Paraskeue in a security milieu: venues and methods for synthetic biology

"While recognizing challenges related to under-determination, current proposals for dealing with security challenges in synthetic biology offer no concrete proposals for developing frameworks for confronting such challenges. In distinction to ***safety*** and ***security*** such proposals will require a framework of ***preparedness"***[1]

The essay is an exercise in thinking about preparedness relative to synthetic biology. The problem of expanding technical capacities in the life sciences is typically taken up within a ***safety*** framework: confronting dangers with technical safeguards. Whereas a safety framework operates within a logic of technological safeguards, a ***security*** framework additionally concerns challenges related to political environment. The options for governance proposed to date in synthetic biology address security matters by folding them into organization, screening, and licensing technologies. Both safety and security measures are important components in a responsible approach to the dangers associated with advanced technical capabilities in the life sciences. However, it has long been a concern of the Berkeley Human Practices laboratory that whilst safety and security measures are necessary, they are not sufficient. Parakseue is a term familiar to the ancient Greeks. As a technical term, it refers to the capacity to respond to events whose form, temporality and impact cannot be known or calculated in advance, yet which must be exercised in relation to. There is a gap today in thinking about the capacity to respond to and recover from high consequence events. All energies in the safety and security work are oriented toward the minimization of low probability events rather than oriented towards the consequences of high consequence events. In addition, working within SynBERC - and at least in principle - in a mode of collaborative engagement, it is not clear that the object of intervention Thrust 4 Human Practices should be working on is security understood as either sovereign or population security. These are obviously

[1] Rabinow Presentation at Human Practices Lunchtime SynBERC event; "Safety, Security, Preparedness", 2007

important and the national and international security apparatus is one of the fields that the laboratory science we are working with has to engage with. However, it seems to me that as ethicists and anthropologists situated in a reciprocal and collaborative position , we are working on science (and its defense) within a security milieu, as opposed to working on security (the securing of a population, the nation , the globe) within a milieu of dangerous science. The latter is of course crucial, but it is important to recognize what work can be done from what institutional positionour object of intervention should be science and scientists within the security milieu and not security as the object on which we work. Within Thrust 4, MIT has focused on the safety and security dimensions[2] and Berkeley has made preparedness a chief concern. The former addresses the technical design challenge of safety whilst the latter is concerned with the organizational design challenge. There is of course great worth in the work on safety and security and it is crucial that national laboratories interface with the national and international security apparatus. However, as stated, there is a lacuna that comes from an orientation to security as the object as opposed to orienting and exercising science and scientists towards the concept of preparedness.

Orientation

History of the Present and the Anthropology of the Contemporary

This piece is an attempt to work with a problem-space not in the form of the history of the present[3], characteristic of Michel Foucault, but rather in a contemporary mode, characteristic of an anthropology of the contemporary[4].

Framing the impetus behind the invention of the diagnostic of equipmental platforms, Rabinow and Bennett suggest one among a number of reasons; ‘‘Unlike the question of what figure comes ‘‘after’’

[2] Cf Mukunda, Synthetic Bioligy 3.0, Zurich, Austria
[3] Foucault, Michel ‘‘Discipline and Punish’’ Vintage 1995
[4] Faubion, Marcus, Rabinow and Rees, ‘‘Designs for an anthropology of the contemporary’’ forthcoming, Rabinow, ‘‘Marking time’’, PUP, 2008, Rabinow, Paul and Bennett, Gaymon. ‘‘A Diagnostic of Equipmental Platforms,’’ *ARC Working Paper,* No. 9, 2007.

biopower, however, the challenge of specifying the vectors and contours of an emergent problem-space remains, in our view, a valid one."[5] This challenge poses the question of how and in what ways the life sciences today are taken up in contrast to a previously stabilized situation. One need only refer to technological innovations such as the internet and high consequence political events to contrast the under-determined problem space of life science today contra 1977. The invention of diagnostic categories orients inquiry to pose this question much more specifically.

One of the conceptual tools we inherit from Foucault is that of the "problematization", a tool used in what he called "history of the present". Rabinow and Bennett suggest that "in that project, a certain understanding of the past would provide a means of showing the contingency of the present and thereby contribute to making a more open future."[6] In a contemporary situation where so much is already identified as contingent, there may not necessarily be a problem- space static enough to render contingent through, for instance, genealogical work. As Rabinow and Bennett identify, history of the present is appropriate for the figures of biopower and human dignity, but not for something like the practices of rapidly changing life sciences. In response, they propose problematization in a contemporary mode. "In this position the challenge is not to make the present seem contingent, but situating ourselves among contemporary blockages and opportunities the challenge is to reformulate these blockages and opportunities as problems so as to make available a range of possible solutions."[7] In a history of the present, something became a problem and through contestation eventually a stable response was formed. The stabilization can be reworked and inquired into in order to find those problematic sites prior to the stabilized response and how those particular responses were possible and under what conditions. In a contemporary mode the aim is to render a space of practices into a problem-space. Rabinow and Bennett, following Auerbach, use the concept of 'the figure' to characterize the stabilized series of biopower and human dignity. By contrast what is happening in the figure they refer to as 'synthetic anthropos' seems to

[5] Rabinow, Paul and Bennett, Gaymon. "A Diagnostic of Equipmental Platforms," *ARC Working Paper*, No. 9, 2007, 5
[6] Ibid, 6
[7] Ibid, 8

be an act or process of figuration where "the concept of *figuration* designates a way of establishing connections among events, actors, discourses, practices, and objects such that a more or less stable and integrated ensemble is produced whose form is such that the significance and functions of the ensemble cannot be reduced to its constitutive elements."[8] In a contemporary mode of inquiry the act of inquiry is to produce connections and form an image of the situation so that it can be worked on further. Synthetic anthropos is a practice of synthesis and recombination by those identifying the contours of the connections in a problem-space which is yet to be stabilized. In this contemporary mode the effort is to characterize the problem space, to shape the problematization and the diagnostic categories are tools for this attempt at characterizing the connections one is interested in.

SynBERC

Over a period of three years (2004 -2007) multiple research projects from fields as varied as engineering, chemistry, mathematics, computer science, biology, anthropology, law and ethics were being thought and practiced in relation to one another in order to propose biological solutions to contemporary world problems. In one version of the story, the version that can be read in Esquire[9] and Wired[10], "Synthetic Biology" is an engineering ethos applied to biological systems. The Synthetic Biology Engineering Research Centre (SynBERC) is housed at UC Berkeley and made up of five partner institutions including Harvard, MIT, Prairie View A&M and UC San Francisco. The emergence of this institutional form and disposition of scientific practices in August 2006 was contingent on various research programs, individual laboratory works, sets of networks and personal relations at play from many years beforehand.

What is important to note is that the fields of molecular and cell biology, systems biology, synthetic chemistry and metabolic engineering were engaged in key interactions to create a constellation of projects

[8] Ibid, 11
[9] Jones, Chris "How to make life" http://www.esquire.com/features/best-brightest-2007/synthbio1207
[10] Morton, Oliver "Life Reinvented" - http://www.wored.com/wired/archive/13.01/mit.html

which had the shared goal of making biology amenable to rational design. In response to the initial proposal from 2004 and in verbal communication between the NSF and Director Prof. Jay Keasling a fourth thrust in addition to the three scientific thrusts was added and integrated in order to approach the wider research and policy questions that this scientific practice raises, ranging from ethics to legal questions. It was crucial to the NSF that SynBERC be not only a dynamic form for solving technical scientific questions, but that it have the resources and capabilities to be reflexive about its own practice relative to the wider mutually formative relations that constitute it. The impetus for this kind of reflexive work can be seen in other NSF funded projects such as the Arizona State University 'Center for Nanotechnology in Society' (ASU-CNS).

A good example of the concern to find inventive ways of thinking about the kinds of techniques and technologies emerging from this corner of the post-genomic world is the "Future Brief" paper by Rob Carlson, written just after the first international synthetic biology conference at MIT in 2004 (SB1). Carlson, a founding member of the Molecular Science Institute in Berkeley, wrote of the security milieu in which synthetic biology operates and suggested that "[o]ur greatest challenge is to avoid imposing rigid regulations on biological tools and skills that are intrinsically flexible. Rather than focusing on specific threats, we should instead create a dynamic response capability, based on a broad technological and economic infrastructure that prepares us to deal with novel challenges as they arise."[11] Indeed, Carlson is critical of the impulse characteristic of those within and without the rDNA field to impose strict controls of licensing and distribution in the attempt to take precautionary measures. "...such measures are not likely to be effective. Worse, they will instil a false sense of security."[12]

The task for Thrust 4 has been to design and develop collaborative approaches to address issues of concern to synthetic biologists, ethicists, human scientists, policymakers, private sector and the many related publics, through the design of collaboration. The developments in synthetic biology have been an

[11] Carlson, Robert "Future Brief: SB 1.0" http://www.futurebrief.com/robertcarlsonbio001.asp
[12] ibid

opportunity to invent new forms of collaborative practice. Standard approaches have sought to anticipate how new scientific developments will impact "society," positioning themselves external to, and "downstream" of, the scientific work per se. This positioning, for example, was mandated by the Human Genome Initiative and the so-called ELSI project (ethical, legal, and social implications). By contrast, the Human Practices frame is an approach that fosters a co-production among disciplines and perspectives from the outset. The value of collaboration is that its goal is to build a synergistic and recursive structure within which significant challenges, problems, and achievements are more likely to be clearly formulated and successfully evaluated. The reason for stating the mandate for Thrust 4 is that in a situation in which Thrust 4 is asked to consider "the biosecurity" problem relative to synthetic biology, I think it is worth asking what problems can be worked on relative to the Research Centre by those involved and through a collaborative practice? The challenge to think about preparedness is to identify what the object we can work on is and how?

The figure of biopower and the use of diagnostic categories

The brief for this piece was to think about what 'preparedness' might mean and consist of for laboratory scientists working within the SynBERC consortium. A number of questions immediately presented themselves; what can preparedness consist of for the laboratories we work with in a situation where the reigning logic is one of safety and security?

This presupposes the question, why is the biopolitical insufficient as an organizing logos / ethos and what are the appropriate supplements to techniques taken up within biopolitical equipment?

In a situation where probabilistic reasoning fails and the problem of security (and hence of its double, freedom) cannot be answered through either safety techniques nor through the calculation of risk, how does one ensure the freedom of a practice, in this case the practice of science, where for other objects this

freedom is ensured through its presence in a security apparatus? This problem revolves around the virtual[13] character of events which are not amenable to calculation and will have enormous impact[14].

There is no 'figure' of preparedness, but it has been useful to try and establish connections for the contours of those practices we are interested in to gain visibility. For Collier and Lakoff in their work on Vital Systems Security they suggest that the "normative rationality relevant to vital systems security is 'preparedness'. The norm of preparedness demands that experts constantly assess the vulnerability of vital systems and the readiness to respond to, and recover from, events that threaten them."[15] One might otherwise characterize those practices we are interested in through the figure of biopower. If we were interested in the stabilized logic of security it would be appropriate to pose questions in terms of the series verficiation-normalization-probabalistic-population/bodies. What this means is that the stabilized figure of security works on an object that is a population, it works on it through probabilistic reasoning and regular distributions according to a norm.

For Collier and Lakoff - contra population (security) - their objects of interest is 'vital system'. In my case also the biopolitical is insufficient as an orienting figure because the object is not a population per se. Of course, I am looking at laboratory science which is subject to a national jurisdiction (as well as a global environment) which regulates and governs in the name of a sovereign territory and a population whose task it is to secure. As such, these labs necessarily interface with a security apparatus. However the object I am interested in is the practice of free inquiry given the possibility of high impact events which put this practice in danger. The capability for free inquiry to be pursued in the wake of an event and the question of how a laboratory which may not have a necessary link to a security apparatus (it does not work on pathogens / Select Agents for instance) will nonetheless be affected by the political conditions following

[13] One definition of virtual from the OED; "that is such for practical purposes though not according to strict definition" , Cf Henri Bergson, "Introduction to Metaphysics", which usefully corresponds to Bergson's opposition of 'conditions of the real' against Kant's 'conditions of the possible'
[14] Stephen J. Collier and Andrew Lakoff "Vital Systems Security.", *ARC Working Paper*, No.2, 2006
[15] ibid

any kind of "bio" event. The object relation is thus event-capability; practitioners ability to defend their science relative to the possibility of events.

Equipment and technologies: towards practice

Why focus on equipment and not technologies[16]? One way of naming the difference between an equipment and a technology is that the former is a practice, in the moral philosopher Alisdair Macintyre's sense of the term. Synthetic biology is inventing new techniques and technologies, but is fundamentally also changing how biology can be practiced. To treat it as a practice means then that relative to the political question of the practical authority that has jurisdiction over it , the means by which it is regulated, this relation between 'science' and the 'political' cannot be consider a purely bureaucratic and technical question. Currently, for most of the scientists we have interacted with the question of security and regulation are considered technical matters. To treat the political milieu relative to synthetic biology as a question of equipment is to ask how can the question of 'responsible' or 'good' science be a question internal to the practice of that science and structured by an organizational form.

Macintyre offers an excellent overview of the term practice and what it might mean to consider science as a practice. "By practice I am going to mean any coherent and complex form of socially established human activity through which goods internal to that form of activity are realized in the course of trying to reach those standards of excellence which are appropriate to and partially definitive of that form of activity with the result that human powers to achieve excellence and human conceptions of the ends and goods involved are systematically extended."[17]

This paragraph requires much unpacking even if the central point – that a practice is characterized by the orientation to a good as a telos internal to that practice – is fairly clear. We might say that Macintyre

[16] A technique is a specific practice which can be taken up in either an equipmental or a technological mode, e.g. techniques for disciplining soldiers are taken up within technologies of the self and techniques for spiritual exercise among the ancient Greeks are taken up in an equipmental mode.
[17] Macintyre, Alisdair, "After Virtue: A study in moral theory", University of Notre Dame 1984, 187

points us towards a historicized anthropology of virtue. He gives us rich accounts of those qualities that are virtues, which allow an individual to move toward the telos of a flourishing life. Macintyre is quick to make a distinction which does not appear in Aristotle. The virtues can be seen as a means to an end; however they are not a technology or a technique. A technology is a particular relation of means to ends, whereby means and ends can be adequately defined without reference to each other. A virtue by contrast is a "means" of acting in which the end is internal to it. Macintyre gives us two accounts of virtues; in Homer, a virtue is a quality which enables an individual to discharge his or her social role. For Aristotle, also read through Aquinas and the New Testament, a virtue is a quality which enables an individual to move towards the achievement of a specifically human telos, whether natural or supernatural. Macintyre takes up this notion in which the cultivation of certain kinds of virtues is contingent on the polis. The polis values those qualities of mind and character which would contribute to the realization of the common good and identifies certain types of action as the doing or production of harm of such an order that they destroy the bonds of community in such a way as to render the doing or achieving of good impossible.

This diversion into Macitnyre is useful for a number of reasons, it shows on the one hand the reason why focusing on equipment and not technologies is necessary if one is interested in the question of flourishing as opposed to, for instance, fame, efficiency or maximization. Secondly, that these practices have to be cultivated in a certain kind of venue, that goods internal to practice do not stem only from that practice itself but also from the structures that the community of practitioners build and invent within which to cultivate that practice. One might disagree with Macinytre that there is or can be a polis in our time, however his point directs us to the national and international political structures that govern and the laboratory space and organizational form of the science and how these interface. He highlights that these interfaces are not extraneous but integral to a practice, in this case, of scientific inquiry. The point here is that even if your laboratory is not working on re-enigneering the 1918 flu virus or small pox, actively building an organization and community of scientists that can respond to political events is crucial for the

practice of science in the contemporary world to flourish. Among our connections within synthetic biology Drew Endy and George Church and from the Molecular Sciences Institute Roger Brent, among a number of others have been proactively thinking about this[18].

How can we understand virtues today and in relation to our object? "Virtues are dispositions not only to act in particular ways, but also to feel in particular ways. To act virtuously is not, as Kant was later to think, to act against inclination; it is to act form inclination formed by the cultivation of virtues. Moral education is an education sentimetale."[19] And yet this is not enough to constitute the cultivation of virtue, as in practice the distinction between the cultivation of virtue and the cultivation of discipline through techniques may be indistinguishable, as in the example of the courageous solider or the child learning chess. The point worth drawing out of Macintyre is in historically locating anthropos and the good. It is worth then outlining the four elements of practical reasoning that we are given in his reading of Aristotle; A person has certain desires, presupposed by but not expressed in, her reasoning. Without desire "there would be no context for the reasoning and the major and minor premises could not adequately determine what kind of thing the agent is to do"[20]. Secondly, the major premise that doing something is good or needed is combined with a minor premise where "the agent, relying only on a perceptual judgment, asserts that this is an instance or occasion of a requisite kind" and then an action is taken.[21] This can be restated as a way of thinking that ethics conforms passions to a telos through reason and produces action (through correct judgment). This is not so far from the characterization of equipment as the attempt to turn logos into ethos[22]. "…inquiry proceeds through mediated experience. It contributes to what used to be called Bildung, a process of self-formation, that today might called an attitude or ethos."[23]

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[18] Bugl et al "DNA Synthesis and biological security", Nature Biotechnology 25, 627-629 (2007)
Brent, Roger "In the Valley of the Shadow of Death", http://dspace.mit,edu/handle/1721.1/34914
[19] Macintyre, Alisdair, "After Virtue: A study in moral theory", University of Notre Dame 1984, 149
[20] Ibid, 161
[21] Ibid, 162
[22] Rabinow, Paul "Anthropos Today: Reflections of modern equipment", Princeton, 2003
[23] Ibid, 3

Paraskeue

Preparedness is a term the US national security apparatus is using in the post 9/11 and post-Katrina security environment to encourage both citizen, military-industrial and critical infrastructure capabilities to respond to high impact events. The Greek term 'paraskeue' meaning both to equip and to prepare is versatile and has a long history. The term has over time been used to denote military activity and spiritual exercise as well as the name for the day in preparation for the Sabbath. As Rabinow writes "[w]hen Foucault undertook his famous detour into ethics during the 1980s, the topics of care and form became central."[24] Foucault's discussion of paraskeue in the '81 – '82 lectures asks, "how can the subject act as he ought, not only inasmuch as he knows the truth , but inasmuch as he says it, practices it, exercises it?"[25] This exercise (askesis) is not practiced relative to the law but relative to the unforeseen events of life. These exercises that work on the events of life are not renunciatory exercise such as is found in Christian ascetism, rather they equip; these exercises provide paraskeue. What is equipment made of? It is not just a supply of true propositions but in Foucault's terms "statements with a material existence" – statements which have a logos (are "justified by reason") must be turned into ethos. "For these material elements of discourse really to be able to constitute the preparation we need, they must not only be acquired but endowed with a sort of permanent virtual and effective presence, which enables immediate recourse to them when necessary."[26] Equipment is a certain set of practices which have appropriate logoi that develops an ethos. This equipment must be an aid in the event, it must be 'voethos.'

June Allison in a philological exegesis of the term paraskeue in her work "Power and preparedness in Thucydides" deftly explains the ambiguity in the term; paraskeue can be translated into English as either equipment or preparedness. What is most interesting is that the fundamental ambiguity is its use as both noun and verb. Paraskeue is both a process and a product. "*Paraskeue*: A word for process and

[24] Ibid, 8
[25] Foucault Michel, "The Hermeneutics of the subject: Lectures at the College de France 1981-1982", Picador 2005, 318
[26] Ibid, 314

components – by definition embodies the process of moving from a time or a state when something did not exist to a time in which it is available for use."[27]

Paraskeue, first introduced (by Herodotus and contemporaries) as a compound of skeuos - para meaning besides or near and skeuos meaning instrument, is never left without a clear understanding of what its objects are. Thus paraskeue both is and is not an instrumental rationality. It is both a means and an end. Cognate forms in other languages generally mean to dart, shoot, burst or thrust forth. It is certainly in motion. It has no fixed referent but always with an appropriate relation to its object.

One other interesting point from Thucydides' History is the question why he used a number of other key words in addition to paraskeue. For example the term 'heteimo'; 'heteimo' is a term which means ready, ready to do something. Allison claims it is not just for stylistic variation, but rather to distinguish between the *particularity* of a state of readiness and the *generality* of a state of preparedness which takes particular objects of reference through the process of equipping. As Rabinow suggests, in synthetic biology (as one among many emergent problem-spaces) the "horizon of emergent challenges, which by definition can only be anticipated in general terms, [should be] framed in terms of ***preparedness."***[28]

Importantly, Allison distinguishes between preparedness (paraskeue) and action (ergon). What is important is that just as every action must have a suitable logos, so too the process of equipping. "Paraskeue can never exist without a logos of some kind. This allows the reader to ask of any preparation whether the reasoning behind it is sound or not. It can be seen in the History that, when one's preparedness breaks down, there is a corresponding deterioration in clear reasoning."[29]

[27] Allison, June, "Power and preparedness in Thucydides", Johns Hopkins, 1989, 37
[28] Rabinow, Paul, "Safety, Security, Preparedness", lunchtime Human Practices event, October 2007.
[29] Allison, June, "Power and preparedness in Thucydides", Johns Hopkins, 1989, 38

What is a security milieu? Foucault's approach

Foucault in the 1977-78 lecture series at the College de France – "Security, Territory, Population" distinguishes between the system of legal code, mechanisms of discipline and the apparatus of security. "…the apparatus of security inserts the phenomenon in question … within a series of probable events."[30] The history of the techniques of the juridical-legal, disciplinary and security mechanisms and the system of correlation between them is the object of analysis in these lectures. The point is that rather than a juridical-legal structure being replaced by a disciplinary regime later replaced by a security apparatus, rather Foucault is analyzing a history of these kinds of techniques and how the thing that changes is the dominance of a set of techniques ,which changes their correlation. For our purposes, one of the general features of the apparatuses of security Foucault investigates is the space of security. This space is, following the Newtonians in Physics and Lamarck in biology, is called the milieu[31]. "The specific space of security refers then to a series of *possible* events; it refers to the temporal and the uncertain, which have to be inserted in the given space."[32] The milieu is then the space of calculation. The object of this field of intervention is a population, a term from the early 17th C, which is known through, among other kinds of calculation, normal distributions and subject to interventions on its health and welfare.

Using the example of scarcity, Foucault thinks of it as a phenomenon in relation to the two categories by which political thought tried to think about inevitable misfortune; fortune (techniques for dealing with uncertainty as a concept paired with certainty) and man's evil nature. Man uses technology for malicious purposes (reflecting his evil nature) but also as an effect of the technology. Evil can be conceptualized as effect when technology is considered to have 'potential' for misuse (which is reflected in cotemporary narratives on dual use). This of course is not exactly Foucault's point, but for our purposes it highlights how the motion Foucault shows between fortune/evil taken up within a space of calculation reflects precisely how the domain of biosecurity takes up the so-called 'dual-use' problem. "Abeille, the

[30] Foucault, Michel "Security, Territory, Population: Lectures at the College de France 1977-1978", Picador, 2007
[31] Cf. Rabinow, "French Modern: Norms and Forms of the social environment"
[32] Foucault, Michel "Security, Territory, Population: Lectures at the College de France 1977-1978", Picador, 2007

physiocrats and the economic theorists of the 18th C tried to arrive at an apparatus (dispositive) for arranging things so that, by connecting up with the very reality of these fluctuations, and by establishing a series of connections with other elements of reality, the phenomenon is gradually compensated for, checked, finally limited, and, in the final degree, cancelled out, without it being prevented or losing any of its reality"[33] This is essentially the birth and refinement of the tools of managing risk among populations. As we shall see, this disposition of things, on the one hand *mitigation of risk* and on the other *ensuring the flow of things and elements*, is reflected in contemporary biosecurity policy.

The population is the correct object to intervene on in within the regime of security. Safety, is equated by Foucault with the traditional problem of sovereignty, that is the problem of territory and the question of how the territory can be fixed and protected. Foucault identifies an exemplar of this mode of thought with Machiavelli and suggests that rather than Machiavelli opening up political thought to modernity, he instead represents a high point of a mode of thought which is de-emphasized in favour of a different set of problems. The problem identified is essentially that of circulation, how it can happen and how it can be allowed to happen "in such a way that the inherent dangers of this circulation are cancelled out"[34]

This is a great characterization of the state of contemporary science, which on the one hand is comfortable with a 'sovereign' relation to the territorial laboratory space (controlling, protecting, fixing, and enlarging through grants, albeit subject to real sovereign power) and on the other is subject to interventions which take up scientific inquiry in terms of its place within the circulation of knowledge and objects and the calculation of the risk of this practice and its objects relative to a population. For those charged with the problem of science in a security milieu, the question is usually posed of how to make that which is out of calculation, calculable and thus amenable to control whilst maintaining the flow of knowledge, capital, symbolic power etc.

[33] Ibid
[34] Ibid

Inquiry

Initially I was trying to map the connections between the national preparedness infrastructure being established, the CDC, the RAC, the NIH, the Whitehouse office of homeland security, the DHS and the NSABB. But it quickly became clear that each of these offices is re-describing the rules and concerns that the others are articulating. Of all the organizations the National Science Advisory Board for Biosecurity (NSABB) is the one most interesting for our purposes and it is likely that recommendations made by the NSABB will be folded into the wider US National biosecurity system. I begin with a summary of the concerns outlined by a white paper by Maurer et al from the Berkeley School of Public Policy to give a sense of the dominant conceptual field for thinking through biosecurity from within the academic sphere and then pick up connections between two NSABB reports and how this may relate to invention of equipment to engage with the biosecurity milieu.

Dominant mode: Asilomar 2.0

One effort at thinking through the safety and security challenges of synthetic biology culminated in the white paper report "From Understanding to Action: Community-Based Options for Improving Safety and Security in Synthetic Biology". The paper is indicative of the "proceeduralist" approach which took the 1975 Asilomar convention as its model and was a mixture of technical criticism and "science and society". The report suggests that 'self-governance' is a preferable mode of governance compared to 'outside regulation'. The evidence for this claim is the success of Asilomar. Three things need to be drawn from this first claim of the report; Firstly the framing of 'self' in self-governance, second the term governance itself relative to what was termed 'consensus-building' and thirdly the use of Asilomar as the gold standard of such self-governance. Self-governance in the report is framed in terms of an assumption that the "community" of synthetic biologists is considered a bounded group. In this proceeduralist

framing, moving from knowledge to action requires 'consensus' and agreement on what is deliverable before action can be executed. The assumption behind this relationship of knowledge and action is that 'things people reliably know' is adequate for action. The position that suggests 'we already know' how to self-govern and thus what is needed is information to be collected on possible interventions, voted on and implemented comes from a model developed in the 70s at Asilomar when biotechnology was reacting for the first time to wider concerns regarding safety and security of the emerging field. The assumption is that there are no new risks that have emerged since this framework was developed.

According to the report, self-governance is "right", "faster", "elegant" and "international". However, a caveat is highlighted, "average members of the synthetic biology community have little time to think about biosafety/biosecurity"[35]. The report and the framing more generally is keen to use expertise to assuage fears and react to new challenges. One result of the framework is that because the synthetic biology community is considered bounded, the knowledge produced by the community is also similarly bounded such that either the community already knows how to regulate itself and consensus needs to be reached among the available known options, or the community must defer to an outside expertise on some issues, for example a bioethics committee. A further result is that whilst the report says that 'biosecuirty is interdisciplinary', the disciplines are considered bounded and parallel rather recursive and collaborative.

What changes does synthetic biology make to already-known risks? The report attempts an analysis of possible biosafety and biosecurity risks collapsed under a single logic (i.e. no conceptual distinction is made between safety and security)[36]. Generally in the field, biosafety concerns are relative to the laboratory practices of scientists, and mainly exist under the risk of accident relative to safety techniques, whilst bio-security signposts risks relative to the threat of malicious use for the purpose of attack.

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[35] Stephen M. Maurer, Keith V. Lucas & Starr Terrell *From Understanding to Action: Community-Based Options for Improving Safety and Security in Synthetic Biology* , 2006 , White Paper

[36] Whilst not explicitly stated, the use of two sub-headings to demarcate bio-security and bio-safety leads to a presumption that the authors do see a distinction between the two terms, although the distinction is never made explicit

However, the report is conflicted between a commitment to the usefulness of expert advice and also a position stating the community believes it has both the resources and knowledge to deal with the safety and security issues of synthetic biology. One example of this is the suggestion to make advice about experiments of concern freely available to both members and non-members. The conflict arises when the report suggests that there is a need for expert advice, whilst members themselves say they have already both formal resources such as safety committees and personal contacts that fulfil these functions.

An appendix included in the white paper is a piece written by the ethicist Laurie Zoloth titled "Ethical issues in Synthetic Biology: Security and Regulation of experiments of concern". In the paper she demonstrates the tension between acknowledging the unknowability of the dangers of synthetic biology and the position of the ethicist as expert within an old model of regulation. The task of the appendix, the author makes clear, is to ask "how such a self-defined field in biology can undertake the considerable challenge of the establishment of *normative rules* to govern and manage the uses of such a powerful technology…"[37] Thus Zoloth has taken up a position as an ethicist relative to the science of synthetic biology in which an outside field of 'ethics' can help a self-defined field establish prescriptive rules for the governance of scientific inquiry.

Thus in some respects Zoloth highlights the ways in which synthetic biology is new and emergent and thus old modes of regulation are inadequate. However, it seems also clear that the solutions proposed are to write a new set of prescriptions in the old mode. This is evident from the framing of the biosecurity problem , "the problem is well characterized and numerous solutions have been offered."[38] The characterization of the problem is centred around the idea that this draft white paper is aimed at "stimulation of the genre of robust discussion that could lead to an Asilomar type discourse."[39] The insistence on an Asilomar-like framework means that, similar to that earlier model, there is a belief that the community is still small enough to create adherent rules, with the recognition that this will change.

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[37] Laurie Zoloth, *Ethical issues in Synthetic Biology: Security and Regulation of experiments of concern*
[38] ibid
[39] ibid

For this proceeduralist framing the main concern is how to make people accountable to a process of regulation, even once that group expands, such that bad practitioners can be identified. This mode of thinking is not redundant, on the contrary, in a stabilized field it is necessary. However, they are insufficient for the hard task of thinking through the problem space which these emerging (rather than stabilized) sets of technologies and relations produce and are constituted in. In other words, an opportunity was missed between "SB1" and "SB2" to take up Rob Carlson's provocation.

NSABB

The National Science Advisory Board for Biosecurity was created at the recommendation of the National Research Council report "Biotechnology research in an age of terrorism" (The Fink report). In the December 2006 NSABB / NIH co-sponsored white paper on security and synthetic genomics, the question they ask is whether de novo synthesis escapes the purview of the extant system regulating Select Agents and what oversight system can mitigate misuse while minimizing restrictions on beneficial uses?

The authors name the oversight system for Select Agents (SAs) most relevant for Synthetic Genomics: The Select Agent Rules (SAR) (42 CFR part 73, 7 CFR part 331 and 9 CFR part 121), 18 USC 175c (the variola virus), Export Administration Regulations (15 CFR part 7) , NIH Biosafety guidelines for working with DNA, (NIH Guidelines) and the CDC / NIH Biosafety in microbiological and biomedical laboratories(BMBL) manual 4th edition. The biosecurity concerns named by the NSABB as posed by synthetic genomics are that it enables the synthesis of a select agent (SA) by nontraditional means perhaps without USDA review. It is possible to develop and produce agents that resemble and have the attributes of specific SAs without being clearly identifiable as an SA on the basis of its sequence and that scientific advance outstrips list based regulation

Their recommendations are for safety training (especially given that many have engineering backgrounds), guidance for which sequences current regulations require authorization, screening, mandated and improved software and an enhanced understanding of sequences associated with virulence.

These all seem sensible safety and security measures. Highlighting the points made from Foucault's discussion of the concept of security, the NSABB rejected recommendations including the restriction of access to new information about SAs, monitoring sale of equipment and the surveillance of students.

In the report from June 2007 on "life sciences and dual use" the NSABB developed a recommendation for a framework within which the Government can develop a comprehensive system of identification and review of dual use research, where dual use is identified as research with benevolent and malevolent 'potential' applications. The general framework is to minimize risk of misuse and maximize open exchange of information. The recommendations have five elements which highlight a number of points. First they want to assess dual use potential relative to criteria which select research 'of concern'. They want to encourage 'responsible' communication, open sharing, to write a code of conduct and lastly to build a framework that "addresses the importance of education and training in biosecurity issues for all life scientists and describes previous, ongoing and future approaches to meet these goals"[40]

Tools such as the writing of codes of conduct are echoed in Europe as a useful approach in addition to technical capabilities such as screening software. Alex Kelle of the EU SynBIOSAFE project quotes the British biosecurity scholar Malcom Dando when he suggests that based on responses from 1,600 life scientists during 60 seminars in 8 countries Dando concluded that life scientists "do not share the threat perception widespread among biosecurity experts concerning bioterrorism or biological warfare. They do not think that their own work might contribute to the threat. Life scientists have practically no knowledge of legally binding international regulatory instruments, such as the Biological Weapons Convention."[41] Indeed Kelle's own research of last year shows just this. Interviews of 18 'leading practitioners' on their awareness and knowledge of "experiments of concern", SB2, the Sloan report, the NSABB and the Maryland project "Controlling Dangerous Pathogens". It is significant that, for example, 13 of the 18

40 NSABB 2007 , "Proposed Framework for the Oversight of Dual Use Life Sciences Research", 3

[41] Alexander Kelle, "Synthetic Biology & Biosecurity Awareness In Europe", SynBIOSAFE, 2007, 10

interviewed had never heard of the Fink report which then established the NSABB. The real question then is not just how to raise awareness of "issues" among scientists working within SynBERC but how to make something like the political ecology within which their science is being practiced a meaningful set of issues to engage with relative to their daily practice. Echoing a point made by Dr Roger Brent of the Molecular Science Institute[42], the June 2007 NSABB report makes the important point that synthetic biology is one among a number of sub-disciplines within the life sciences which have to be brought within a more comprehensive approach to the challenge of biosecurity. This makes the concern over tying awareness raising to daily practice especially significant.

The report suggests that while "virtually all life sciences research has dual use potential"[43] the number of 'truly' "dual use research of concern" is minimal. Importantly they suggest that on the basis of the framing, "misuse of dual use research of concern is therefore a *low-probability high-consequence event*, and this is a significant factor in the NSABB's formulation of oversight recommendations."[44] The NSABB then insists that the response should be to institute new biosecurity measures to minimize this risk, i.e. to minimize the probability of a low probability event taking place - contra preparing for the consequences of a high consequences event. Indeed this is the framing of the problem at the MIT side of SynBERC Thurst 4 where they have focused on the safety and security concerns of synthetic biology and are using Christopher Anderson's Tumor Killing Bacteria work as a model for thinking through the design of "fail-safe" organisms. Anderson's work involves a K-12 e.coli capsule which effectively 'hides' itself from the bodies immune system in order to bind to tumor cells and destroy them.

In a section of the 2007 report entitled "Need for engagement of the life sciences community" the NSABB names a number of key areas they want to see worked on; a culture of responsibility and three stakeholder areas, health, national security, vitality of the life sciences research enterprise. "Responsible scientists have a duty to be aware of the potential for misuse of their scientific findings with dual use

[42] Personal communication
[43] NSABB 2007 , "Proposed Framework for the Oversight of Dual Use Life Sciences Research*"*, 2
[44] ibid

potential." What kind of responsibility is this? Not just a minimization of risk but a preparation for consequences. At the level of the lab this might be as small as to defend the scientific enterprise rhetorically or as large as interfacing with local, national and international public health and security actors. The 2007 NSABB report cites a Nature article from 2001 by Aldous, "biologists must begin a process of self-regulation for projects that have potential applications in developing bioweapons – or risk the imposition of restrictive controls from the outside." Self-regulation has its geneaology from the 70s and Asilomar and it is not clear that self-regulation is sufficient. What are the practices that are adequate to defending free inquiry within this security milieu? The NSABB highlight an insight from the UK's Royal Society / Wellcome trust report from earlier in the year where they suggest that, "the challenge is to think beyond the obvious and identify those avenues of research and technologies that present risks of being misused for harmful purposes that are quite distinct from the original aims of the work. This needs *imaginative thinking* as the vast majority of work falls into the grey area of having some potential for misuse."[45] This means both imaginative thinking relative to misuse and imaginative thinking relative to high consequence events.

Almost across the board, both those within synthetic biology and in the wider post-genomic scene thinking about security issues have, not surprisingly named the same set of concerns; criteria for identifying "risky" work, clarity over rules, promotion of responsibility both through screening technologies and codes of conduct that will maintain responsible science. "Responsible" etymologically is a word from the 17th c, "to be morally answerable for one's actions", whose root is the Latin 'spondere' – to engage oneself. Going back to the discussion of spiritual exercise in Foucault's '81-'82 lectures, it is clear that whilst a juridical-legal framework for the governance of these technologies is necessary it is not sufficient. Moral rules as outlined in things like codes of conduct and pledges etc. are to a large degree meaningless when not tied to daily activities and practices. To paraphrase from Foucault, spiritual exercise is not practiced relative to the law but relative to the unforeseen events of life. As the NSABB

[45] Ibid, 7

go on to say, "the responsible conduct and communication of dual use research of concern depend largely on the individual conducting such activities. No criterion or guidance document can anticipate every possible situation."[46]Responsibility does not mean only the individual capacity to minimize risk (researcher should "take steps to minimize misuse of their work") but also the capacity of individuals within organizational forms to respond to events.

Methods:

What would this building of capacity consist of? Collier and Lakoff identify preparedness as the form of rationality appropriate to working on vulnerable critical infrastructure. They outline techniques of preparedness which include scenario planning, response and recovery exercises and kinds of assessment. The authors argue that "while insurance seeks to calculate probability and distribute risk, preparedness assumes that probability is not calculable and so enacts plausible scenarios in order to reveal vulnerabilities."[47] To name once again a distinction in our objects, while the political logic of vital systems "enjoins *the state to take responsibility* for ensuring the ongoing functioning of critical systems in the face of disastrous events", we are interested in how it is possible to make "responsibility" a meaningful diacritic relative to the laboratory.

Lakoff in a recent blog discussion[48] worked through the example of the Dark Winter scenario exercise in relation to the history of the "political exercise". He writes, "What was crucial to a successful scenario was that the players take their decisions in the exercise seriously. One had to somehow persuade them to behave as if the simulation were the real thing…. The point was to create a plausible – rather than likely - scenario". What this point highlights for me is Deleuze's claim that the virtual is opposed not to the real but the actual. This highlights a tripartite distinction which has been implicit which is worth unpacking between the potential, the possible and the virtual. As Carlo Caduff has written, "the dangerous events of

[46] Ibid, 8
[47] Stephen J. Collier and Andrew Lakoff "Vital Systems Security.", *ARC Working Paper*, No.2, 2006 , 4
[48] Andrew Lakoff, Vital Systems Security blog, 12/12/07

the near future are distinctive in their virtual quality"[49], in contrast to the accident whose timing is unknown , they are unknown *in form*. "The near future, accordingly, comes into view not as a realm of the possible, but as a realm of the virtual"[50]. According to this distinction then the possible is known form and unknown in visitation, whereas the virtual is unknown in form. Cynthia Selin from ASU's Centre for Nanotechnology in Society in an recent article on scenarios titled "Trust and the illusive force of scenarios" suggests that "by definition, scenarios are *possible* versions of the future so judging and evaluating scenarios is thus not about revealing truthfulness, but rather demonstrating trust, reliability, credibility in the absence of truth…"[51] It is worth repeating a quotation from Foucault's security lectures; "The specific space of security refers then to a series of *possible* events; it refers to the temporal and the uncertain.." The majority of people working within the policy realm refer to the 'potential' of technology relative to a bio-event, reflecting the political logic that Foucault suggests Machiavelli was the highpoint of, namely the pairing of fortune/evil. The move to the modern security milieu made the population the object of possible events, whose form is knowable but whose timing is uncertain (put within an apparatus to control this uncertainty).

I think it make a difference to argue that whilst scenarios *can* be used to exercise *possible* versions of the future they may also be used to work on the future in a virtual mode. One characteristic of scenarios as highlighted across the board by those who work on scenarios is that they must be "plausible". By this many things are implicitly referred to; for example, "realism" ("the experience of the realism of the event" - Lakoff) or "verifiable" ("Having verifiable facts and a 'sound analysis of reality' are criteria for a successful scenario" - Selin).

If the object of the scenario is the social, and specifically the securing of a population, then verification is the right mode of veridiction. Making the object of scenarios the social puts it in the figure of biopower such that the elements must be made object to a probabilistic reasoning. So taking up scenarios in terms

[49] Caduff, Carlo "The Futures of Risk"
[50] Ibid, 6
[51] Selin, Cynthia "Trust and the illusive force of scenarios", 2006

of non-probablistic reasoning, what can be taken seriously as a speech act and what is the object? What kind of speech acts can be taken as serious? Peer review of technical knowledge may be step one. What is serious enough to warrant continued discussion? According to Selin, at CNS "plausible" took on the meaning of 'negotiated in the context of a workshop'[52]. I think this is an interesting way of thinking about metric as it is akin to the veridictional mode suggested by Foucault of an 'aid'.

Reflecting on scenarios and the relation to trust and efficacy Selin writes, "there is only anecdotal evidence available to determine on what basis and for what reasons people may believe or trust in a particular representation of the future described in a scenario and how their behavior or thinking changed as a result."[53] If one thinks of scenarios as exercise to build capacity then it does not matter whether one *believes* in or trusts a scenario. What matters is how you *think* in them. The question then becomes what kind of thought is possible in what kind of scenario? Selin points out that "without action, or the promises of action, the scenario exercise is moot and irrelevant"[54]. I wonder if this does not overlook the distinction Allison gives us from Thucydides between action and preparedness. The logos for action of course must be readily implementable, it must be "heteimo" in Allison's words. Selin shows deftly how scenarios can be used for this purpose. For preparedness what counts is whether the exercise and the logos is an aid (voethos) rather than immediately implementable. Of course both require rumination as to the correct logos for the object. I wonder if the scenario can be used instead of as a decision making tool for a particular action, as an exercise for the building up of capacities to respond to the unknown and unknowable. As Caduff suggests, "capability clearly is the obligatory passage point of preparedness."[55] I envisage the scenario tool as an aid for thinking in which those SynBERC researchers concerned about the security milieu in which they operate are able to work on inventing adequate equipment to prepare themselves by using kinds of thinking to engage their work in a way that means, for instance, they could

[52] personal communication
[53] Cynthia Selin, 2006 "Trust and the illusive force of scenarios", Futures Volume 38, Issue 1, February 2006, Pages 1-14
[54] Ibid
[55] Caduff, Carlo "The futures of risk"

defend the pursuit of inquiry in the aftermath of an event in which their funding was threatened. One SynBERC researcher at an event Thrust 4 held at the laboratory on "Safety, Security, Preparedness" was concerned that her work, the aim of which is to make higher yield of a potentially lifesaving drug, could also be used to create new street drugs as they are part of the same family of drugs. The defense of this research and the ability to work on exercising responses to events cannot happen within the lab and so new venues are needed.

Venues:

"The venue is not a neutral scene in which specialists work, nor is it only the site within which a given mode of composition is advanced. Rather, it is a facility. That is to say, when composition is successful, the venue facilitates rather than obstructs the design and synthesis of specific interfaces. Consequently, there are venues in which particular interfaces are more likely to be obstructed than facilitated. Once the equipment is successfully synthesized in relation to upstream and downstream design parameters, then, of course, it has to be put to use. The consideration of venue thus raises the question of how, where, and when the composed equipment actually will be used as an equipmental platform."[56]

In the definition of venue in the diagnostic, what comes out clearly is the notion of interaction. The venue is the site of a certain kind of interaction. In an organizational context, where would those interactions occur? This is not self-evident. Venues must be formed. The formation of subjects happens within a structured space with norms, levels of commitment and interests. Selin in a piece for Time and Society suggests that "temporal coding" is about "the way that time is built into stories", borrowing a term from Barabara Adam she calls them "timescapes". "As a landscape architect designs spaces, a timescape artist renders time visible and focuses on the design of temporality."[57]The point is that there must be the creation of an organizational form within which kinds of temporality can unfold. For example, the

[56] , Rabinow, Paul and Bennett, Gaymon. "A Diagnostic of Equipmental Platforms," *ARC Working Paper*, No. 9, 2007, 46

[57] Selin, Cynthia "Time Matters: Temporal harmony and dissonance in nanotechnology networks" *Time & Society*, Vol. 15, No. 1, 121-139 , 2006, 126

monastery is the form within which the temporal duration of the life and practice of a monk is structured - the lab likewise for the scientist. Spaces have to be temporalized for particular kinds of ends. It is clear that the lab is one space in which a kind of inquiry is practiced, in Macintyre's sense, but it is possible that adjacent venues might be found to do other kinds of work. For instance, a venue in which scenarios can be worked on might develop capacity and make terms like "responsible science" connect to daily activities.

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