Sleuthing and Science: How to Research a Question in Medical History*

History as a simple recitation of names and dates is dusty, boring stuff. But questions about why we do what we do or think what we think are compelling. Similarly, it can be equally compelling to seek answers to questions about why people used to think or do certain things, especially if those thoughts or deeds are now considered wrong. Historians can enjoy the excitement and intrigue of detective work with a much lower risk of getting shot.

Bad medical history gives the entire enterprise an undeservedly poor reputation; it may explain why books about teaching history to health-care students seem obliged to begin with self-justification. Anatomy, physiology, and pharmacology do not apologize for their presence in the curriculum. Yet good history is also directly relevant to health-care education. It revolves around a fundamental truth: things change at different rates in different times and places, and for different reasons. Exploring the dimensions of that statement with respect to any aspect of health-care provision, in any culture, is history. Historical investigation relates to the goals of lifelong learning and evidence-based choice, which are essential for competent practice. Furthermore, good historical research resembles the scientific enterprise in many ways; it is about questions and answers.

This chapter contains my advice for conducting historical research. It is a subjective product of personal trial and error. I make no claims for originality. A history project can be approached in countless other ways. My method was and still is being shaped by my professors in medicine and history, and by colleagues, writers, editors, and especially my students. Since I am unable to perceive its weaknesses and biases, I advise you to use these ideas with care.

Framing a Clear Question

The question is like the hypothesis in a scientific experiment.

The would-be investigator of history must understand exactly what is being sought and why she or he is seeking it. Presenting rounds, writing a report or an after-dinner speech, contemplating a change in practice, developing a policy, or simple curiosity are some of the many reasons that lead a student or practitioner to ask an historical question. The question will inevitably be refined by the available sources of information, by the results, and by the individual conducting the investigation. The final form of the question may bear little resemblance to the original.

At all times, the investigator should have in mind an honest and concise statement of the current question. Sophisticated questions take into account theoretical explanations that have usually been generated by other scholars for application to similar problems; however, simple questions are not intrinsically boring, nor does anything preclude creating a new theory.

Thoughout the process, the historian must acknowledge his or her role as a participant in the project – in matters of taste pertaining to the selection of subject, in the choice of research avenues that appeal, and in the neglect of pathways that seem less promising.

Identifying Sources

Sources are like the materials in a scientific experiment.

The evidence for statements about the past are the sources. In general, sources are of two types – primary and secondary – but they

*Educational objectives for this chapter are found on p. 399.
may overlap. Sometimes it is simpler to begin with the secondary sources, where you may quickly find an answer to your question. Appendix B, on resources and research tools, introduces general secondary sources on various subjects. But answers derived from secondary sources should be handled with care. The best evidence comes from primary sources.

**Primary Sources**

Primary sources are documents produced during the period under investigation or produced by the subject of the study. Sometimes – for example, in the case of a newly discovered manuscript – they become the question, because their origin and purpose are unknown. If the project focuses on a person, the primary sources encompass that individual’s publications and manuscript papers, including diplomas, practice records, laboratory notebooks, diaries, letters written and received, and scrapbooks. Primary sources also include other collections of manuscripts, contemporary books, journals, and newspapers. If the subject is a disease, a treatment, or a technology, the primary sources could include original descriptions, subsequent modifications, commentary, and possibly extant artifacts. If the subject is an institution, a period, or a place, the primary materials are found in anything emerging from that institution, period, or place. To learn about the health of populations, government documents, census statistics, and agency surveys are invaluable.

In defining primary sources, context is important. A historian must strive to situate the topic in time and place. No medical subject – be it a person, a practice, an institution, a technology, or an idea – can be fully explored without also studying its political, social, economic, and cultural environment. Sometimes, the environmental conditions are revealed by contrasting them with those elsewhere. For example, revolution or famine in one country will influence its medicine, while the medicine of another country, which may be enjoying peace and prosperity, will not be so affected.

History – itself made up of writing – has traditionally placed a special value on the written word as the ultimate form of evidence. But this practice can obscure or skew the past by excluding the testimony of those who were not able to publish or write – women, children, patients, and illiterate or disadvantaged peoples. Moreover, just because something had been written does not make it accurate. Historical documents are powerful witnesses, but they have certain problems: quantities are variable; they reflect the authors’ priorities; and their contents may be flawed. In recent decades, historical emphasis shifted away from great men, great discoveries, and great nations. Consequently, primary sources have become more eclectic and include ‘oral histories’ (the result of interviews), pictures, films, novels, art, music, and objects.

In the search for printed primary sources, the historian must rely on libraries – the bigger the better – and on bibliographies and indexes. For example, when dealing with a subject from antiquity, claims and quotations found in a secondary source must be verified with scholarly editions (e.g., the Loeb Classical Library or the Corpus Medicorum Graecorum). With electronic resources, it is possible to stay at home and browse the catalogues of great institutions such as McGill’s Osler Library and the National Library of Medicine. Printed (and online) catalogues of the national libraries of France (Bibliothèque Nationale), Britain (British Library), and the United States (National Union Catalogue) are available in most university libraries and provide a wealth of bibliographic information.

Most health sciences libraries hold the early series of the Index Catalogue of the Library of the Surgeon General’s Office. From 1880, it listed the holdings of what is now the U.S. National Library of Medicine, including references to a host of medical books and journal articles dating back several centuries. Early editions of the Index Medicus also are useful, but they must be examined year by year. For recent topics, both Medline and periodical literature indexes, including newspapers (such as The New York Times Index, The Times Index, and Canadian Periodical Index) provide a start, but they have limitations (see below). Morton’s Bibliography is an attempt to list the most significant contributions to Western medical literature. (See also Appendix B2.)

Tracing unpublished primary sources is usually more compli-
cated. Historians are rarely confident that they have examined every scrap of paper that could be seen. Archives exist in a surprising variety of forms and places. National and institutional archives are good places to begin. Published catalogues of holdings are helpful; specific collections are often indexed in unpublished guides called 'Finding Aids.' Archivists will usually respond to questions by mail or e-mail. But the scholar must know (or imagine) that an archive exists in order to find it. Again, archivists can be of assistance.

In a perfect world, all important papers would be kept in archives. Government and institutional documents are ordered by law to be preserved. Every country, every province or state, many cities, all universities, and most hospitals, organizations, and associations maintain records. In reality, however, complete preservation is rare. Even when a scholar is confident that the papers must reside in a particular archive, locating them there through a baffling classification system can be daunting. Having found the ‘official’ government records, scholars must remember that they are precisely that – official. They tell a version of the story chosen by a bureaucrat. Unknown quantities of papers may have been lost or deliberately destroyed. Indeed, the most salacious, controversial, and intriguing aspects in the life of an individual or institution can be forever excised in this way. Some papers may belong to friends, relatives, or descendants who refuse to open them to historians. Still others are withdrawn from scholarship, having become the property of private dealers and investors. Occasionally, an obituary or an entry in a biographical or national dictionary will indicate where the papers of an individual are kept. Finding papers is time-consuming and frustrating, but it is also deeply rewarding. For this kind of discovery – a piece of evidence to support an idea – the historian shouts, ‘Eureka!’

Secondary Sources

Secondary sources are produced by fellow historians, be they living or dead. They include all attempts to explore the same or similar questions. The authors may be other practitioners, historians, sociologists, or philosophers, but they may also be contemporaries of the subject, such as colleagues, eulogists, and descendants. Sometimes,

the secondary source will provide an immediate and satisfying answer to your question; however, before accepting such information at face value, it is wise to contemplate the nine caveats described below.

On Secondary Sources: Beware!

1. Assume someone else has already asked (and answered) your question.
2. Find out who, when, and where.
3. If you find no predecessors, be creative and search in tangential fields.
4. Exploit others’ references for additional primary and secondary sources.
5. Be aware that you are not obliged to agree with your predecessors.
6. Find reviews of the sources on which you rely heavily. Is your opinion shared by experts? Is your confidence well placed?
7. Do not trust history without references, a.k.a. ‘scholarly apparatus.’
8. Believe nothing you read if it does not refer to primary sources.
9. Believe nothing you read if you cannot understand why it was written.

When asked for help with a research question, I begin with the accessible Bibliographies of the History of Medicine, prepared by the National Library of Medicine since 1964. These five-year cumulative indices of the historical publishing recorded in the Index Medicus are cross-referenced by subject, author, and period. Individual diseases appear under the main heading of ‘Disease.’ Medline is also an excellent guide to secondary sources (as well as primary sources for late-twentieth-century topics). Separate entries on the history of a MeSH subject can be located by adding a ‘/hi’ subheading (e.g., ‘nursing/hi’). MeSH subject headings for history are organized by century only; to narrow a search, a strategic combination with key
words must be made. Do not rely on Medline alone. It includes only some of the scholarly journals that have an interest in history; it does not always assign historical subject headings or key words to articles with historical information; it contains nothing published prior to 1966; and it ignores books and edited volumes (unless they happen to have enjoyed essay reviews). Other print tools, such as the Index Medicus and the Science Citation Index, cover the years prior to 1966 and include books.

A thorough search should extend beyond health-care literature. Relevant information may have appeared in periodicals devoted to philosophy, anthropology, history, sociology, economics, geography, political studies, and public administration. Database and print tools are available for the scholarly literature in the humanities and social sciences, and for newspapers and other periodicals. Ask a reference librarian for help.

The distinction between primary and secondary sources can blur in several situations. For example, an obituary can be both a primary and a secondary source. Similarly, a history written at the time of the subject of study can be a primary as well as a secondary source. A survey of several volumes of a journal counting the frequency of articles on a certain topic, will turn a primary source into a secondary source; or vice versa, as the numerical results raise new questions. Analysis of what other historians have said about a topic transforms secondary sources into primary sources, as part of the fascinating enterprise of historiography. Historiography examines trends, problems, methods, gaps, and interpretive styles. It can help to orient confused enthusiasts (see the suggestions below).

**Method and Interpretation**

For figures in the past, including other historians, the most important question is this: How did writers come to know what (they thought) they knew? In other words, how did they justify their beliefs?

Mirko Grmek, physician and historian

Analysis of the sources reveals the evidence, or 'argument,' to support the answer to your question. Historical methods are the direct cognate of methods in scientific experiments. Reading may be its basis, but this work also entails selection, interpretation, and manipulation – actions strongly influenced by current standards of historical practice and by the taste and imagination of the investigator.

In gathering evidence, examination of all relevant primary and secondary sources is ideal. Sometimes, however, an overwhelming abundance of information – for example, in the case of hospital records – can be dealt with only by devising a sampling system. Microcomputers have revolutionized historical research and enhanced the potential of voluminous collections, but this technology demands selection. Decisions to rely on some data and reject others must be made with care, confronting any biases that the historian may introduce.

Secondary sources must be analysed too. Like a review of the literature in scientific writing, this analysis locates your research – questions and answers – in the context defined by predecessors. Being human, historians like to see their work cited – but citation is much more than a placebo to vanity or a homage to reputation. It distinguishes good history from bad. Here's how it works:

- Good historical product is not only information about the past; it situates data and ideas within the domain described by predecessors. It may support existing ideas with new data, or, even better, it may introduce original ideas to explain the past. Exciting new theories about why and how things came to be, or to change, can be applied and tested in future projects. In other words – and still drawing parallels to science – a thorough history project may conclude with questions to guide future research.

The political and philosophical biases of an investigator enter into the interpretation of data, just as they enter into framing the research question. Marxists, capitalists, socialists, feminists, chauvinists, racists, creationists, scientists, Baptists, atheists, deconstructionists, midwives, nurses, physicians, surgeons, and patients will find radically different explanations to account for the same past (see for example, Chapter 11). The laudable, positivist aim of controlling all subjective variables, which dominates laboratory work, is simply
not attainable in history, nor may it be in science. Unlike scientists, however, historians admit it — although, for a short time earlier in the twentieth century, they too strove for elusive objectivity. Instead, historians deal with interpretive bias by recognizing it and by bolstering their arguments with convincing evidence comprised of a swatch of sources chosen by complete and/or systematic sampling in an openly reproducible fashion. An eclectic array of evidence, selected simply because it tends to support an investigator’s hypothesis, does not inspire confidence. A project that ignores mainstream historical thought may be entertaining, stimulating, plausible, and well written, but it is not history; it is journalism or editorializing. These principles are reflected in the writing process.

**Writing It Up**

Acknowledge your biases, but do not judge the past by the standards of the present.

Even if publication is not your goal, recording your findings in a summary or bibliography is a good idea. Names and dates are easily forgotten or confused; sources are tricky to recall; and ideas — even brilliant ones — prove evanescent. Retracing one’s steps in historical research should be unnecessary, but all too often historians come to check their references and find holes or mistakes. A passage, which seemed trivial on first reading, can suddenly loom crucially large after further research sparks a related idea. Finding it again can be daunting. Even if your work was only for an introduction to case rounds, keep your notes, overheads, and slides; you have become an expert, but you are no good without your evidence.

For health-care professionals, writing history is inhibiting. Like scientific reporting, however, the best composition is not a solid, seamless block of narrative — it needs a structure. The steps included on these pages outline the process I generally use, its sequence, and the reasons for it. Many other procedures exist, but starting at the beginning and writing to the end is perhaps the least popular approach.

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**Steps for Writing History**

1. Start in the middle with the results of your research, i.e., the evidence and argument, a description of primary sources, method, and interpretation.

2. Next, draft the conclusion. With the argument set down in step 1, conclusions (hopefully) become obvious. The conclusion contains the answer to the question used to guide the work.

3. Next, write the introduction. In it, review the secondary literature and present the final version of your question. In other words, (re)compose your question after you have decided on its answer. Sometimes, the most intriguing version of the question will not have been discovered until after the research is done and the answer (conclusion) found.

4. You may then return to the conclusion, modifying it with commentary on how your question and your findings differ from those of your secondary-source predecessors. Historians are often excited by the unanticipated discovery that their research on a tiny topic challenges existing ideas about the past on a much broader scale. Another historiographic ‘Eureka!’ is possible here too.

5. Leave traceable references for everything you write.

Publication of historical research, just like that of scientific research, demands originality. A rehash of other work is not usually very interesting. Again as in science, there is vast scope for originality in topics, questions, sources, methods, analysis, and conclusions. New topics are constantly being discovered. For example, the rise of feminism brought women practitioners and patients to the fore; shifts in political views revealed gaps in knowledge about alternative medicines and the experience of patients. Even well-studied topics merit re-examination in the light of new sources, histories, methods, theories, and questions. Because questions about the past emerge from the present, it is often said that all history needs to be rewritten in each generation.
Historical writing is distinguished from scientific writing by the relative permisibility of the first person and the active voice. By convention, scientific reports use the passive voice and the third person to reflect the positivistic ideals of experimentation: ‘The blood was let, then it was boiled.’ In clinical reports, patients become ‘cases’ who do not take pills but are passively ‘treated.’ Rarely, and usually only in the conclusion, does the first person ‘I’ or ‘we’ appear.

Here, history is different from science. Modesty and style may dictate sparing use of the first person and the active voice, but their relative acceptability reminds authors of their own creative role at each step of the project. This acknowledged subjectivity is the open recognition that history is not limited to information about the past; history is also made up of the writing that expresses it, thereby marking it as a humanities discipline akin to art, music, and literature.

**Pitfalls of Crossing Boundaries**

The meetings of the national and international societies for the history of medicine are sometimes dominated by two artificial solitudes: doctors (generally older and often male) congregating in one room, historians (generally younger and more often female), in another. Sometimes plenary sessions will force one group to listen to the other, and much mutual grumbling will follow. Editorials proclaim who should be doing history and how. This particular dichotomy—a woeful intellectual apartheid—is not the only controversy in a fractious field, but it is perhaps the most counterproductive. It derives, I believe, from intolerance and a failure to communicate. If I could bequeath one contribution to my discipline, I would choose to heal this rift. Neither group functions well without the other.

Doctors complain that historians are boring, abstract, divorced from clinical reality, absorbed with minutiae, and too frequently hostile to the medical profession. They know that medicine is not perfect, but they respect it, and like generations of their predecessors, they strive to do no harm. They resent history being used for political purposes; for them, history is a collection of ‘facts’ or ‘truths.’ They do not salivate over effete references to obscure historians. At the mention of Foucault—or, worse, his cognate adjective, Foucauldian—their eyes glaze over.

Historians are not boring to each other; theory turns them on. They celebrate the creativity of humanities writing, thinking, and speaking. They love convincing arguments and imaginative yet well-reasoned interpretations anchored in detailed examinations of sources, inevitably constrained by time and space. For them, ‘facts’ do not exist and ‘truth’ is relative. They are suspicious of a medical preoccupation with what has survived, misinterpreting it either as unwillingness to face up to past mistakes or as a desire to glorify present practice. Trained through and by ‘the word,’ historians are baffled by doctors’ love of images, which they find distracting, especially when the ‘pictures’ are made up entirely of words. For them, images trivialize communication, turning history into entertainment, a slide show, a travelogue. And if historians do not mention Foucault, some clever listener, reader, or editor will punish them by archly pointing out the omission. The trick is to refer to important theorists first—nod in the direction of common ground—and carry on. Some historians dislike the medical profession—a few may even be motivated by hatred for it—but editors try to assess quality by evidence and argument, not by opinion.

Historians complain that doctors who attempt history are bumbling amateurs or devout antiquarians, dabbling in a professional discipline that they neither respect nor understand. They invoke an obvious analogy—that retired historians do not take up brain surgery. How dare these rich interlopers think that age and experience alone can turn them into historians?

On either side of this useless debate, the criticisms are both valid and unjust. Beyond jealousy and intolerance, there is a happy mean. From practitioners, historians could learn how to challenge their assumptions and communicate their findings. Here, however, I will concentrate on the problems of health-care providers who want to write history. How do you convince an anonymous, sceptical, academic historian that your work is worth publishing?

**Common Problems and How to Avoid Them**

With pressures stemming from the ‘publish or perish’ mentality, editors of quality medical journals turn increasingly to professional historians for advice on submissions. Rejection letters can be baffling as
well as disappointing. The criticisms cite ‘problems’ that appear to be inconsequential or mysterious to clinicians. Yet these faults are rarely insurmountable. To overcome them, the first step is to understand them. The second step, accepting them, is often more difficult, but it helps to set aside the readers’ reports for a few weeks before responding. Whether or not you agree with the comments, it is foolish to ignore them. If you hope to carry on with this editor (or another), you are obliged to reframe your work in a manner that addresses the criticisms with respect. The most common faults of doctor-written history are summarized below.

1 Failure to ask a question. An assemblage of names, dates, and events set out in chronological, thick description is not history. The editor will wonder, ‘Why should I or the readers care?’ Enthusiastic historians who have done their research well should have no difficulty supplying a question, but they must remember to write it. Sometimes, a statement of why you yourself are interested in the topic now, or of why others ought to share that interest, is sufficient to remedy this problem. More attractive questions will feature the originality of your work.

2 Failure to use primary sources or to reveal the method used to exploit them—a serious flaw in much of the history once published in medical journals. One variation of this ubiquitous problem is the exclusive use of translations, something many of us are obliged to do when it comes to using ancient, medieval, or Asian sources. It may be unavoidable, but it should be acknowledged with humility. Translations inevitably contain interpretations.

3 Failure to contextualize a subject in time or place. Research that ignores social factors is often called ‘internalist.’ The topic is examined from within—in the boundaries of medical knowledge—a process that is inappropriately equated with history of ideas (intellectual history). As a result ‘external’ issues, which may be of equal importance, are overlooked, leading the author into anachronistic assumptions. The reverse criticism, ‘externalist,’ could be applied to some social history writing, although critical doctors do not resort to that word. Instead, they deride it as ‘medical history without the medicine.’ Just as doctors and historians need each other, historical accounts either of an idea or of a social phenomenon are incomplete without the context provided by the other.

4 Failure to cite relevant secondary literature. This failing has two vast dimensions. The first relates to the nature of history; situating the work within the body of ideas defined by fellow historical writers is an important part of the process. The second is common sense; the reader who is invited to assess your work will most likely be a person who has already published on the same topic or a related one. How would you react if you were asked to evaluate an essay by some young upstart (or old dodger) who proposed to publish in your area of expertise without having read your brilliant book?

5. Overreliance on secondary literature. Why should any article be printed if it merely rehashes what has already been published elsewhere? Explicitly state the originality of your work. Be honest. If it is not original, why do you think it deserves to be published? It may be difficult, though not impossible, to justify its publication. For example, perhaps you are the first to bring two bodies of secondary literature together; or maybe you can enhance your research by going back to primary sources to test the claims of the secondary sources that you used. Sometimes such an exercise may surprise you by showing errors made by the other historians on whom you relied. It may also provide you with a new question. Do not allow yourself to perpetuate the mistakes of others. Expert readers will notice and trace the genealogy of your research to a certain second-rate history rather than to a credible primary source.

6 Presentism and Whiggism (see below).

Presentism and Whiggism

We are not obliged to forget what we know, if we use it with care.

Presentism and Whiggism are serious flaws from a historical perspective—they could even be called sins or crimes. Presentism is the ten-
dency to judge the past by the standards of the present. It is unfair and anachronistic to blame predecessors for not saying, seeing, or knowing what could not yet be said, seen, or known. It is better history (and more interesting) to understand why they saw things as they did. 'Whiggism,' a term directly related to the progressive political philosophy of the British Liberal Party, is similar; it portrays the past as a series of events progressing to a better present. The assumption is that things change by improving and that progress has brought us to where we are now.

Historians are wary of 'progress.' The very word sets off mental alarms and shrilling whistles. Are things really getting better? Many technologies and treatments have been touted as miracle cures only to be rejected because of unforeseen side effects. The most ingenious discovery may have negative ecological considerations when the passage of centuries is taken into account. Not only is it premature to judge our own practices, but it is simplistic to reduce the past to a mere preparation for the future (a.k.a. our own glorious present). For postmodern scholars, progress, like facts, may no longer exist. Progress, in the sense of desirable improvement, is certainly problematic when those doing the labelling are also its proponents. We can be curious about the present without believing in its immutable superiority.

What to do? Never use the word 'progress.' If you feel an urge to do so, ask yourself why you think it is necessary and what you might really be avoiding. Take a deep breath, and if that doesn’t work, take a Valium.

For health-care professionals, presentism and whiggism are the most difficult problems to avoid, since our questions emerge from a present anchored in practice. We cannot suppress our awareness of current medicine, and we lapse into 'medicalese' as a vehicle for our ideas. Pretending that we do not know what we do know is dishonest posturing. To that extent, Marxists, feminists, deconstructionists, and a host of other theorists also use questions, interpretations, and language that emerge from their present. Indeed, their works are presentist too. But somehow they manage to avoid the charge. I think the key is language. Medical verbiage should be kept to a minimum. For nonpractitioners, it is exclusionary jargon, a red flag; and even for practitioners, it can mask a superficial understanding of the past.

**An Example: Hypothetical Histories of Bloodletting**

All authors have carefully researched how and when bleeding was done when it worked, failed, or appeared to work in situations that we might now think of disastrous. But individual writers produce different histories.

The presentist history suggests that some applications were more 'rational' than others, since bleeding 'works' or is still used in a few cognate conditions of the present (e.g., polycythemia, hemochromatosis, or heart failure), none of which were diagnosed in the period under study.

The whiggish account of bloodletting is governed by the assumption that less bleeding is better. It exalts a noble (but nonexistent) crusade marching into the present, intent on eradicating phlebotomy.

Here's where it gets tricky. A medically trained historian might explain the popularity of bleeding by appealing to neurovascular responses to depletion — a red-faced, hot individual turns pale, cool, and clammy — thus providing immediate positive feedback for the practice. Such use of modern concepts is neither presentist nor whiggish, but it makes some nonmedical reviewers nervous.

Sometimes accusations of presentism are unjust. They are inspired by the ideas we use or the way we write. If you must resort to current medical ideas or terminology, provide a footnote to explain why, and deal directly with the potential criticism of presentism or whiggism. Make it clear that you understand the flaw and explain why you think it does not apply in your case. Show that you know what you are doing.

**The Last Word**

Have fun. Remember that these ideas are far from infallible. I have a drawer full of unpublished papers. If you know an editor who might like to see them, please let me know.
Suggestions for Further Reading

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On the History and Historiography of Medicine in Canada

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**APPENDIX A**

**The Nobel Prize in Physiology or Medicine, 1901–1998**

<table>
<thead>
<tr>
<th>Year</th>
<th>Laureate</th>
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<tbody>
<tr>
<td>1901</td>
<td>Emil von Behring</td>
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<td>1902</td>
<td>Ronald Ross</td>
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<td>1903</td>
<td>Niels Finsen</td>
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<td>1904</td>
<td>Ivan Pavlov</td>
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<td>1905</td>
<td>H.A. Robert Koch</td>
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<td>1906</td>
<td>G. Goëti</td>
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<td>1907</td>
<td>Charles Chamberland</td>
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<td>1908</td>
<td>Paul Ehrlich</td>
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<td>1909</td>
<td>Elie Metchnikoff</td>
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<td>1910</td>
<td>F.T. Kocher</td>
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<tr>
<td>1911</td>
<td>A. Kossel</td>
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<tr>
<td>1912</td>
<td>H. Gallstrand</td>
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<tr>
<td>1913</td>
<td>Alexis Carrel</td>
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<tr>
<td>1914</td>
<td>C.R. Richet</td>
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<tr>
<td>1915-18</td>
<td>No award</td>
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<tr>
<td>1919</td>
<td>Jules Bordet</td>
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<tr>
<td>1920</td>
<td>S.A.S. Krogh</td>
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serum therapy, diphtheria and tetanus antitoxin, mosquito and malaria light therapy for lupus digestive physiology – conditioned reflex discovery of tubercle bacillus neural structure malarial parasite immune function – side chain theory immune function – phagocytosis thyroid physiology, pathology, and surgery biochemistry of cell nucleus; amino acids dioptics of the eye vascular anastomosis and organ grafts anaphylaxis, passive immunity vestibular apparatus of ear and equilibrium

immune lysis, antibody complement regulation of microcirculation bioenergetics of muscle physiology