfinkel, Drew Endy, Gerald Epstein & Robert Friedman, *Synthetic Genomics: Options for Governance* (Rockville MA: J. Craig Venter Institute, CSIS, 2007). This report was circulated in December 2006 and published the following October.

n26 Rabinow, Bennett & Stavrianakis, *supra* note 24.

n27 *Id.*

n28 *Id.*

n29 *Id.*

n30 Michael Selgelid, "A Tale of Two Studies: Ethics, Bioterrorism, and the Censorship of Science," 37 *Hastings Center Report* 35, 41 (2007).

n31 Stephen Collier, Andrew Lakoff & Paul Rabinow, "Biosecurity: Towards an Anthropology of the Contemporary," 20 *Anthropology Today* 3 (Oct. 2004).

n32 Evelyn Fox Keller, *A Feeling for the Organism: The Life and Work of Barbara McClintock* (San Francisco, CA: Freeman, 1983).

n33 Rabinow, *supra* note 13, at 4. The rhetorical links between molecular biology and its commercial potential have been present from the time of its initial appearance, particularly in the work of James Watson. See S. Michael Halloran, "The Birth of Molecular Biology: An Essay in the Rhetorical Criticism of Scientific Discourse," in *Landmark Essays on Rhetoric of Science*, ed. Randy Allen Harris (Hillsdale, NJ: Lawrence Erlbaum Associates, 1997).

n34 This should not be taken to imply that attempts at upstream engagement are always straightforward or successful. For a brief discussion of initiatives associated with nanotechnology in the UK, see Nick Pidgeon & Tee Rogers-Hayden, "Opening Up Nanotechnology Dialogue with the Publics: Risk Communication or 'Upstream Engagement,'" 9 *Health, Risk & Society* 191 (2007). For a recent overview of these issues, see Alan Irwin, "STS Perspectives on Scientific Governance," in Hackett et al., *supra* note 18, at 583-607.

n35 See the discussion in Synthetics: The Ethics of Synthetic Biology, IDEA League Summerschool, The Netherlands (Aug. 2007), Delft University of Technology, http://www.ethicsandtechnology.eu/images/uploads/Ethics_of_synthetic_biology.pdf (accessed Sept. 1, 2009), and Willem Heemskerk, Henk Schallig & Bart de Steenhuijsen Piters, *The World of Artemisia in 44 Questions* (Amsterdam: The Royal Tropical Institute of the Netherlands, 2006) available at <http://www.kit.nl/smartsite.shtml?id=5564> (accessed Sept. 1, 2009).

n36 Obviously, these arguments will vary depending on who owns the IP and how any product is manufactured and distributed. While tree cropping might not represent large numbers of jobs, the example indicates how particular technological frames might obscure implications or even close off alternatives.

n37 Sheila Jasanoff, *Science at the Bar: Law Science and Technology in America* (Cambridge, MA: Harvard University Press, 1995).

n38 By way of a thought experiment, we wonder whether having human scientists in U.S. banks would have influenced banking practices in ways that might have limited or reduced the recent (i.e., 2008-2009) series of collapses. Here, again, it is useful to reflect upon self-regulation by interested participants and what flourishing might mean, and for whom.

n39 For a classic overview of various traditions and different interpretations of the meanings of technocracy, consider David Elliot & Ruth Elliot, *The Control of Technology* (London: Wykeham Publications, 1976), 51-101.

n40 Hedgecoe and Martin suggest that notwithstanding claims that genomics has been transformational in terms of scientific knowledge, practices, and forms of public engagement, a more realistic assessment would address the unevenness of changes corresponding with different regulatory regimes and local political cultural and institutional factors. While Rabinow may be correct in identifying changes in patterns of laboratory practices and fields of expertise, his tendency to extrapolate and generalize patterns and the consequences of such changes might be difficult to sustain empirically. We will return to these points later in this essay. See Adam Hedgecoe & Paul Martin, "Genomics, STS, and the Making of Sociotechnical Futures" in Hackett et al., *supra* note 18, at 817-39.

n41 Jasanoff, *supra* note 30; David S. Caudill & L.H. LaRue, *No Magic Wand: A Non-Romantic View of Expert Testimony* (Washington, D.C.: Center for Public Justice, 2006).

n42 To be fair, we understand that Rabinow has not turned his attention to this issue, but his reconceptualization does embody a range of implications and potentials that are worth contemplating. Here, we do not mean to suggest that the current state of affairs is ideal. As things stand, *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993) represents a confused model of science and is operationalized in ways that are not merely inconsistent but often lack principle. See Gary Edmond & David Mercer, "Daubert and the Exclusionary Ethos: The Convergence of Corporate and Judicial Attitudes towards the Admissibility of Expert Evidence in Tort Litigation," 26 *Law & Policy* 231 (2004).

n43 See Gary Edmond & David Mercer, "Conjectures and Exhumations: Citations of History, Philosophy and Sociology of Science in US Federal Courts," 14 *Law & Literature* 309 (2002).

n44 It would be our contention that metascientists in other traditions might offer more serviceable models, ironically, better suited to the exigencies of practice. Though, as the discussion by Lynch and Cole suggests, such interactions can be complex and protracted. See Michael Lynch & Simon Cole, "Science and Technology Studies on Trial: Dilemmas of Expertise," 35 *Social Studies of Science* 269 (2005). See also Harry Collins & Robert Evans, *Rethinking Expertise* (Chicago: University of Chicago Press, 2007).

n45 Kara Swanson, "Biotech in Court: A Legal Lesson on the Unity of Science," 37 *Social Studies of Science* 357 (2007); Alberto Cambrosio, Peter Keating & Michael MacKenzie, "Scientific Practice in the Courtroom: The Construction of Sociotechnical Identities in a Biotechnology Patent Dispute," 37 *Social Problems* 275 (1990); Sheila Jasanoff, ed., *States of Knowledge: The Co-Production of Science and the Social Order* (London: Routledge, 2004).

n46 See Gary Edmond, "Judging the Scientific and Medical Literature: Some Legal Implications of Changes to Biomedical Research and Publication," 28 *Oxford Journal of Legal Studies* 523 (2008).

n47 Sheldon Krimsky, *Science in the Private Interest* (Lanham: Rowman & Littlefield, 2003); Wendy Wagner & Rena Steinzor, eds., *Rescuing Science from Politics: Regulation and the Distortion of Scientific Research* (Cambridge: Cambridge University Press, 2006).

n48 Phil Fontanarosa, Annette Flanagin & Catherine DeAngelis, "Reporting Conflicts of Interest, Financial Aspects of Research, and Role of Sponsors in Funded Studies," 294 *JAMA* 110 (2005); Annette Flanagin, Phil Fontanarosa & Catherine DeAngelis, "Update on JAMA's Conflict of Interest Policy," 296 *JAMA* 220 (2006); Sheldon Krimsky, "Small Gifts, Conflicts of Interest, and the Zero-Tolerance Threshold in Medicine," 3 *American Journal of Bioethics* 50 (2003). See *infra* note 65.

n49 The Cochrane Collaboration and the efforts by the International Committee of Medical Journal Editors are examples of attempts to overcome some of these problems. See International Committee of Medical Journal, eds., *Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication* (2005), <http://www.ICMJE.org>.

n50 Stephen Turner, "What Is the Problem with Experts?," 31 *Social Studies of Science* 123 (2001); Alan Irwin & Mike Michael, *Science, Social Theory and Public Knowledge* (Maidenhead: Open University Press, 2003).

n51 Marcia Stone, "Life Redesigned to Suit the Engineering Crowd," 1 *Microbe* 566 (2006); Hans Bugl et al., "DNA Synthesis and Biological Security," 25 *Nature Biotechnology* 627 (2007); Laurie Zoloth, "Ethical Issues in Synthetic Biology: Security and Regulation in Experiments of Concern," A White Paper on the Ethics of Self-Governance in New Scientific Community (Chicago: Town Hall Meeting Series, Center for Bioethics, Science and Society, Northwestern University, 2006), available at <http://www.synbioproject.org/topics/synbio101/bibliography/governance/> (accessed Oct. 10, 2009).

n52 Garfinkel et al., *supra* note 25.

n53 Bennett & Rabinow, "Invitation: Synthetic Biology and Human Practices," *supra* note 8.

n54 At the time of writing (December 2008--February 2009) we are reliant upon accounts by Rabinow and Bennett. Maurer, and others who were involved, may or may not publish their versions of the matter in due course.

n55 Bennett & Rabinow, "Invitation: Synthetic Biology and Human Practices," *supra* note 8, at 2-3 (Synthetic Biology 1.0: The First International Meeting on Synthetic Biology, MIT (June 10-12, 2004); Synthetic Biology 2.0: The Second International Meeting on Synthetic Biology, UC Berkeley (May 20-22, 2006)).

n56 *Id.* at 5.

n57 Rabinow, *supra* note 10, at 318. See also the works cited in note 7.

n58 Rabinow, *supra* note 10, at 318. Perhaps revealingly, this episode reminded us of some of the interactions between the poor and those with power and affluence in Scott's studies of peasant resistance. See James Scott, *Weapons of the Weak: Everyday Forms of Peasant Resistance* (New Haven, CT: Yale University Press, 1985) and James Scott, *Domination and Arts of Resistance: Hidden Transcripts* (New Haven, CT: Yale University Press, 1990).

n59 Consider, for example, the problems encountered by analysts in the debate between Collins, and Richards, Martin and Scott: Pam Scott, Evelleen Richards & Brian Martin, "Captives of Controversy: The Myth of the Neutral Social Researcher in Contemporary Scientific Controversies," 15 *Science, Technology, & Human Values* 474 (1990); Harry Collins, "Captives and Victims: Comment on Scott, Richards and Martin," 16 *Science, Technology & Human Values* 249 (1991); Brian Martin, Evelleen Richards & Pam Scott, "Who's a Captive? Who's a Victim? Response to Collins' Method Talk," 16 *Science, Technology, & Human Values* 249 (1991).

n60 For the classic STS formulation of the processes of scientists establishing and demarcating their professional identities, see Thomas Gieryn, "Boundary Work and the Demarcation of Science from Nonscience: Strains and Interests in Professional Ideologies of Scientists," 48 *American Sociological Review* 781 (1983); David Mercer, "Seen but Not Heard? Assessing the Impact of STS in Legal and Regulatory Settings Involving Controversial Science," in *Yearbook 2005 of the Institute for Advanced Studies on Science Technology and Society*, ed. Arno Bammé, Gunter Getzinger & Bernhard Wieser (Wien: Profil Munchen, 2005); Simon Cole, "A Cautionary Tale about Cautionary Tales about Intervention," 16 *Organization* 121 (2009).

n61 David Mercer, "Hyper Experts and the Vertical Integration of Expertise in EMF/RF Litigation," in *Expertise in Regulation and Law*, ed. Gary Edmond (Aldershot: Ashgate Press, 2004), 85-97.

n62 Stephen Turner, "The Social Study of Science before Kuhn," in Hackett et al, *supra* note 18, at 41-42.

n63 Robert Merton, *The Sociology of Science: Theoretical and Empirical Investigations* (Chicago: University of Chicago Press, 1973), 266-78. "Communalism" and "communality" are often substituted for "communism."

n64 Michael Mulkay, "Norms and Ideology in Science," 4 *Social Sciences Information* 637 (1979); Ian Mitroff, *The Subjective Side of Science* (Amsterdam: Elsevier, 1974).

n65 Consider Kenneth Rothman, "Conflict of Interest: The New McCarthyism in Science," 269 *JAMA* 2782 (1993); Mario Biagioli, "Aporias of Scientific Authorship: Credit and Responsibility in Contemporary Biomedicine," in *The Science Studies Reader*, ed. M. Biagioli (New York: Routledge, 1999), 26; and Philip Mirowski & Mirjam Sent, eds., *Science Bought and Sold: Essays in the Economics of Science* (Chicago: University of Chicago Press, 2002).

n66 Mulkay, *supra* note 64.



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SYMPOSIUM ON PAUL RABINOW'S PROSPERITY, AMELIORATION, FLOURISHING: FROM A LOGIC OF PRACTICAL JUDGMENT TO RECONSTRUCTION--AN ACCOUNT OF HIS WORK WITH SYNBERC: Reply to the Respondents

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SUMMARY:

... Two years ago, the discordancy we were addressing was relatively abstract insofar as SynBERC was just getting organized; there was an air of discursive openness that later proved to be for the most part transitory. ... What is less obvious (and perhaps more typical) is the case of top-flight (at least in their own eyes) researchers whose curiosity remains active, but highly selective, tightly boundary-defined and well defended by an array of self-justificatory and self-limiting practices, many of them tacit and dispositional. ... An approach to a situation of discordancy that extends

beyond the technical and immediately institutional--denial, indifference, neglect, dismissal--is almost without exception what we practitioners of the human sciences have encountered. ... It would have provided a false set of solutions to a complicated and emergent set of security issues; to an unresolved set of tensions between open-source and entrepreneurial aspirations; to a mode of practice that was ethically superior, collaboration not cooperation. ... Of course we could cite in our defense of a longer and richer tradition of thought and critique, similar claims from Max Weber, Ludwig Fleck, Gaston Bachelard, Georges Canguilhem, and Hans Blumenberg, among many others. ... Returning to Merton's infamous assertions about scientific norms, we think it is helpful to pose the question: what are the norms governing STS? ... By identifying sites of discordancy and the limitations of practices, Mullender's consideration of negligence, despite obvious topological differences between English law and synthetic biology, reveals and opens up the possibility of collaboratively exploring a problem space. ... The mode of this practical reflection is one in which an obligation to care and the expansion and refinement of legal reasoning become dispositions for lawyers, judges, and the community alike. ... He also shows how the introduction of metrics of neighbor-regard and mutual flourishing provide a means by which judges have reconciled tensions and impasses involving deontological and consequential-based modes of reasoning by backgrounding the priority of principles and foregrounding case-based considerations.

TEXT:

[*471] Denunciation, indifference, and disciplinary boundary maintenance are the taken-for-granted norms of much of academic life such that when one encounters generosity, serious engagement, and expansive criticism there is a distinct and pleasurable affect of revitalization, a flicker of hope. Furthermore, when such a response comes from people one does not know personally, the gratification is all the greater.

Without over-schematizing, the responses found here can be placed into two groups:

- . Those that find something of interest in the essay and its topics, themes, and claims under discussion and take what they have found to their home domains as a catalyst for further reflection and elaboration.
- . Those that find deficit and error and who respond in a tone of what Michel Foucault used to call "*petite pedagogie*" or disciplinary lesson-giving.

One might say that the second group adopts a mode of discipline and punish while the first practices a mode of discipline and flourish.

RECAPITULATION, REFORMULATION

As the writing of the essay under discussion, the generous hospitality and reception at Haverford, as well as the larger experiment with SynBERC that is described in the article under discussion, all took place in the recent past [*472] (a mere blink in ordinary academic time but actually a rather extended duration for technoscience and its participant observers), it seems appropriate to frame the response, at least in part, as an updating, a report, a reformulation.

The original paper was a kind of programmatic statement, an initial response to what Dewey called discordancy. By this he meant a breakdown of meaning and practice in a specific situation. Such discordancies for Dewey were the occasion, the catalyst, and the object of thinking. Two years ago, the discordancy we were addressing was relatively abstract insofar as SynBERC was just getting organized; there was an air of discursive openness that later proved to be for the most part transitory. As in all things human, and especially in the protected game park of the academy, demonstrations of pettiness and grandeur were present in unequal proportions; the actors embodying them and the institutions and disciplines in which they were embedded proved to be, as one would expect given the vastly different strategic resources available to them, unequal sparring partners. While the manifestations of these human dispositions were frequently frustrating, there was nothing surprising in the maximization strategies that proliferated: ordinary careerism, predefined self-interest, and from time to time, an indisputable passion for the specific challenges at hand.

What was most disheartening, however, was, and is, not the array of human limitations but rather the steadfast lack

of a broad curiosity on the part of the engineers, molecular biologists, and chemists (and their students). It can plausibly be claimed that the lack (or death) of curiosity is the diacritic of a scientist who has become a technician, a bureaucrat, or a clock watcher. What is less obvious (and perhaps more typical) is the case of top-flight (at least in their own eyes) researchers whose curiosity remains active, but highly selective, tightly boundary-defined and well defended by an array of self-justificatory and self-limiting practices, many of them tacit and dispositional. When such practices are reinforced by every aspect of the structural conditions of their career trajectories, it becomes easier to understand how such self-limitation has come about and how it endures, but despite all that insight, not one whit less discouraging to observe. Of course, one encounters this phenomenon both in the life sciences and the human sciences.

An approach to a situation of discordancy that extends beyond the technical and immediately institutional--denial, indifference, neglect, dismissal--is almost without exception what we practitioners of the human sciences have [*473] encountered. Our field notes are replete with instances of such behavior and we have spent many hours discussing what it consists in and how we might counter it.

Surprisingly, as opposed to the usual array of annoyance and impediments that one becomes accustomed to in the human sciences, there was very little overt hostility coming from our engineering colleagues. In their own eyes, they simply had neither the time nor the inclination to recognize that there was a pressing problem, as we were so keen on repeating. Our promptings and challenges awakened neither any discernible intellectual or ethical curiosity nor any serious defensiveness. Cassandra, go do the dishes!

At most, and this came mainly from a committed administrator, there was an overt proposal (accompanied by a series of threats about our funding) that we should essentially function as public relations people. The administrator had spent his whole career in industry and his sense of corporate loyalty and hierarchy were sociologically comprehensible. Of course, that was not how we understood our role. Eventually he more or less let his resolve to make us functionaries drop.

More pervasive and persistent was the expectation that we would provide instrumental solutions. We characterized this mode as one of cooperation in which there was a clear division of labor, norms, and practices. This was precisely the ELSI mode we had been mandated to move beyond by the NSF. We hoped to invent a collaborative practice that was upstream and more interconnected, this demand for instrumental advice was irritating. Affect aside, we also believe that there were at the present moment no instrumental solutions for the discordancy and indeterminations we were confronting. In a word, not only was it not our task to provide such solutions but we came to believe ever more firmly that to do so would have been in bad faith. It would have provided a false set of solutions to a complicated and emergent set of security issues; to an unresolved set of tensions between open-source and entrepreneurial aspirations; to a mode of practice that was ethically superior, collaboration not cooperation.

That being said, in the Human Practices camp, and an involuntary enclosure it was, recognizing discordancy, suffering from it, and insistently experimenting with ways to resolve, remediate, or at least diminish the stress and distress was over time the dominant order of the day, month, year. We have achieved some things of interest and perhaps even significance in that regard.

[*474] . First, we have learned to cherish our own collaboration.

. Second, we have begun to implement a multisited approach to other practitioners of the human sciences themselves working in homologous settings.

. Third, realizing full well that we are thoroughly dominated in terms of internal power relations, we have forged ahead with one of those weapons of the weak, creating a venue by moving to an adjacent domain in which we can be neither disciplined nor punished--thinking.

Hence, appropriately the response that follows is a collaborative one.

DISCIPLINE

We have been thinking about the moral landscape of contemporary knowledge production and producers, with special attention of course to the biosciences and the human sciences. Starting out with a Deweyian attention to discordancy, we have found it informative to experiment with a kind of neo-Aristotelian schema of the virtues, concentrating on excess, deficiency, and the mean. For example, if curiosity is an intellectual virtue, indifference is a deficit and programmatic hyperbole untempered by the chill and exhilaration of disciplined laboratory experimentation is an excess. Or, if *thumos* is the appropriate response of a citizen to injustice, then snarly *ressentiment* is the excess and scowling self-justification the deficit. This work is in progress.

& PUNISH

Following Aristotle's distinctions, the type of rhetoric of the articles by Caudill and by Edmond and Mercer is forensic whereas ours is epideictic. Our judges share a core accusation: we are not taking the lessons taught by STS seriously. They share an imperative: to accept the core insight that science is constructed and conditioned. They assign penalties: to return to the founding texts of STS and its authorized commentary. They offer us hope of amelioration; if we would only recant.

The shared critique in these pieces turns on the claim that we are naive about the established fact that science and society are constructed. Caudill [*475] puts it like this: "while the humanities have moved upstream nearly to the source of knowledge, there is little acknowledgement that the scientists were already, inevitably, engaged in a social, political, institutional, and ethical enterprise." If we would only recognize that science is "always already" cultural, then co-labor would have been recognized as a redundant reformulation of coproduction and we could have gotten on with the task of critique, i.e., denunciation in the name of the social. But is this the only way to understand "construction"? Or "the social"? Or "critique"? Clearly, we think not.

We are reprimanded that we are decades behind the STS critique of Merton. Let us underline that we are even guiltier than charged as we started our discussions with essays by John Dewey written a century or more ago. Dutifully, we looked back at some of Merton's writings. In his 1970 preface to his 1928 book *Science, Technology and Society in Seventeenth Century England*, Merton wrote, "the social, intellectual and value consequences of what is done in one institutional domain ramify into other institutions, eventually making for anticipatory and subsequent concern with the interconnections of institutions. Separate institutional spheres are only partially autonomous, not completely so." n2 Of course we could cite in our defense of a longer and richer tradition of thought and critique, similar claims from Max Weber, Ludwig Fleck, Gaston Bachelard, Georges Canguilhem, and Hans Blumenberg, among many others.

Returning to Merton's infamous assertions about scientific norms, we think it is helpful to pose the question: what are the norms governing STS? They appear to be universal, involving communicative rationality, institutionally enforced through both disciplinary power relations and operating in a non-ironic rhetorical mode. Furthermore, we are instructed that there is a historical inevitability to STS. In sum, our STS respondents embrace a rhetorical modernism in which the principles of STS are the only thing that counts under this legal regime; such things as precedents, cases, casuistry, and the like have no place in this mode of veridiction or jurisdiction.

Epideictic rhetoric operates on a register of virtue and vice. Ethical questions of vocation, transformation, and risk, far from being "banalities," as Caudill would suggest, are at the scientific and experimental core of our undertaking. We begin with the diagnosis that there is something distinctive about the post-genomic space of biological engineering. Since bioengineers are generating new capacities for the production of foundational technologies, such as automated sequence assembly, and applications, such as tumor-destroying [*476] bacteria, then ethicists might well need to develop new capacities to respond appropriately in a mode in which the ethical stakes are (a) shared by scientists and nonscientists and (b) not completely known beforehand. Moreover, the purpose of our work has never been co-labor per se. Rather, it has been to work on contemporary problems, which in their complexity and temporality would seem to require collaboration. Were this not the case then a simple consequentialist or deontological position would have sufficed. As Mullender shows in his sterling article, these familiar positions cannot take up the emergent properties of post-genomic technologies and their ethical stakes in a register of knowledge and care.

Flourishing today is a problem. The dominant (if not unique) mode of rationality guiding the life sciences today is instrumental. The factors contributing to this orientation are diverse: the predominance of the biotech industry as an increasingly widespread model for all scientific research; the demands of funding agencies (private and public) that experimental results be immediately commercialized; the tendency to reduce the worth of science to instrumental norms and the dismissal of those who don't accept this position; and, of course, the express desire both sincere and insincere to make science serve the common good.

Collaboration is called for precisely because amelioration is not synonymous with flourishing. While Mercer and Edmond recognize Rabinow as the leading scholar of what could be considered the "implications" of biopower, they are unwilling to grant us as a research group the right to pose the question of whether or not there is an ethical outside to biopower, and if so, what it might consist in. In this light, flourishing was proposed as an alternative metric to both the maximization of the health and welfare of populations and the issue of resource distribution under conditions of contemporary capitalism, as the only ethical questions that count.

Incidentally, the reason for producing a synthetic artemisinin drug was a response to disease-affected area fluctuations in price that occurred once the WHO made it the recommended drug for the treatment of malaria. The production of a rival synthetic product to locally grown artemisinin products was to keep the drug affordable. Provisions to protect local farmers have been included. None of this precludes the strategy of distributing nets that existed long before the Delft conference and continues after it, seemingly uninfluenced by actor network theory.

[*477] Mullender's article, "English Negligence Law as a Human Practice," provides a welcome conceptual and ethical invitation to consider ways in which our work might ramify and flourish through nourishment from other sources. Such sources are the wellspring of collaboration, and demonstrate among other things that collaboration can arise across distance and time and beyond organized disciplinary policing. In particular, Mullender's fascinating account of English negligence law provides resources to think about practical judgment, mutual flourishing, and capacity-building in a venue quite different from the one in which we are working. By identifying sites of discordancy and the limitations of practices, Mullender's consideration of negligence, despite obvious topological differences between English law and synthetic biology, reveals and opens up the possibility of collaboratively exploring a problem space.

Importantly, he arrives at his insights not through the application of an abstract method or a comprehensive theory, but through a practical reflection on the limits of legal principles and possibilities of casuistic reasoning. The mode of this practical reflection is one in which an obligation to care and the expansion and refinement of legal reasoning become dispositions for lawyers, judges, and the community alike. This mode of practical reflection requires an attention to social change, tradition, and the horizon of the near future.

Mullender shows that this mode of practical reasoning entails a reworking of legal *equipment*. Thus, for claims to count as matters of negligence they must meet jurisdictional and veridictional conditions established by a "duty to care test." He writes:

The first stage of this test specified that claimants had to establish "a sufficient relationship of proximity or neighbourhood" in order to show that the defendant owed them a duty. Where judges answered this question affirmatively, they had to consider (when turning to the second limb of the test) whether there were any "considerations" that might militate against the imposition of a duty. This element of the test is an invitation to judges to consider whether policy-related considerations provide grounds for rejecting an otherwise good claim. Thus the second component of the two-stage test embraces matters of broad public concern (e.g., the question as to whether a finding for the claimant will inspire an unmanageable flood of similar claims). n3

[*478] He also shows how the introduction of metrics of neighbor-regard and mutual flourishing provide a means by which judges have reconciled tensions and impasses involving deontological and consequential-based modes of reasoning by backgrounding the priority of principles and foregrounding case-based considerations. One important

ramification of this shift in metric is the expansion of the range of circumstances in which addressees of negligence law were held to bear duties to others. The ethic of neighbor regard and care for mutual flourishing needs to be taken seriously if we are to deal in a case-based and careful way with emergent and discordant situations.

Mullender's analysis of negligence affirms what our own research and moral inquiry has led us to. Reflecting on two years in SynBERC, we had come to the conclusion that indifference on the part of our hoped-for collaborators was a key to understanding the persistent difficulties and blockages we encountered. Hence, reading Mullender's article was a welcome surprise and confirmation of our somewhat inchoate diagnosis, providing us a repertoire of concepts and practices, which though taken from a different domain seem to provide illumination of the discordancy we are facing. As with the example of labor law in the 1930s, we too have found ourselves in a situation marked by a breach in the duty of care. But of course the jurisdictional constraints of our work are quite different than those found in law.

CONCLUSION

We have concluded that in important yet ultimately constructive ways, the results of our first set of experiments in Human Practices at SynBERC have proven to be unsuccessful. An unsuccessful experiment is not a failed experiment. An unsuccessful experiment can be considered worthwhile for several reasons. It might demonstrate that the whole experiment was misconceived; there was no real problem to which the experiment could provide answers or clarifications. It might demonstrate that the experiment was crude in its initial formulation and needed to be refined so as to become fruitful. It might demonstrate that the nature of the objects (and their component elements) under consideration were incommensurate with the larger goals of understanding that the experiment was designed to explore in the first place. It might demonstrate that aspects of the experiment needed to be modified so as to perform [*479] it better. In the latter case, if one can identify the elements that functioned as expected and those that did not then one would have made scientific progress. And one would then be in a position to recast the experiment in more precise terms.

Legal Topics:

For related research and practice materials, see the following legal topics:

Civil Procedure Venue General Overview Copyright Law Subject Matter Literary Works Scope of Protection Labor & Employment Law Collective Bargaining & Labor Relations Impasse Resolution

FOOTNOTES:

n1 FOOTNOTE REFERENCE MISSING IN ORIGINAL Robert K. Merton, preface to *Science, Technology and Society in Seventeenth Century England*, 2nd ed. (New York: Fertig, 1970), x, reprinted as "Social and Cultural Contexts of Science," *The Sociology of Science: Theoretical and Empirical Investigations*, ed. Norman W. Storer (Chicago: University of Chicago Press, 1973), 175.

n2 Richard Mullender, "English Negligence Law as a Human Practice," 21 *Law & Literature* 321, 327 (2009).

n3 FOOTNOTE TEXT MISSING IN ORIGINAL