Philosophy of Medicine and Model Design

PSE Symposium: New Challenges for the Philosophy of Science

Raffaella Campaner
University of Bologna

EPSA conference
Athens, October 2011

Philosophy of medicine

- Philosophy of medicine: recent branch of philosophy of science. Specific features with respect to bioethics, philosophy of biology, medical humanities.

- Philosophy of science and medicine are interacting in the elaboration of different models and the clarification of issues such as explanation, reduction, the notions of mechanism and generalization, the relations between explaining, predicting, intervening and controlling, …

- Attention paid to *actual* scientific practice and its implications, to both disciplinary specificities and general conceptual and methodological aspects.

- Focus here mainly on epidemiology.

Diseases as multilevel systems

- Diseases: multilevel systems, brought about by a number of different factors, acting at many different levels.

- After a tremendous growth of research in molecular biology, attention increasingly paid to environmental and socio-economic factors:

  - causal influence of the neighbourhood socioeconomic conditions on the incidence of coronary heart disease

  - causal relationships between area-level socioeconomic disadvantage and the incidence of advanced breast cancer and cirrhosis mortality

Social and Eco-epidemiology

- This perspective affects both the generally accepted view of health and disease, and prevention and health policies.

- Public health prevention strategies are interested in the improvement of environmental and socio-economic conditions, and epidemiology intensifies exchanges with other disciplines.

- The features of epidemiology as a science overcome the distinction between the so-called natural and social sciences. Epidemiology involved with research and results coming from both the biological domain and economics, sociology, political science.

Multilevel systems, causation, explanation

- The elaboration of a multilevel paradigm of disease is being accompanied by extensive reflections on causation and models of explanation, prediction and control.
- How are causes to be conceived? How do they interact?
- One of the notions that is being more extensively analyzed to capture medical causation is that of mechanism.
- No consensus. In very general terms, a **mechanism** can be taken to be a complex system that produces a behaviour or an outcome by the interaction of a number of parts and by virtue of their organization.

Mechanistic approach

- What can a mechanistic approach be good for? Among the merits of the notion of mechanism in conceiving of pathologies:
  - It allows to represent **diseases** as **multilevel productive systems** and the **organization of their components**;
  - **All components** are taken into account (low-level; high-level) and **interlevel relations** are stressed.
  - It attempts to grasp the **development in time** of pathologies, the **order** in which different factors interact, the **processes** going from causes to induction period, up to symptoms.
  - **Different components and activities** are admitted as constituting mechanisms, according to the field of enquiry and varying together with progress in medical knowledge.

Mechanistic approach

- Mechanisms allow to **generalize** the results of studies beyond specific tested cases to a wider population.

- Previously acquired mechanistic knowledge can have **confirmative power**, as well as help in hypothesizing that some mechanistic relations hold in the investigation of still poorly understood phenomena.

- Mechanistic knowledge allows **more precise, more effective** and **fruitful interventions**.

Mechanistic approach

- Mechanistic knowledge is sometimes crucial for the very **characterization and classification of pathologies**:
  - A thorough investigation of specific mechanistic steps in carcinogenesis is *needed* to adopt an unequivocal definition of cancer

    (Vineis and Porta, "Causal Thinking, Biomarkers, and Mechanisms of Carcinogenesis", *Journal of Clinical Epidemiology* 1996)
  - Often mechanistic characterizations of diseases have allowed a new taxonomy for diseases, moving on to disease definitions based on causative events and pathways, overcoming the heterogeneity deriving from phenotypic definitions

    (Bell, "Clinical Research is Dead; Long Live Clinical Research", *Nature Medicine* 1999)

- Epidemiology is interested in the interplay between genes and the environment; infectious disease epidemiology is interested in models of transmission and diffusion of diseases, accounting for time-varying patterns of exposure and interactions. The notions as "**interaction**" and "**transmission**" play a crucial role.

Mechanistic explanation

- Mechanisms are largely appealed to for **explanatory purposes**: to obtain an explanation, we do not rest content with the knowledge of *what* the causal factors are, but aim to understand *how* the effect has been brought about by the causes.

- In epidemiology, mechanistic reasoning has been advocated also **to overcome the so-called "black box", "risk factor – outcome" paradigm**, by displaying what mediates from the causes to the effects and crossing boundaries between different levels of inquiry.

- That some factors count as risk factors must be explained in terms of *how* they work.

Mechanistic explanation

- The identification of a mechanism can also be used to **reduce the range of plausible explanations**. Some alternatives are ruled out because any explanation will have not only to tell the association between the causal factors and the outcome, but also exhibit the mechanism responsible for the outcome.
  - E.g. Studies in psychiatric epidemiology on the relationship between maternal overweight and schizophrenia spectrum disorders.

Multilevel systems

- Is epidemiology committed to a ***genuinely* multilevel** idea of mechanism? Investigations are pursued on how social and economic elements get embodied, on how they actually influence disease pathways.

- On the one hand, research is pursued on *how* higher level factors enter biochemical processes; on the other hand, this is not taken as an embracing of a reductionist standpoint, and hence as a renouncing to a multilevel paradigm of pathologies.

- **How bridges are to be built across levels** is a matter of debate.

Interventionist approach

- “Mechanism sketches”
- Mechanisms are not essential for various purposes; e.g. prevention and treatment can do, and very often have to do, in the absence of mechanistic knowledge.

- Interventionist approach.

- A relation is deemed causal if it is **invariant under certain interventions**. Causal generalizations can have a narrow scope and admit of exceptions. As long as they are relatively stable, they have explanatory power.
- **To explain is to answer a “what-if-things-had-been-different” question**, telling what factors, if changed, would make a difference to the explanandum. Scientists’ capacity to explain is very strictly linked to their **knowledge of how to manipulate** the phenomena to be explained.

Interventionist approach

What can be the merits of a counterfactual-manipulative view here?

- It can account for causal claims assessed for **prevention** and **public health** goals: what are revealed are the **factors on which we can intervene**.
- It sees no problem in **mixing causes** belonging to different levels: high level variables can act on lower level ones, and vice versa, as long as stable manipulability relations hold. They all figure in "what-if-things-…" explanations.
- It can remain **neutral** with respect to ontological claims, issues such as the mind-brain and mind-body problems, and all related problematic matters.

Interventionist approach

- "**Interventionist counterfactuals**" suit cases in which actual interventions are very difficult or impossible to perform, for practical or ethical reasons.

- In a clinical context, **diagnoses** can be made without a full understanding of the pathology's functioning.

  Prevention and public health goals affect the search for explanations, and the choice of the most adequate account in a given context. A what-if-things-had-been-different claim yields insights into properties we would like to control, and can hence capture therapeutic or prevention situations.

Challenges for the philosophy of medicine

- Reflections on epidemiology and psychiatry – as well as other medical disciplines – can challenge some important notions in the philosophy of science, contributing to revise them. For instance:
  - With respect to the notion of **mechanism**, a largely adaptable notion is to be elaborated; contributions from different neo-mechanistic accounts;
  - With respect to **generalizations** describing system behaviors, they're presented as narrow in scope, often quite specific to a given system, stochastic, contingent and admitting of exceptions;
  - With respect to **theories**, they can be defined as "middle-range theories" (see Schaffner, *Discovery and Explanation in Biology and Medicine*1993), supported by mutually reinforcing types of evidence, referring to processes developing in time, connecting different levels of reality, with a limited scope and admitting of variations.

Challenges for the philosophy of medicine

- The disciplinary context and the specific enquiries at stake has led to suggesting pluralistic approaches.

- With respect to the reductionist-antireductionist issue: "**Mixed models**".
- With respect to explanation, **explanatory pluralism** is preferred to monistic explanatory approaches, to account for the complexity of systems under enquiry and for the multiple targets for which an explanation can be sought, promoting different and complementary kinds of understanding.

Challenges for the philosophy of medicine

- The disciplinary context, the purpose of the enquiry and its specific object affect the assessment of what information is to be deemed causally and explanatorily relevant. When, where and why investigations on diseases are performed must be considered.

- The adoption of a given set of notions and the shaping of different models of health and disease can promote the development of certain trends in biomedical research, and/or enhance different aspects of medical practice and health policy. The adoption of pluralistic views does not confine us to a single level of analysis, and, hence does not confine us to a single level of action.

- Pluralism does not mean treating all available methodological options as equal, but trying to meet "the challenge present and future biomedicine is facing, namely trying to keep together the two visions" (Vineis, "La confusione tra cause e meccanismi nell'insorgenza della malattia", 2005) of biomolecular research and of health care.