

## **“Taxonomy at a Crossroads: Science, Publics and Policy in Biodiversity”**

### **Contributions of the anthropology/sociology of science to the ‘Barcoding of Life’ (CBOL) Project**

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**This note explains the ways in which a team of sociologists and anthropologists of science are examining real-time innovation in science. Bar-coding is characterised here as one such innovation. The researchers are particularly interested in the roles that systematics and taxonomy play in underpinning biodiversity research and are fortunate to have well established links with a world-leading taxonomic and biodiversity research institution – the Natural History Museum in London. The research arose out of a fruitful collaboration between a team of sociologists and anthropologists of science at Lancaster University in the UK, and a team of natural scientists (botany and biodiversity) at the Natural History Museum, London.**

#### **Background**

Taxonomy at a Crossroads is a three year project funded by the UK government research council, the Economic and Social Research Council (ESRC). The ESRC have a longstanding interest in the social, economic and cultural aspects of science and technology. This briefing accompanies the project’s more general information document and website (<http://www.lancs.ac.uk/fass/projects/taxonomy>). It aims to do two different things:

- To introduce some of the basic premises underlying the work of sociologists and anthropologists of science and the relevance of this scholarship as applied to the global ‘Barcoding of Life’ initiative.
- To introduce ‘Taxonomy at a Crossroads’ project plans for working in dialogue with CBOL – how can the project bring to light the social, political and economic dimensions of barcoding in ways which contribute to CBOL and other taxonomic developments?

We outline below some important themes within our area of social science, STS<sup>1</sup>, which have most relevance when applied to CBOL.

#### **Science as Social**

As Sismondo has summarised (2004)<sup>2</sup>, STS begins from the assumption that science and technology are thoroughly social activities. Scientists and engineers are members of communities, trained in those communities and working within them. Communities set standards and evaluate knowledge claims. They engage in resource struggles and need to present science rhetorically in order to convince their peers and sponsors. Values and conflict are therefore inherent to science. In addition, the tensions and dynamics of wider societies – e.g. class, gender, and national culture – tend to shape scientific trajectories and can be mirrored within scientific endeavours. A commonly accepted way of describing this is to recognise that

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<sup>1</sup> STS is an umbrella term which encompasses a variety of social scientific approaches to understanding science and technology and their relationship and interdependencies with society.

<sup>2</sup> Sergio Sismondo has written one of the most accessible introductions to Science and Technology Studies: Sismondo, S. (2004) *An introduction to Science and Technology Studies*, Oxford: Blackwell.

many diverse social groups are also knowledge-actors, users and contributors. Their different ideas of purposes help shape what counts as working, valid knowledge<sup>3</sup>.

STS therefore takes an ‘anti-essentialist’ position with respect to science and technology. This means that science and technology are not defined or constrained solely by nature. Science and technology, and what we call scientific ‘facts’ are, STS argues, shaped *both* by society *and* nature.

### **What does this mean in practice?**

For STS, science and technology are active processes in which the social and the natural are mutually co-produced. For example, as scientific standards evolve and change, social standards correspondingly change, and vice-versa. STS suggests, therefore, that science should be studied ‘in action’. One practical benefit of this perspective is that it highlights the complexity of real-world science and technology. This can be particularly helpful when thinking about science in the public sphere. Whilst it can be argued that, essentially, all science takes place in the public sphere, barcoding can be seen as a case in point, in that one of the underlying assumptions of the initiative is the need to create and facilitate a ‘biodiversity commons’. So here, we have a cluster of scientific endeavours (the taxonomic sciences) in the process of innovating in both method and purpose, and in doing so, making clear linkages to public policy. Within that scenario, STS approaches, because they do not take for granted any given trajectory for the taxonomic sciences, can potentially make room for creative reflection about what kind of science society needs and wants. In the case of the ‘Barcoding of Life’ project, this could mean reflecting about different and/or improved future trajectories for taxonomy, bioinformatics and biodiversity.

### **The Innovation of Bar-Coding and STS**

STS scholars have recently become particularly interested in scientific innovation and the project ‘Taxonomy at a Crossroads’ draws upon the experience of a team of social scientists and STS scholars (Duret et al 2000), who, working together with a team of industrial innovators in France, developed a methodology designed to set up a working *dialogue* between the social scientists and the industrial innovators in order to bring science studies insights to bear in situations of scientific innovation. Their aim in doing this was to add value to the learning undergone by both teams in the process of innovation.

Duret et al.’s methodology was based on observations about how innovations have come about and been handled in the past. Among these observations was the idea that innovators often do not think about the process of the innovation, nor do they learn from it. Commonly, much effort is put into the innovation and it either succeeds or fails. Very little is learnt about the state of the world imagined through the innovation. Very little is learned about the innovation’s trajectory and how it could have been improved. The STS scholars highlighted a number of pitfalls as common threats to scientific innovatory processes. These included the following:

- i) The tendency to focus exclusively on technical developments, neglecting the importance of social, cultural and economic factors;*
- ii) The tendency to discard opposing views as non-rational;*
- iii) The tendency to confine tests, trials and debates to a small circle of those already involved.*

The ‘Taxonomy at a Crossroads’ researchers believe that discussion of these tendencies could be relevant to Bar-coding and CBOL when characterised as an innovatory process. We can characterise DNA

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<sup>3</sup> Michael Gibbons and colleagues’ book ‘The New production of Knowledge: The Dynamics of Science and Technology in Contemporary Societies’ is a much cited source for this kind of understanding of science. Gibbons, M., Limoges, C., Nowotny, H., Schwartzmann, S., Scott, P., and Trow, M. (1994) *The New production of Knowledge: The Dynamics of Science and Technology in Contemporary Societies*, London: Sage.

barcoding and CBOL itself as an innovation in the following scientific, social, economic, infrastructural and political terms:

- In scientific terms, innovation is occurring through the use of high throughput sequencing technologies together with cutting edge bioinformatics (algorithms and database technologies) in ways which transform the production and distribution of taxonomic information.
- In social terms, CBOL is innovating in the way that it is bringing into being new configurations of producers and users (as well as imagined users) of taxonomic science. The concept of the public as ‘users’ of the biodiversity commons is a good example of this point.
- In economic terms, innovation is occurring as the introduction of DNA barcoding shifts funding priorities in taxonomy, and new potential users (ranging from Aviation Authorities to Forensic, Public Health and Agricultural Pest Control authorities) appreciate the uses to which rapidly and accurately produced taxonomic data can be put.
- Finally, infrastructural/political innovation is occurring in that CBOL understands that in order for a scientific project of this scale to work globally (ensuring barcoding is universal in both application and access), it has to standardise people’s actions: it has to develop standards and protocols for the collection of whole specimens, the extraction and sequencing of DNA, and the analysis of data distributed through an on-line, digital database.

### **The creation of dialogue**

Our plan is to use the three possible pitfalls highlighted (i., ii., iii., above) as a tool for the creation of *dialogue* with selected key CBOL players. Together with CBOL and regional partners, we will work towards explicitly bringing the social, political and economic dimensions of the ‘barcoding of life’ initiative into discussion. The aim in doing this is to place the unfolding development of this science within a wider conceptual frame for debate by those involved. In our project proposal, and in the project’s general information document, we refer to this type of dialogue as a ‘consortium building’ methodology. This is because it brings together social scientific and natural scientific thinking on the process of innovation underway. We hope that such two-way dialogue will work to enable the ‘barcoding of life’ initiative and the social scientists to think about scientific, public and policy expectations and needs alike.

The following are some of the kinds of questions that we would raise in dialogue with CBOL through the methodology pioneered by Duret et al..

- a. To what extent do/can CBOL’s working groups focus upon social/economic/infrastructural/political issues in parallel with the scientific and technological needs of barcoding?
- b. Where/by whom should the definition and practice of barcoding science take place?
- c. What is the taken-for-granted meaning of (biodiversity, or other) ‘policy’ or ‘policy-relevance’?
- d. Can views which question or even oppose ‘barcoding’ be incorporated within CBOL?
- e. How is the ‘barcoding of life’ initiative presented to different audiences? At what point, and how, is it presented as having achieved closure?

The researchers recognise that these are challenging questions. However we offer them in a spirit of openness in the collaboration between social and natural sciences. These are the kinds of question that STS has found salient to creating open, inclusive, and ‘learning’ innovatory trajectories in science. They are also the kinds of question relevant to attempts to create stronger and mutually positive bridges between science and society. The researchers have considerable experience in positioning these kinds of questions in open, non-threatening ways, for the purpose of creating dialogues and reflection. Our aim is to do this in full consultation with CBOL, hence this briefing.

### **Next stage**

In the next stage of our research we aim, in consultation with our scientific partners, to set the ‘consortium building’ methodology in motion. As emphasised above, this is, in simple terms, a process designed to create dialogue and reflection. To do this we are planning to run a focus group at CBOL’s next regional meeting in Campinas in Brazil, February 2007. This event will include 8-10 regional and international CBOL players and will be designed to facilitate discussion about the innovatory potential of the ‘barcoding of life’ initiative as well as the so-called ‘pitfalls’ of innovation mentioned above. Two social scientists on the research team will facilitate this discussion.

The ‘evidence’ gathered from the focus group will then be used by the social scientists at CBOL’s next international meeting to be held in September in Taipei. This stage will consist of further structured discussion between social scientific and CBOL players. The intention is to encourage all selected players to reflect directly upon the innovatory ideas and options that are open within CBOL, to recognise the diverse (social/economic/infrastructural/political as well as scientific) futures that are incorporated within these ideas and to open out dialogue and thinking to address how these might be practically relevant to the ‘barcoding of life’ initiative itself.

At a subsequent Bar-Coding of Life meeting in 2008 we hope to build on the achievements of Taipei, re-iterating dialogue processes and presenting new reflections. Finally, a last meeting will be held within the CBOL timetable at the end of the three year project (2009) designed to evaluate what these dialogue processes have contributed to innovatory processes and learning within CBOL.