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Historical case studies as teaching tools: A case from erythrocyte aging research

(1) Introduction

It is well known that case studies provide a privileged chance for the implementation of inquiry-based teaching methods and, thus, constitute a valuable resource in science education, promoting independent work and engaging students in the learning process. Historical case studies are often described as science in action stories. The focus of such stories may be the dynamics of a research domain, an issue we might explore by the epistemic objects constructed within given experimental systems, through specific material practices.

The present paper aims to analyse an historical case study as an interesting tool in view of a teaching and learning scenario at the undergraduate level in the field of life sciences. The paper begins with a brief description of that scenario. It proceeds with the setting up of the case — which deals with a specific biological / biomedical problem (erythrocyte aging) —, followed by an illustration of some issues that can be considered for in-class discussion. Finally, some concluding remarks are outlined.

(2) A teaching and learning scenario

The present approach was developed for the scenario of undergraduate biochemistry. It has been implemented, in the academic year 2005–06, in a basic biophysics subject — "Biophysics II" — of the 4th semester of the Undergraduate Degree Programme in Biochemistry of the University of Porto. Biophysics II is taught in close association with another subject, namely "Biochemistry and Biophysics Laboratory".

The topic was included in a series of classes on the theme "Biophysics and the Construction of Knowledge within the Life Sciences". Those classes — distributed throughout the semester — were designed to provide an opportunity to discuss questions around what is biophysics (and how biophysics is enacted) as well as on its origins and impact in the broad fields of biology and biomedicine.

As stated in textbooks, erythrocytes have been an invaluable experimental model within the domains of biophysics and biochemistry; the proposal was thus to examine a specific area of research that has been performed on these cells.

(3) Setting up the case

It is well known that mammalian erythrocytes are peculiar enucleated blood cells specialized for oxygen transport within the organism. These cells have a definite life span, which in health and under normal condition has duration of approximately 120 days. During that period the cells undergo a series of changes globally understood as an aging process and that ultimately lead to their removal from the bloodstream.

The phenomena of erythrocyte aging has been the object of much and diversified research work [1] The starting point for the discussion is a plot representing the temporal evolution (1950–2003) of the number published papers per year indexed by "erythrocyte aging" in the PubMed database. What might these data tell about the dynamics of the research domain?

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[1] For reviews see Clark (1988), Bratosin *et al*. (1998), Bosman *et al*. (2005) and Lang *et al*. (2005).

(4) Some issues to look at

The discussion [2] was conducted on the following issues:

- Genealogy of a biological / biomedical problem. (How did the problem of erythrocyte aging appear?)
- Establishing experimental systems. (How was erythrocyte aging assessed?)
- "Doability".[3] (What are the conditions making scientific problems doable?)
- Emergence of new conceptions. (How do conceptions change?)

Looking at these issues, a timeline of major breakthroughs within the erythrocyte aging research domain was built by the end of the discussion.

(5) Concluding remarks

A timeline of major breakthroughs in the research domain can be "actively" constructed in-class based on the temporal evolution of the number of published papers per year. The followed approach provided an opportunity to involve students in a discussion on the dynamics of science; an alternative approach would be to give to the students (or groups of students) the written case for independent work. To conclude, the study of topics of the dynamics of science within a science subject seems easy to implement and might be an important contribution to the training of science students in history of science.

References

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[2] Inspired by the work of Rheinberger (1997).

[3] In the sense developed by Fujimura (1987).