

## **An anatomy of bioscience image-making: divides and loop-holes in between research and teaching**

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### **Abstract**

In this paper, recent research of scientific image-making process will be combined with new empirical analysis of close-reading images, drawing and accompanying interview data among leading pharmaceutical researchers and their students. The work explores the sharp divide between the image-making practices of original research (with its preference for material data) *versus* the “literary turn” included among the explanatory (and inferential) image-types of textbooks, reviews and the majority of lecture presentations. Nevertheless I will also explore some of the loop-holes whereby these two different cultures sometimes interact and sustain each another, pointing at an ability to toggle back and forth between material knowledge-work and talk about it as a source of new creative insight. My paper will suggest a variety of drawing-based research methods which might also become a new repertoire of teaching in university science.

### **Outline**

“Academic literacy” (cf. Lea and Street, 1998) has created vital gains in the “writing” disciplines of Higher Education (Haggis, 2009). Academic literacy implies method, methodology and deep theorising (e.g. Lillis, 2008) while also being a simultaneous means of personal development (e.g. Baxter Magolda, 2007), so that while literary text production is a process of *self*-authorship, writing and its allied practices also lends itself to qualitative measure of relationships in and towards “other” cultures/beings (Freedman & Ball, 2004). In science education, however, the “literary turn” is somewhat more contentious (Radder, 2012). In order to *practice* Science people inevitably need to learn to read, write and speak scientifically (e.g. Norris & Phillips, 2003; Yore, 2003), but the epistemic virtues of scientific “objectivity” place greater store in visual data than in writing (see Daston & Galison, 2007). This would not be problematic if the difference were only of communication mode: If it were true that science multi-modal grammar (Kress & van Leeuwen, 2001) functioned in comparable (or at least analogous) ways to those of the “literary turn” in the Humanities, the Social Sciences and contemporary Philosophy. The larger problem is that while communication *about* science may show a corresponding (literary) reading path, this is much more doubtful when applied to science knowledge-making (see Latour, 1987): Where material realization is rendered in the setting of experimental (or better, referential) realism (cf. Radder, 2012).

Latour’s account of laboratory life (Latour and Woolgar, 1986) remains one of the most relevant science studies of this issue. In this ethnographic work the whole *system* of the laboratory and its extensions (its people, technologies, transactions and economies etc.), are shown to exist primarily for the purposes of material inscription whereby material *per se* is mobilised (see also Latour, 1999; 2005; 2013). The essential issue (the crux of scientific “verification” and “verifiability”; cf. Radder, 2012) is that throughout the transformations which substitute one referent for another in order to achieve mobility, the identity of the referent is preserved immutably. Where for example, the specific characteristics of soil (the referent of pedology), dug-out in different places, is gradually replaced by

numeric codes and other graphic marks which build a map of soil-type valid for exchange among soil scientists so long as it is true that *the soil* itself remains the constant matter of the map (Latour, 1999). Little wonder then that one of the most constant refrains of experimental science is: "*I don't want to be told about your findings; I want to see your methods and your data!*"

Moving to the science education setting, the term "scientific literacy" now becomes a somewhat problematic catch-all as it must embrace both talk *about* scientific findings (including the written, spoken and image-based communication to which early and mid-stage students are pointed in review articles, textbooks and in lectures; while also including the exclusive category of images of science-research *practice*: A practice determined by the code of referential realism which automatically precludes talk *about* science, preferring only verifiable render of the referent (Radder, 2012). This is not to say that original research papers exclude discussion (they almost always do include such discourse); nor that textbooks don't include the image-types of research (they do). What is important is acknowledgement that while these two strands of practice (one essentially material; the other, inferential) run side-by-side, they nevertheless exhibit very different epistemic virtues, even contradictory ones, and these must be disentangled if we want to approach science (or science education) as a comprehensive whole.

In this paper I will review the literature which sheds light on this otherwise intractable problem and I will present new empirical analysis of images taken from textbooks and research papers. I will also present new interview data and the results of drawing/image-making exercises carried out by research-leaders and their students. My key-informant studies are all situated in the field of leukocyte recruitment (the study of the process by which white blood cells aggregate and activate at wound-sites) and my work gathers expert contributions from different branches of that field (immunology; haematology; histopathology; and vascular physics).

In my presentation I will deliberately explore the ways in which drawing-tasks and image-discrimination tests (Ainsworth, Prain & Tyler, 2011) might be developed for the purposes of new educational research in science visual-studies even while they are also being used to teach students to discriminate between the virtues of referential realism *versus* inferential image-types or to differentiate among the various material strands of laboratory work in immunology, haematology, histopathology etc. But I will also use the latter parts of my presentation to re-examine the research-to-textbook boundary, revealing some of the possible loop-holes which might blur the over-arching problem of divide between the making of research (material) and its inferential explanation. To achieve this move I will explore new turns in notions of inscription process, showing how traces of research might pass through the switch to textbook-teaching mode because of the corporeal entanglements (Myers, 2014; Knorr Cetina, 1999) which bind-up scientists within their epistemic things (Rheinberger, 1997). I will also draw on the work of Hoffman (e.g. Hofmann, 2013) and Whitmann (2013), showing how drawing/writing processes sometimes legitimately participate in the making of scientific reference. My final step will be to trace some important examples of research which includes imaginative render at the point of conceptual origin using historical accounts of Pauling's Lock and Key Hypothesis and Ehrlich's visual representation of antibody structure (see Cambrosio, Jacobi & Keating, 1993; 2006) to model what Latour and Woolgar (1986) describe as the often hidden "analogical path" of creative science.

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