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Biology and war: American biology and international science

(1) Introduction¹

“Biology and war” was the title of a short essay the German-American physiologist Jacques Loeb (1859–1924) published in “Science” 1917.² This paper summarised the unpleasant feelings Loeb had about the First World War. He was deeply disappointed that the international scientific community had been destructed by bellicose politicians.

As the discussions of the symposium on “Politically active scientists in the 20th century” (R-17) have shown the case of Loeb is by far not unique, but in my presentation Loeb will serve as a perfect example to display the interconnection of a scientist’s epistemology with his world view and his social commitment. From this starting point I will try to explain why and in which way it was imperative for Loeb during and after the First World War to combine his social commitment with the promotion of his approach to biological research. I will reconstruct in how far Loeb’s social commitment directed his attempts to act as a catalyst for the implementation of his epistemology into the post-war European life sciences. I will argue that he played an important role in formulating and integrating an experimental, quantitative and reductionist approach into European biology. As sources will serve his correspondence shared with prominent scientists all over the world and his works published between 1888 and 1924.

(2) Jacques Loeb and his science

When the First World War started in 1914 Jacques Loeb’s career had reached its zenith. Until the year 1914 forty-five colleagues from all over the world had nominated him more than 40 times for the Nobel Prize and his more than 300 papers and books published until that year were widely read and received. (During his whole scientific career Loeb published more than 450 articles and books). Loeb held honorary doctorates from e.g. Cambridge (Sc.D.), Geneva (M.D.) and Leipzig (Ph.D.) and he was mentioned in the same breath with colleagues like Wilhelm Ostwald, Ernst Mach, Thomas Hunt Morgan or Svante Arrhenius.

Loeb was born 1859 in Mayen, Germany. He had been trained as a physiologist in a medical setting under prominent representatives of German physiology like Friedrich Goltz, Nathan Zuntz or Adolf Fick. After he had started his scientific career with studies on brain physiology, he came under the spell of the experiments performed by the plant physiologist Julius Sachs. Sachs had explored tropisms and growth in plants assuming that differences in forms of organs were accompanied by differences in their physical and chemical constitution. Loeb referred to these theories when he himself experimented on tropisms, regeneration and growth in lower animals during research trips to Naples in 1889 and 1890. Loeb feared to be unable to get a permanent position in the German university system. Therefore, he emigrated to the USA in 1891. Via Bryn Mawr, Chicago (1892), and Berkeley (1902), he came to the Rockefeller Institute for Medical Research in 1910, where he held a research position until his death in 1924.

His most famous “discovery” was the invention of artificial parthenogenesis. He could show that embryological development could be initiated in sea urchins’ eggs by treating them with inorganic salt solutions. After joining the Rockefeller Institute for Medical Research in 1910 Loeb shifted his research to the exploration of temperature coefficients and to the theory of colloidal behaviour. He was able to prove that proteins could be described as genuine molecules and that their chemical behaviour

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¹ A more detailed and annotated version of this paper is currently being prepared.

² Loeb, J. (1917): “Biology and War”, *Science*, vol. 45, p. 3–76.

could be described in classical stoichiometric terms. Furthermore, Loeb was one of the first who realised that

the swelling, the viscosity, and the osmotic pressure effects produced by varying the ionogenic equilibrium may be adequately explained and predicted by an application of Donnan's membrane potential law.³

In American biology Loeb played a role that he could not have played in Germany. His experimental, physiological interest did not fit into the prevailing morphological style of German biology. His biological interest did not fit the mainstream of German medical physiology. Pursuing his kind of research interests was impossible in Germany but fostered in America. In America he was able to combine in a professional setting his tradition of physico-chemical oriented "German style" physiology with an interest in "biology".

Loeb's epistemology can be summarised as trying to find the physico-chemical basis of life on a quantitative, experimental basis. However, Loeb went even further. He insisted on a technical approach, which the historian Philip Pauly summarised as Loeb's "engineering standpoint".⁴ Loeb stressed that the aim of his research

is not solely analytical. It has another and higher aim, which is synthetical or constructive, that is, to form new combinations from the elements of living nature, just as the physicist and chemist form new combinations from the elements of non-living nature.⁵

(3) Jacques Loeb and his world view

This engineering standpoint not only constituted Loeb's research but also his world view. His ethics, his social commitment and his view of scientific cooperation was derived from this standpoint. According to Loeb his "technical biology" had an impact on different aspects of human societies: 1. anthropology and culture, 2. the economy of industrialised countries and 3. social behaviour. From his understanding of biology Loeb derived his solutions for social problems. Science was the guideline for his ethics. As a consequence he fought against what he considered superstition or "metaphysical romance".⁶ Because for Loeb the "nature of superstition consists in a gross misunderstanding of the causes of natural phenomena" he pleaded for the masses to be taught sciences to overcome superstition. He saw the western societies still under the influence of ancients who acquired wealth "by dispossessing others of it". He hoped that through the natural sciences and his technical biology the ethics of political and economical life could be altered. For Loeb the natural sciences had shown that "there is another and more effective way of acquiring wealth, namely by creating it." According to Loeb the

wealth of modern nations, ... , is not due to their statesmen or to their wars, but to the accomplishments of the scientists.⁷

Therefore, he became an anti-capitalist and was of the opinion that politicians and lawmakers should be urged to learn the sciences.

³ Bogue, R. H. (1922): "Recent Chemical and Technological Advances in Our Knowledge of Gelatin and Glue". *The Journal of Industrial and Engineering Chemistry*, vol. 14, p. 795–796.

⁴ Pauly, P. J. (1987): *Controlling Life: Jacques Loeb and the Engineering Ideal in Biology*. New York: Oxford University Press. See also Rasmussen, C., T., & Tilman, R. (1998). *Jacques Loeb: his science and social activism and their philosophical foundations*. Philadelphia: American Philosophical Society.

⁵ Loeb, J. (1912): "On some facts and principles of physiological morphology", in: *The mechanistic conception of life. Biological essays* (Chicago: University of Chicago Press), pp. 85–109.

⁶ Loeb, J. (1915): "Mechanistic science and metaphysical romance", *Yale Review*, vol. 4, p. 766–785.

⁷ Loeb, J. (1904): "Recent developments of biology, Address delivered at the Congress of Arts and Sciences, St. Louis", *Science*, vol. 20, p. 777–786, here p. 784–785.

(4) Commitment to world view

Loeb not only formulated these ideas in programmatic pamphlets, he also tried to be actively involved in their realisation. While in Zürich around 1890 he joined a circle of free thinkers around the physiologist Justus Gaule and the Gustav von Bunge. He promoted the works of Popper – Lynkeus on social reform and when he came to America he immediately tried to establish contact with Paul Carus, the editor of the American journals “The Open Court” and “The Monist”. However, he hesitated to join any political or philosophical organisation until 1911. In that year Loeb publicly promoted his idea of science as a world view under the roof of the “Monistenbund”.

Asked by Wilhelm Ostwald, one of the leaders of the German monist movement, he participated in the First International Congress of Monists at Hamburg giving one of the key addresses. In a letter to his former teacher Nathan Zuntz he played down his participation with the words

The monists really interest me and I think it will be great fun to participate as an apostle in the Monistenbund, especially in team with Arrhenius and Ostwald.⁸

Nevertheless, until 1914 Loeb tried to work for the monist cause in America and he even explored the possibility of bringing social democrats and monists in America together.

(5) International science and war

The outbreak of the First World War meant a catastrophe for Loeb — personally and scientifically. On the 31st of August 1914 he wrote to Simon Flexner, the Head of the Rockefeller Institute for Medical Research: “All scientific work abroad, even in England has stopped, publications likewise.” He was directly affected scientifically because three of his papers were in print in Germany and he feared that they “will of course never be published”.⁹ He was also affected personally being confronted with miserable fates of some of his colleagues.

However, Loeb did not just lament, he immediately tried to help. Again and again he wrote letters to Flexner inquiring the possibilities of help for the one or the other scientist stuck in America, who was deprived of his earning a living through scientific work by the war. Among them were not only German biologists like Richard Goldschmidt or Rhoda Erdmann. Loeb also tried to help for example the Belgian historian of science George Sarton, editor of *ISIS*, who got stuck in the US and was

apparently literally starving and offers to give French lessons in order to support his wife and child.¹⁰

Loeb did not only fight for individuals, he also fought for the internationality of science. After America had entered the war he tried to convince his American colleagues that

science knows neither enemy nor friend, but is solely a question of the promotion of truth and the knowledge of nature.¹¹

According to this understanding of science Loeb was heavily disappointed when the Wistar Institute, publisher of the *Journal of Experimental Zoology*, refused to publish an extremely positively reviewed paper by the Swiss researcher J. Seiler who was affiliated to the Kaiser Wilhelm Institute for Biology, because it did not want to publish the works of enemy aliens leaving aside the fact that Seiler was a Swiss citizen. Being one of the editors of the journal Loeb was of the opinion that it should be insisted upon the publication of the article. To him it was

incomprehensible ... why political affairs should in any way be mixed up with the publication of statements of abstract science which is or should be above the stupidity and the brutality of politics.¹²

⁸ Loeb to Zuntz 11.04.1911, Sammlung Darmstädter, Staatsbibliothek Preussischer Kulturbesitz Lc1871, translated by HF.

⁹ Loeb to Flexner 31.08.1914, *Flexner Papers*, American Philosophical Association (APA).

¹⁰ Loeb to Flexner 30.03.1915, *Flexner Papers*, APA.

¹¹ Loeb to Ross G. Harrison 29.10.1917, *Loeb Papers*, Library of Congress.

¹² Loeb to Ross G. Harrison 29.10.1917, *Loeb Papers*, Library of Congress.

However, when after the war his own “Journal of General Physiology” was affected, Loeb decided against publishing a German author fearing the boycott of his journal.

(6) Shifting to science politics

At the beginning of the War Loeb had tried to balance the arguments and interests of Germany and Austria-Hungary on the one side and France, England, Italy and Russia on the other. To him the war was the result of alliance of misled politicians and industrialists. The joint forces of superstition, capitalism and militarism in Loeb’s view had seduced the masses on both sides to rush into war. In accordance with his world view he tried to find a biological explanation for this seduction. Referring to his own tropism experiments he argued that chemical substances played a major role in determining “degrees of freedom” in individual actions. People could be aroused by certain phrases, because these lead to the secretion of certain substances in the body. Politicians in the countries in War, especially in Germany, now had, in Loeb’s opinion, reduced the degrees of freedom of their population to use them for their purposes. The phrases in action were “racial superiority” or “Slavic” or “French culture”. To Loeb all these phrases were supported by any scientific fact.¹³

In the course of the War Loeb shifted his assumptions more and more towards blaming the “German Junker” for the misery of the War. He was disappointed by noticing that even scientists were misled. He ended his friendship with the Ostwald family and when Richard Goldschmidt was interned in the US as an enemy alien he noted to Thomas Hunt Morgan:

To tell the truth, I have never been able to understand how it was possible for a man of Goldschmidt’s intelligence not to look through the imposition worked upon the German people by their Junkers and industrialists’ class. I think their’s is a case of a nation rendered insane by philosophy and peer biology, to such an extent that even men like Goldschmidt cannot gain their mental health any more.¹⁴

Before the War, Loeb had considered science to be a matter of method and not a matter of race or national style. In contradiction to this view but in analogy to his biological interpretation of the War’s reasons he began to associate some trends of science in Germany with German Junkerism. Among these were e.g. “colloid chemistry” or “morphology”. Thus, he related scientific approaches he considered as false to a “German style of science”.¹⁵

When the War was over Loeb was so convinced that German science and the German universities were contaminated by the virus of Junkerism, that he consequently began to direct his science politics towards fighting the German striving for cultural hegemony. He followed the plan to overcome the alleged German dominance of science on two levels of disseminating resources:

1. On the level of publishing scientific findings and
2. on the level of financial support for scientists.

(6.1) Science Politics — dissemination of literature

Loeb knew well of the powers of scientific publications for fostering the one or the other world view. To support his view of science he developed the plan to edit an own journal — “The Journal of General Physiology”. In May 1918 he justified his plans for this journal (financed by the Rockefeller Institute) to Flexner:

The more I think of it, the more I am convinced that the organization of all the sciences by the Germans was a deliberate part of their scheme of world domination, and I am also strongly of the opinion that they could carry through their scheme only by having their scientific periodicals subsidized because the latter were not self-supporting. ..., I think it

¹³ Loeb, J. (1914): “Freedom of will and war”, *New Review*, vol. 2, p. 631–636; Loeb, J. (1917): “Biology and War”, *Science*, vol. 45, p. 73–76.

¹⁴ Loeb to Morgan 03.05.1918, *Loeb Papers*, Library of Congress.

¹⁵ For an overview of Loeb’s views on national styles of science see Fangerau, H., & Müller, I. (2005): “National Styles? Jacques Loeb’s Analysis of German and American Science Around 1900 in his Correspondence with Ernst Mach”, *Centaurus*, vol. 47, p. 207–225.

becomes imperative for us to see it that the coming generation is not compelled to submit to German leadership in science, and the only way we can accomplish this is to create scientific journals of our own in sufficient number and of a sufficiently high character.¹⁶

With the identical aim he started a series of monographs on quantitative experimental biology in the same year with T. H. Morgan.

After the war Loeb intensively began to promote the monograph series and the Journal in Europe. In the aftermath of the War, during time of inflation and lack of resources he sent several copies of them to scientists and institutions in Central and Eastern Europe (e.g. Emil Godlewski, Hans Przibram, Otto Warburg ...). Thus, by helping colleagues to re-establish scientific activities Loeb could disseminate his ideas. Furthermore, he urged his European colleagues to make his papers accessible to other scientists and to review them in European journals. For example, when he sent copies to Hans Przibram from the Biologische Versuchsanstalt in Wien he asked:

It is possible that the journal may interest other scientists outside of the Versuchsanstalt and if you feel that it should be made accessible to them I leave that to your discretion. If you should feel also that some of the contents of my book on 'Forced Movements etc.' would be of interest to other biologists I leave it to you to arrange to have the book reviewed either in Roux's Archiv or in the Biologisches Centralblatt, as you may see fit.¹⁷

Only one month later he repeated this wish in a letter that was accompanied by food cards for Przibram and other scientists at the Anstalt.¹⁸ Loeb had become a clever manager of scientific content and managed to combine his social-philanthropic world view with his wish to foster his way of doing science.

(6.2) Science Politics — funding research

The second level on which Loeb proved to be a clever science manager was that of financially aiding scientists in need after the War.

The more he heard from scientists approaching him about the conditions in German universities the less sympathy he had for the whole German system. Richard Goldschmidt, Nathan Zuntz, Hans Driesch, Otto Meyerhof, or Albert Einstein wrote of anti-Semitism and a reactionary climate. Thus, Loeb was convinced that it was better to direct financial aids and support to:

the few good and decent men in German universities as to disregard the brutal and stupid majority of professors.¹⁹

In contrast to the politics of the Rockefeller Foundation that funded institutions he wanted to give grants to selected scientists directly. To Goldschmidt he wrote

I feel that your group of men at the Kaiser Wilhelm Institut should be helped before anybody else. A committee is organized here which tries to help indiscriminately whereby in my opinion little will be accomplished. It does not pay to help the research of men who are incompetent to do research. I think the men who have shown that they can make progress and have originality and self-criticism should be helped first. I am trying my best that when the time comes that help is extended by the Rockefeller Institute this viewpoint will prevail.²⁰

Loeb's best was not enough. Neither Flexner nor the Rockefeller Foundation did consider Loeb's approach of aiding European scientists by personal small appropriations feasible. Nevertheless, Loeb was successful in helping single scientists through steady applications to Flexner. Among the ones he could organise financial aid for were the Nobel Prize winners Otto Warburg, Otto Meyerhof and Albert Einstein, scientists who shared Loeb's view of science and society to a large extent.

¹⁶ Loeb to Flexner 16.05.1918, APA.

¹⁷ Loeb to Hans Przibram 10.03.1920, *Loeb Papers*, Library of Congress

¹⁸ Loeb to Hans Przibram 14.04.1920, *Loeb Papers*, Library of Congress.

¹⁹ Loeb to Flexner 13.12.1923.

²⁰ Loeb to Goldschmidt 18.01.1921, *Loeb Papers*, Library of Congress.

(9) Conclusion

Loeb combined epistemology, world view and social commitment after the World War. He strived for re-establishing the international scientific community. Furthermore, he wanted to re-shape European science. Facing his substantial support for selected scientists and institutions in Europe Loeb's role as a catalyst for a transatlantic scientific exchange cannot be underestimated. During the first years after the war Jacques Loeb played a key role in implementing a physico-chemical view of the life sciences in Central and Eastern Europe. He helped to disseminate a technical experimental biology that was sometimes oversimplifying characterised as a reductionist American approach. Of course one cannot attribute the success of this approach solely to Loeb and his activities, but in the examination of the development of the life sciences in Europe Loeb's joint epistemology and social commitment deserve consideration as one of the mosaic stones that make up the whole picture of American biology and International science.