Editor's Introduction

Looking and seeing are essential ingredients of biological research. A proposition like this sounds trivial, however. Doesn't every fully-fledged instantiation of empirical research by definition imply the fulfillment of at least two prerequisites: (a) that *sensory*, rather than imagined, data be collected, whatever the means of collecting these data may be; and (b) that the areas of the brain involved in cognitive activity duly process the incoming sensory data in order to produce interesting propositions about the object of investigation?

Furthermore, aren't visual data richer, more compelling, and above all more precise than sensory impressions provided by other modes of perception? (Francis Galton's not too far-reaching attempts at designing methods for doing arithmetic by smell at least suggest that visual signs denoting numbers are more amenable to mathematical processing by humans than olfactory signs standing for numbers.) Yet, though granting that Kant was right after all when he claimed that intuitions without concepts are blind, and concepts without intuitions void, one may still consider the possibility that the regimes of gathering *visual* data for the life sciences have undergone major transformations in the past four hundred or so years. Hence, saying that seeing is an essential ingredient of biological research is likely to turn out to be not only trivial, but also epistemologically not well informed, and thus inadequate.

And yet, if the visual inspection of animals and plants had been a standard procedure in the life sciences from the outset, the insistence with which Bernard Palissy (ca. 1510–ca. 1590) pleaded for the use of one's eyes in the study of nature would not have struck late-sixteenth-century French readers as a novelty. Palissy's treatise on how to build new collections of natural history specimens or to enrich existing ones frequently resorted to expressions like "I shall put before your eyes...!" or "You see...!" The emphasis laid on the epistemic power of vision confirmed the shift that was taking place from the ancient regime of knowing by reading (mainly texts from the Aristotelian tradition) to the new regime of knowing by looking at natural bodies of all sorts and in all places. But just looking at such bodies wouldn't have sufficed, for the visible parts of organisms had to be *understood* before they could be represented properly by texts and possibly by artfully executed illustrations. Palissy's disquisitions were therefore also meant to *educate* the eyes of his fellows. Demonstrating by scholarly prose and icons what the fabric of animal and plant life looks like was at the same time demonstrating how to teach oneself the appropriate way of visually observing nature.

The relationship between the observer and the bodies to be studied became much more complex with the advent of prostheses of vision (such as the microscope) and, later, with the invention of imaging devices that replaced the onlooking
subject with sensors made up of non-living parts somehow mimicking the optic power of the human eye. In addition, since 1625 when Francesco Stelluti, one of the founding members of the Academia dei Lincei, made what were probably the first engravings of microscopically observed bodies, the use of intermediate apparatuses capable of widening the scope of the life scientists' vision also created scopic paradoxes. One such paradox may here be summarized in one sentence: Usually the lower the scale of the target object of observation, the more this object has to be rendered selectively visible by manipulations. Rather than catching the naturally given morphological properties of living matter, biological seeing implied the management of bodies by various techniques such as slicing, applying dyestuffs, filtering light rays, etc. Yet, how could one be assured that selective visibility had really been achieved under such constraints? And how could one be sure that the manipulations had not very efficiently created artefacts? One could as well, by way of alluding to a passage in Denis Diderot's Elements of Physiology where the author compares the human eye to a dog helping a blind man to find his way, ask whether the dogs of microscopy, microphotography, radiography, and kindred machineries were in fact always leading life scientists where they intended to go. Be that as it may, it turns out that the relationship between (a) the intervention that is done to make the target objects of biological inspection fit to be seen; (b) the more or less well trained eyes of observers who are looking at the objects made fit to be seen; and (c) the mind of observers who are theoretically envisioning what the eyes were supposed to see: by far exceeds in complexity the supposedly simple link that holds the onlooking organ of visual perception on to the things visually perceived, as the articles collected for this issue of the Journal amply show.

A word may be welcome informing readers how the articles were prepared for this special issue. The texts originated from an informal group of authors who were doing research in early 1998 at the Max Planck Institute for the History of Science at Berlin. The group conceived of a project that would investigate how small-scale entities have been approached in the history of the life sciences. Some of the authors are still working at the Max Planck Institute; others who were visiting scholars at that time have since returned to their home institutions. None of the authors had been focusing exclusively on the topic of the present issue. Rather, the issue of envisioning small-scale entities in the life sciences (infracellular architectures, cells, parts of organic tissues, organs, minute anatomical features, small animals, etc.) by manipulatory management of the target objects of investigation had been touched upon only occasionally in our discussion. But it revealed itself to have been stubbornly present throughout the past four centuries of the life sciences. Hence the decision to ask each contributor to articulate what epistemic seeing entailed in the domain she/he would investigate.

Drafts of the papers first circulated among the authors. At a later stage, the contributors met in Berlin for a three-day colloquium in the course of which each text was cross-examined by the contributors. Finally, the revised versions were once again read and critically assessed in early 1999 by the editor, who, though
Editor's Introduction

tempted to join his colleagues in the thrilling enterprise of historically gazing at researchers who had been looking into the minutiae of life, refrained from doing so in order to freely keep up with his role as “manager” of a rather exceptional collective enterprise.

Alexandre Métraux