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Who's afraid of the recent biomedical heritage?

Medicine is one of the oldest and most venerated ingredients of the world's cultural and scientific heritage. Consequently medical artefacts are staple features in many university museum collections around the world and they are also among the most conspicuous and popular items in medical historical exhibitions.[1] With respect to the historical time range covered, however, almost all museums deal with what might be called 'modern medicine', that is, they mainly contain artefacts and ideas that represent the medical practices of the modern era, from seventeenth century anatomical specimens to late-twentieth century mechanical medical instruments. With few exceptions, museums have not yet taken the rapidly growing biomedical culture of our present age into account, and so far no museum has made systematic efforts to document the recent biomedical heritage.[2]

I suggest it is time for university museums to take biomedicine — that is, the fusion of cell biology, molecular biology and information technology with clinical diagnostics and therapeutics — seriously.[3] The reason is, of course, that biomedicine is emerging as a significant formative part of contemporary society and culture. The discovery of the structure of DNA in 1953 and the subsequent rise of molecular biology have radically changed the research agendas, strategic decisions, and curricula of medical faculties over the last decades. A rapidly growing numer of new molecular technologies have changed diagnostic and therapeutic methods beyond recognition; today's clinical biochemical laboratory (the spider in the hospital web) is a highly sophisticated and robotized molecular diagnostic system; likewise molecular and even gene therapy is becoming clinical reality. Digitalization too has changed biomedical research and clinical practices drastically in the last decades. Medical research is highly dependent on computerized methods. Clinical departments — like neonatal wards or intensive care units — are as digitalized as the cockpit in a modern aircraft. Similarly, diagnostic imaging tools like CT-, MR- and

PET-scanning are impossible to imagine without advanced digital technology.

This combined process of molecularization and digitalization of the laboratory and the clinic (in other words, biomedicalization)[4] is embedded in a broader social and cultural context. The many, and often politically mediated, interactions between the transnational 'biomedical-industrial complex' and the steadily growing popular demand for better health care are turning biomedicine into a significant player on the global economic arena.[5] Biomedicine has also entered the political scene. While some view its recent developments as a threat to basic human values, others see it as a key to the future of humankind. New technologies such as cloning, stem cell manipulation and tissue engineering have raised both professional and popular expectations of the powers of biomedicine, to combat, for example, cancer and degenerative diseases.

How shall university museums accomodate to these material and discursive changes in the medical landscape? What consequences will the recent revolution in biomedical research and clinical development have for medical history collections and exhibitions? In the Medical Museion at the University of Copenhagen we are presently coping with these and similar questions,[6] and in this paper I will discuss one of the museological problems raised, viz., how to handle the abstract and non-tangible character of many recent biomedical objects.

The Medical Museion is the continuation of the Medical History Museum that was founded by means of a private initative in 1906. The rapidly expanding collections were taken over by the university in 1918, and thirty years later moved to their present location in the former Royal Academy of Surgeons and adjacent buildings. Today the University of Copenhagen owns one of the largest and most diversified medical history university collections in the world, including some ** obstetric, radiological, ophtamological, dental, and surgical instruments, several complete apothecaries and old pharmaceutical laboratories, a well-assorted collection of microscopes, a world-famous osteopathological collection from medieval leprosaria, and so forth. According to a recent survey the collections comprise approx. 60.000 registration units (a registration may contin many separate physical items so the number of singular objects probably exceeds a hundred thousand); in

addition there are some ** oil paintings, around 100.000 photos and drawings, a library with approx. 30.000 volumes, and *** shelf meters of archival documents, including hospital patient records from the late eighteenth century and onwards. Only a small proportion of this material is displayed in the public exhibitions; most is kept in storage or in special 'study collections' for specialists.

Like most other medical university museums, the collecting and exhibition activities of the Medical History Museum focused on 'modern medicine', especially on instruments that documented the triumph of the modern medical profession in the late ninenteenth and first half of the twentieth century. But in recent years the museum has changed its orientation. The incentive for this move was the fact that the museum had stagnated since the 1970s; there were no research activities of any significance, the collections were run by amateur curators, and the exhibitions had hardly been revised since the early 1970s. A devastating report by The Danish State Board of Museums in 2000 gave negative headlines ("Chaos in the museum") in the Danish medical weekly,[7] and induced the Faculty of Health Sciences to take its responsibility as an owner. A year earlier, the chair in history of medicine had been filled to boost medical history research; in the following years a couple of new museum positions were announced. Basic funding was increased as well and in 2003 the faculty gave its unanimous support to a five-year plan for re-conceptualizing the former Medical-History Museum as a Medical Museion.

The Medical Museion concept is two-pronged. The basic idea is that research, teaching, collection activities and public outreach (including exhibitions) are closely integrated activities that mutually support each other. The notion of 'mouseion' has been chosen to bridge the gap between the traditional academic medical history research and teaching culture focusing on the production of texts (articles, books), and the traditional curatorial culture dealing with the acquisition, preservation and exhibition of material objects and images. In daily practice, this means that both research and museum staff attend the weekly seminar dealing with all aspects of the institution, from registration systems and conservation methods to the history and philosophy of biology and the interaction between biomedicine and art. Guest speakers include medical researchers, historians, etnologists, museologists and

artists. In other words, instead of making the traditional distinction between an academic university department and a museum, we consider research, curating and acquisition to be closely related forms of 'inquiry', and scholarly publishing, teaching and exhibitions as closely related aspects of 'presentation'.

The other main idea behind the Medical Museion concept is, as already indicated, to shift the focus to the understanding, documentation and presentation of recent biomedicine in its social and cultural context. From the point of view of our university identity this shift of focus is rather unproblematic since a growing number of conferences, monographs and research articles on different aspects of biomedicalization have appeared in the last decade; in other words, we are joining a growing trend among historians of science, historians of medicine, and scholars of science studies to investigate the recent history of biomedicine.

From the point of view of our museum identity, however, the new focus on recent biomedicine is more problematic. With the exception of the Science Museum in London, very few museum institutions have taken the recent biomedicical revolution seriously, and even fewer have begun to systematically acquire biomedical artefacts. Most medical history exhibitions still present medicine as it were in the period from the late eighteenth to the mid-twentieth centuries, that is, before molecular biology and information technologies began to change its face.

However, if (or rather when) museums begin to pay attention to recent biomedicine, they will be running into a major museological problem that has to do with the object character of biomedical artefacts. Traditionally, museums are institutions that deal with material objects and material culture. The key-word here is tangibility and medical museums are no exceptions, filled as they are with tangible medical objects like surgical instruments, microscopes, contraceptive devices, iron lungs, hospital beds, anatomical specimens, and so forth. Nor do medical museum curators usually consider it a problem to define what an object is, or what constitutes a 'good' museum object. Good objects are concrete, sensual and spectacular, like foot-driven dentist's drills, siamese twins in jars, amputation saws, and trepanation instruments in handy travel sets. These and similar objects are considered 'good' objects because they are made of easily recognizable materials and resemble familiar

tools; they are immediately understandable and also appeal to our fear of pain and death; they trigger the visitor's attention, elicit memories, evoke emotions, and make us pause in front of the objects with a sense of curiosity and wonder. The lithoclast — an instrument invented in the early nineteenth century to pull out bladder stones through the urethra, thus lowering the risk and pain of classical stone cutting — is an archetypical good medical history exhibition object; in fact young male visitors to the Medical Museion regularly turn pale when they realize how the instrument was used — before anaesthesia.

The emergence of recent biomedicine, however, challenges this classical notion of material objects as familiar, tangible, and sensuous. Today's biomedical objects are neither familiar, nor tangible, neither sensuous, nor emotionally evocative. To illustrate the challenges of recent biomedicine to university museums, I will shortly discuss three cases: gene microarray analysis, PET scanning, and molecular therapy.

Microarray analysis is one of the most sophisticated methods in post-genomic medicine. Based on the fact that the degree of hybridization between single-stranded oligonucleotide molecules is a measure of their similarity, it uses arrays of hundreds of thousands of specific oligonucleotide sequences as probes to map an unknown RNA/DNA-sample, thus making it possible to gauge the gene expression level of the entire genome (that is, which genes are 'on' and which are 'off') in one single run. The analytical power of the method has ushered a rapid growth of expectations in the biomedical research community and the pharmaceutical industry to use it as a major diagnostic and therapeutic tool, for example for individualized drug treatment: "The explosion in interest in DNA microarrays has almost been like a gold rush", proclaims a textbook in the field.[8]

The most widely used and best known microarray platform, the Affymetrix GeneChip®, was invented in the late 1980s and put into into industrial production a few years later.[9] For several reasons the GeneChip provides a perfect focusing point for writing the history of recent biomedicine and post-genomics. By combining information technology and molecular biology it embodies the very essence of biomedicine. It also illustrates the restructuring of health-care in the advanced post-

industrial societies towards increased individualisation of diagnostics and treatment. By drawing on globally produced and globally available sequence data bases it epitomizes another salient aspect of the biomedical revolution, viz., its integration in the process of globalization. Furthermore, as one of the few biomedical technologies that has made it to the front-page of Financial Times, the GeneChip is an exsmpale of how cutting-edge university research often has given rise to successful private enterprises (the 'Silicon Vally effect') over the last decades. Finally it reminds us of Peter Sloterdijk's (1999) point that biotechnology, for better or for worse, can make the old vision of eugenics come true. The Affymetrix GeneChip thus provides an ample focusing point for historians of recent biomedicine and biotechnology.

For museums curators, however, the GeneChip is more problematic. What is immediately abaiable for display is just the handy 1 x 2 inch plastic casing where the hybridization reaction takes place. The ½ x ½ inch 'chip' inside, with some half million oligonucleotide molecular-sized probes attached to it, is not immediately visible, or intelligible. The result of the test is visible indirectly only; the genome data are produced by reading the hybridization pattern on the chip with a laser scanner (which looks like an advanced coffee machine) and the result is interpreted by a computer program. It is hardly necessary to say that the GeneChip technology, which is now revolutionizing medical diagnostics, makes for lousy museum objects because all the components of the platform are abstract, intangible and hardly evoke any memories or strong emotional reactions.

The PET (positron emission tomography) scanner, too, illustrates the problem of displaying new biomedical artefacts in a museum exhibition. The instrument is built to produce images representing the inner metabolism of the body; information that is indeed useful for diagnostic purposes. The patient is injected with glucose molecules marked with a short-lived isotope that emits positrons which in turn can be measured by a detector. The ensuing data are then interpreted by a computer program to represent slices (tomography) of the spatial distribution of glucose metabolism in the body on a screen. For example, the screen image of metabolism in the brain of patients with Alzheimer's disease is significantly different from that in 'normal' patient brains.

The PET-scanner is an impressive piece of combined digital and molecular technology which has already had great impact on medical diagnostics. An update of earlier imaging technologies, like X-ray, as it were, and as such it is a 'must' in any museum that wishes to document and exhibit significant features of recent university medicine. But whereas X-ray technology is easily understandable in terms of 'modern medicine' and does not create any problems for medical museum curators, the PET scanner poses at least two museological problems.

One is that it defies traditional museological display strategies. The directly visible and tangible 'objects' — the enclosing cabinet and the bed which the patient is placed on during the scanning procedure — are not at all important for the functionality of the scanner. The working material parts are either invisible and non-tangible (the isotope molecules) or non-intelligible (the detector and the computer hardware) and in addition do not make much sense without the resulting screen image. The 'image' in turn is indeed visible as long as the machine runs, but it is not tangible; it is ephemeral result of the handling of signal data by the 'text', that is, the computer programme code. (Another important text, placed outside the combined material-visual-textual artefact, yet part of the PET-platform, is the manual, which is as complicated as the artefact.)

The other problem (and this is why I have placed the words 'object', 'image' and 'text' between inverted commas) is that the PET scanner blurs the traditional categories of 'object', 'image' and 'text'. How shall the artefact be classified? Does it belong among the physical museum objects? Or is it better placed (as an image) in the iconographical collection? Or even (as program code) in the archive?

My last example of how recent biomedicine is a challenge to university museums is the advent of molecular therapy. Traditionally, pharmacology is based on trial-and-error experience. The administrered drug may not even be chemically characterized (as in folk herbal medicine) and physicians usually have no knowledge of the biochemical mechanism behind the effect; it just happens to work. Molecular therapy means that the black box is being opened up so that the biochemical mechanism that mediates between the active substance and the physiological response is elucidated. A good recent example of molecular therapy is AstraZeneca's

Losec®, the world's best-selling drug against ulcer and heart-burn in the 1990s. Before the 1990s, ulcer patients were largely treated with surgery; today they are given antibiotics against the Heliobacter infection and Losec to lower stomach acidity (often in the form of combination therapy).

The active substance in Losec is a synthetic molecule, omeprazol, that specifically blocks the proton pump and hence acid production in the stomach. In other words, the omeprazol molecules work as a kind of biochemical microsurgery. Smart (and a major source of income for AstraZeneca) — but hardly a best-seller for medical museums. True, the Losec pill is tangible, but otherwise it looks very much like all other kinds of pills. The trillions of 'molecular knives' (omeprazol molecules) are intangible and invisible. The ion channels in the gastric lining are tangible on the microscopic level, but not visible to the naked eye. Furthermore, the most interesting 'object' is neither the pill nor the molecule, but the international network of scientists, medical doctors, advertising firms, and financial analysts who made a business success out of the omeprazol molecule. One could, of course, put the pill on a piece of black cloth under a spotlight and play a recorded deep voice telling the visitor that it gave AstraZeneca a 8 billion dollar revenue in the year 2000 only. But such stories are probably better told in books and magazines than in exhibitions. Likewise, the molecular and biological mechanisms of omeprazol are better told in book pages and computer screens than in museums.

Microarray systems, PET scanners, and molecular therapies exemplify the problems involved in collecting and exhibiting recent biomedicine. I believe that medical museums today are caught in a paradox. On the one hand, biomedical research and technology fills more and more of our lives, from the neonatal care unit to the threshold of the grave. On the other hand, the whole idea of what constitutes a medical museum collection and what is displayable in a medical museum exhibition becomes questionable, simply because medical diagnostics and treatment has become less and less visible, less and less sensuous. The biomedical ideas and artefacts of the last decades are very different from those presently gathered and displayed in museums. They are smaller (often microscopic), more abstract and mediated, less (if not altogether) tangible, and generally much less emotionally

evocative than traditional 'modern medical' objects. And sometimes they are not even material artefacts in the classical sense, but 'boundary artefacts',[10] that is simultaneously 'material objects', 'texts' and 'images', depending on the context of interpretation.

There may come a point when it becomes impossible to display such objects in a museum exhibition in any meaningful way. After all, who would bring the family to the local university museum on a Sunday afternoon to read computer manuals, look at anonymous plastic cabinets discretely labelled Perkin-Elmer or Hewlett-Packard, or watch video screens that represent repetetive patterns of DNA hybridization? Will not those who are curious about the historical emergence of biomedicine and its impact on the world rather download the molecular images on their own computerr or read about the biomedical economy on a webpage, or in a book or a magazine article instead? It makes sense to visit the local university museum to wathch lithoclasts, amoutation saws, and siamese twins in jars? But why at all visit a museum if one wants to 'see' a PET scanner, a gene microarray or a 'molecular knife'?

I believe this is a genuine museological problem and one that all museums with medical collections and exhibitions will have to solve in the near future — unless they want to restrict their activities to the safe realm of 'modern medicine'. I am surely not pretending that the Medical Museion in Copenhagen has a solution in sight or even a smart way of circumventing it. But we are presently working on explicating and conceptualizing the problem it, and with some help from our colleagues in the university museum world we will hopefully be able to find a solution along the way.

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1. Arnold, Ken (1996). "Time heals: making history in medical museums". Pp. 15-29 in: Gaynor Kavanagh, ed., Making Histories in Museums. London: Leicester University Press.

2. A notable exception is Science Museum, London, which has devoted the major part of a whole new extension, The Wellcome Wing, to exhibitions of recent biomedicine (see http://www.sciencemuseum.org.uk/wellcome-wing/splash_ie.html).

3. 'Biomedicine' as defined here excludes nursing, social medicine, classical epidemiology, social psychiatry, etc. 'Recent' is defined as the period covering the professional life of historical biomedical actors that are presently living, i.e., approx. the last 50 years.

4. For an analysis of biomedicalization, see Adele E. Clarke, Janet K. Shim, Laura Mamo, Jennifer Ruth Fosket and Jennifer R. Fishman (2003), "Biomedicalization: technoscientific transformations of health, illness, and U.S. biomedicine", American Sociological Review, vol. 68, 161-194.

5. Cf. the notion of 'biomedical complex' in Jean-Paul Gaudillière (2002), Inventer la biomedicine: la france, l'amérique et la production des savoirs du vivant (1945-1965). Paris: La Découverte, 2002.

6. Söderqvist, Thomas (2004), "Medicinsk Museion", Novo Nordisk Fondens Årsskrift 2004-2005, 28-33; Söderqvist, Thomas (2005), "Kan den moderne biomedicin udstilles på museum?", Bibliotek for Læger, vol. 197: 171-89.

7. Haller, J. (2001) "Kaos på museet: vi kan skabe et unikt museum", Ugeskrift for Læger, vol. 163: 2158-61.

8. Knudsen, Steen (2004), Guide to Analysis of DNA Microarray Data, 2nd ed., New Yorki: Wiley (quote on p. 2)

9. For Affymetrix' own historiography, see http://www.affymetrix.com/support/technical/other/pioneer_brochure.pdf

10. I have adopted the notion of 'boundary artefact' from Susan Leigh Star and James. R. Griesemer (1989), "Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39", Social Studies of Science, vol. 19: 387-420.