



Essay

Pharmasophy: Pharmacy, Society and Philosophy

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Abstract: Pharmacy is not only a science; it is also a profession, a trade and an art. As such, it frequently encounters society, where it leaves its impact in a way which is probably unique among the natural and life sciences. In turn, individuals and society have become increasingly dynamic and also often critical of modern pharmacy and its products. This poses a multitude of intra- and extra-scientific questions which cannot be studied with the traditional tools of pharmacy. Addressing them requires additional expertise from a wide range of disciplines, including social sciences, psychology, ethics and other branches of philosophy. Pharmasophy aims to bring this kind of wisdom to pharmacy by taking a holistic view of pharmacy and pharmaceuticals, from the process of research and development to regulation, distribution, application and compliance. In doing so, it aims to master some of the challenges facing pharmacy in the 21st century

Keywords: epistemology; humanities; pharmacy; philosophy; psychology; social sciences

1. Introduction

Common parlance has it that pharmacy is not only a science—it is also a profession, a trade and an art. Indeed, the more practical aspects of pharmacy, such as clinical pharmacy, are arguably amongst the most applied disciplines in the natural sciences. Not surprisingly, this raises a multitude of questions, ranging from the better known ethical and societal implications of medications to more abstract and theoretical issues in fields such as epistemology and even aesthetics. These questions are not simply academic, as seen in heated debates on vaccines and vaccination [1]. In fact, they touch on private, in many cases even confidential, matters affecting everyone's daily life. In this context, vaccines are only the tip of a huge iceberg, with pharmacy and pharmaceutical products entangled in a plethora of similar—and equally urgent—issues, underneath and about to surface soon [2–4]. Thus, a comprehensive and interdisciplinary strategy is urgently needed to tackle the challenges facing pharmacy, from the laboratory to regulations and applications.

Pharmasophy represents such a strategy. The word is a portmanteau of “pharma”, referring to pharmaceuticals and pharmacy, and “sophy”, derived from the Greek word “sophia”, meaning wisdom. At the same time, pharmasophy blends pharmacy with social sciences and philosophy, a timely view considering the various challenges facing this discipline today. Indeed, pharmacy causes quite a few “side effects” when conducted in and applied to society and is loaded with issues which cannot be adequately addressed from the bench at the laboratory or from the perspectives of other sciences and their philosophies. The pharmacological activity of a medication is rooted in biology, chemistry and their specialized sub-disciplines. Nonetheless, the journey of such a medication from bench to bedside, including its regulation and role in public health, economy, politics, and the environment, introduces emergent properties which transcend these fields of natural science. Such important and complex issues demand a kind of examination which goes beyond the scope of traditional scientific inquiry. Although philosophical and social discussions in other natural sciences, such as chemistry, biology, medicine, together with



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bioethics, can inform and guide the discourse within pharmacy, to fully comprehend the “pharmaceutical phenomena” which make pharmacy unique, and to appreciate their broader implications, a more sophisticated interdisciplinary approach is essential. This is the essence of pharماسophy.

Pharماسophy employs theoretical frameworks and empirical methods from philosophy, history, psychology, sociology, and other human and social sciences. It integrates the philosophical, social and scientific dimensions of pharmacy prudently to address difficulties pharmacists routinely encounter from the bench to the bedside Table 1 summarizes a selected few of these current “societal” difficulties associated with pharmacy today, and, of course, there are many others.

Table 1. A number of imminent issues related to pharmacy at the intersection with social sciences and humanities.

Topic	Intersecting Field(s)	Issues
Aesthetics in medication packaging	Graphic design, psychology	Influence of packaging design on patient choice and adherence to medications
AI and big data	Computer science, data science, ethics, economics, politics	Privacy, confidentiality and data protection acts, possible abuse of methods in chemical weapons research
Alternative pharmacy	Integrative medicine, cultural studies	Use and perception of alternative formulations in place of approved medications, placebo effects
Epidemics and pandemics preparedness	Global and public health, ethics, law, sociology	Allocation of resources, equity and equality in drug distribution, access in developing countries
Family planning	Public health, sociology, ethics, law	Awareness of and access to contraceptives and reproductive health information
Geriatric Care	Gerontology, public health, sociology, psychology, medicine	Prescribing practices, impact of dementia and depression, influence of cultural beliefs and role in health literacy
Illicit drugs and counterfeit drugs	Law, sociology, psychology, ethics, economics	Ethical, legal, and social issues of the manufacture, distribution and consumption of illicit and counterfeit drugs
Interdisciplinary collaboration	Natural and social sciences	Reductionism, epistemological differences, ethical literacy, conflict management
Lifecycle of pharmaceutical products	Economics, politics, ecology, environmental sciences, law, ethics, psychology	Clinical trials, direct-to-consumer advertising, psychotropic medications, disposal of medications, environmental footprint
Patient-centric health promotion	Public health, psychology, sociology	Motivation and behavioural change, handling cognitive and socioeconomic barriers, promoting patient autonomy and empowerment
Polypharmacy	Nutrition, medicine, economics, psychology	Management of diet, stress, depression and social issues, such as stigma and cultural beliefs
Publishing, open access and patents	Data science, communication, ethics, law, economics	Access, transparency and integrity in scientific communication, issues related to confidentiality, dissemination of dual-use information and methodology
Sustainable and green pharmacy	Economics, politics, ecology, environmental sciences, law, ethics, psychology	Bioaccumulation, depletion of energy, rare earth metals and metabolites in water, microplastic, environmental justice
Treatment protocols and religious beliefs	Theology, ethics, sociology, psychology	Medication and dietary restrictions, end-of-life care, blood transfusion and blood products, animal products, ethanol, gelatine

At first glance, many of the issues outlined in Table 1 might appear primarily to require ethical reflection, and one might be tempted to connect them directly to ongoing debates in the field of bioethics. While ethical considerations are certainly important and the insights from other sciences and their philosophies can indeed inform the debate in pharmacy, this perspective alone is unsatisfactorily narrow. Issues such as impurities in medications, their

use after expiry, medical insurance or the uses of AI and big data in pharmacy, for instance, extend far beyond ethics [5,6]. These challenges also pose epistemological questions, such as how such technologies influence the generation and validation of scientific knowledge in pharmacy, or if they may be used to identify and produce toxic substances for chemical weapons rather than for pharmaceutical research [7]. Some of these issues also touch on sociological aspects, behaviour and norms, and even reach psychological dimensions, including how persons perceive and deal with medications and innovations. By examining these issues through the broader lens of pharmanosophy, we can better understand the complex interplay between pharmacy and society, ensuring that our approach is not only ethically sound, but also philosophically robust and socially informed (more on this in Sections 3 and 4).

In the following sections, we aim to recount, and structure our journey around, the history of the development of pharmanosophy. This venture formally began in 2016 with the establishment of the Pharmanosophy Unit within the Institute for Bioorganic Chemistry at Saarland University. Over the past eight years, our dedication to structure this interdisciplinary approach has enabled us to build a unique and unconventional network of collaborators, including philosophers, historians, sociologists and public health experts. There have even been contacts with garlic farmers with a strong interest in “farmercy”. Together, we have supervised several master’s and doctoral theses and have produced a body of literature, comprising over 20 publications to date. Our efforts have primarily invested in developing and providing an overarching framework for how social sciences, such as sociology and psychology, and philosophy can engage with and interact with pharmacy. As always, our primary objectives are to stimulate debate about the evolving scope of modern pharmacy and to pose relevant questions practitioners in the field ought to address. By doing so, we aim to supplement modern pharmacy with the necessary perspectives and tools to tackle current and future challenges. This may enable us to find new ways to cross the academic divide between pharmacy as a natural science on the one side, and its societal impact on individuals and society on the other. Thus, we briefly take a closer look at pharmacy in the context of sociology and philosophy and see what “pharmanosophy” can do for us and can benefit us in ways which classical pharmacy alone traditionally cannot.

2. A Definition of Pharmacy

To begin with, it is necessary to define pharmacy, a task which, at closer inspection, is not as trivial as it first may seem. To most people, “pharmacy” is understood as the traditional community shop in town dispensing medicines, and (village) news at no extra cost, as a vast pharmaceutical industry, or as “a science and technique of preparing and dispensing medicines”. Thus, common parlance is quite right: pharmacy is not just one scientific discipline, it is also an industry, a practice and a point of interaction with the public.

Despite the widespread understanding of pharmacy, this perspective falls short in two key areas. Firstly, there is ambiguity regarding whether the focus lies predominantly on the practice of pharmacy within community pharmacies, clinical pharmacists at hospitals or the pharmaceutical industry [8]. This suggests the need for an updated definition of pharmacy as both the science and application of pharmaceuticals. Secondly, it is important to recognize that pharmacy, whether viewed as a science or an application, is one of the most highly regulated fields globally. Many pharmacists dedicate their careers to the regulatory dimension of the profession. Regulatory mechanisms established by bodies, such as the Food and Drug Administration (FDA) and the European Medicines Agency (EMA), ensure the safety and efficacy of pharmaceuticals. This regulatory aspect is critical yet often underrepresented in pharmacy curricula worldwide [9]. Therefore, a comprehensive and updated definition of pharmacy would view it as the science, regulation and application of pharmaceuticals. This holistic view acknowledges the multifaceted nature of the field and highlights the importance of regulation alongside scientific and practical applications, including the perspective of the patient embedded in her specific socio-cultural environment.

As such, the multifaceted aspects and implications of pharmacy can be neatly organized into three categories: (1) research and development, (2) regulations and (3) application, as illustrated in Figure 1. Research and development, often referred to as R&D, encompass the scientific practices involved in generating knowledge and creating new pharmaceuticals. Regulations focus on controlling pharmacy through decisions about drug approval, quality assurance and risk management. The application of pharmacy addresses issues such as the acceptability and accessibility of medications and adherence.

Whereas drug design still falls within the realm of natural sciences, drug development already has a legal/regulatory and financial/economic side. The focus changes whilst the white coat slowly turns into a black suit. Reaching the patient is even more complicated and almost entirely outside the realm of chemistry or the Life Sciences. It is an issue of logistics, access, dispensing and, eventually, personal motivation and compliance.

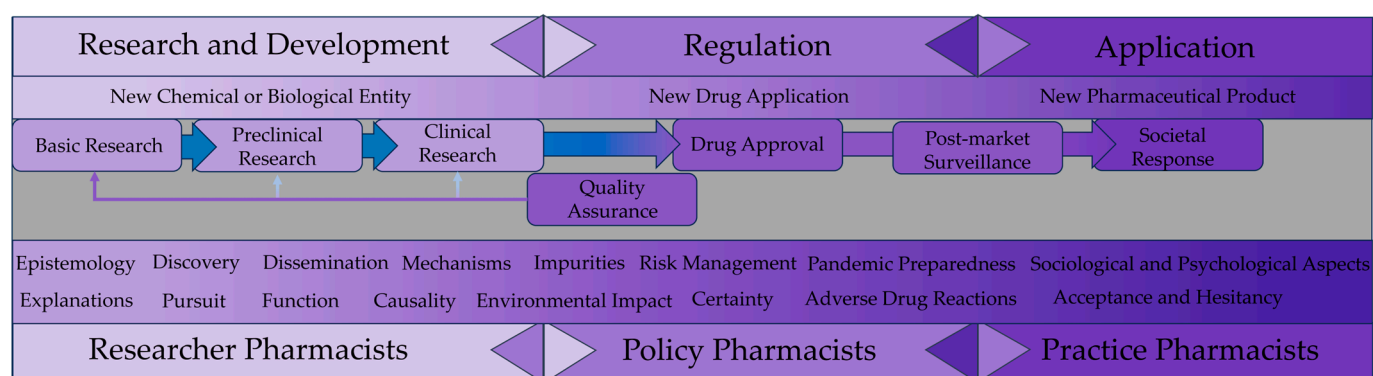


Figure 1. The lifecycle of a pharmaceutical product from bench to bedside. This is a complex journey raising a multitude of important questions. Figure adopted with permission [10].

3. Pharmacy and Philosophy

Figure 1 summarizes a few of these facets summoned under the label “pharmacy”, which go beyond the classical academic curricula classification in chemical, biological, medicinal or technological pharmacy. It is, therefore, hardly surprising that pharmacy as a science and practice cannot stay within its own shell and needs to reach out, interact, debate and evolve through other academic disciplines, well beyond its traditional boundaries and interfaces with natural sciences such as chemistry or biology, medicine or physics [11]. Some of these interfaces are indeed more obvious, such as the ones with “empirical” natural sciences, whereas others are more exotic. Some of these interfaces are more academic in nature, whereas others are highly relevant in daily discourse and often quite controversial. Among the better known examples is, of course, ethics. Research into medications, animal studies, clinical trials (and their expedited procedures during COVID), access to and allocation of funding, foci on some and neglect of other diseases, result in a plethora of questions, which have already found their way into the textbooks of bioethics [12–17]. In most countries, governments, therefore, rely on professional Ethics Committees for advice, and some of us may remember the appearances of Anthony Fauci, the Chief Medical Advisor to the President of the United States during the pandemic. Other questions, such as the continued use, donation, recycling or disposal of expired medications, also fall within this field and provide ample opportunities for renewed discourse [18–21].

Yet, as mentioned in the introduction, pharmacy is not “just” chemistry, biology or medicine, and therefore bioethics is not a sufficient substitute for a wider pharmanthical debate [22]. Besides ethics, pharmaceutical research also poses quite intriguing epistemological and even metaphysical questions, such as that of causality at different layers of scientific complexity [23–25]. Issues such as understanding and defining the mechanisms of action in pharmacology, uncovering causal relationships, addressing the complexities of extrapolating data from model organisms or transferring and relying on *in silico* results, indeed, go beyond

ethical considerations. These aspects highlight the need for a deeper philosophical inquiry to inform decision-making and evidence-based practices in pharmacy.

Similarly, while some considerations regarding reductionism and emergent properties are not especially unique to pharmacy and may also be found in (other) Life Sciences, they become of utmost and often also very practical and specific importance in the context of medications, their actions, interactions, benefits and side effects. One might also draw on philosophical discourse to evaluate the production and amalgamation of evidence to answer empirically resistant questions about the safety and effectiveness of pharmaceuticals [26–30]. Furthermore, systematically studying and analysing episodes of discovery might help develop methodological approaches to discovery and justification in pharmacy [31–34]. Philosophical issues related to the sharing and dissemination of knowledge, the role of peer review, the “publish or perish” culture and the replication crisis are also themes best reflected upon from the perspective of philosophy [35–37].

4. Pharmacy and Social Sciences

Interestingly, talking about ethics in pharmacy almost involuntarily lures us into more sociological and, on occasion, even psychological waters [38–41]. The issue of (compulsory) vaccination during the COVID pandemic, for instance, has illuminated a social dynamic around “pharmaceuticals” which has surprised many scientists, who have been preoccupied to date with excellent scientific research in their respective ivory towers. The COVID vaccines produced just months after the outbreak of the pandemic were hailed by these scientists as a feast of modern research and development. Yet, astonishingly, this feast not only unleashed a rush for the vaccine, but also triggered heated demonstrations and protests against it [42,43].

If not apparent before, these months in 2021 have demonstrated that pharmacy is not just research and development, but is deeply rooted and embedded in a highly dynamic medley of many different societies and their respective cultural undercurrents. In other words, pharmacy is not simply the “science and technique of preparing, dispensing and administering medicines”; it is also about production, access and individual and social acceptance and compliance. The dynamics behind these social processes are paramount for pharmacy to fulfill its mission [10]. They are a different kind of “pharmaco-dynamics” from that found in the textbooks of pharmacy—rather a social factor, which needs to be studied with the tools of social sciences. Supported by rigorous and continuously evolving empirical tools and methods, colleagues from across the aisle may be better suited to help us understand individual and group behaviour, as well as the influence of cultural, sociodemographic and psychological factors. Vaccine hesitancy, for instance, is a social and (motivational) psychological issue, which can be difficult to grasp from the perspective of the scientists developing the vaccines [44]. Nevertheless, it poses a significant challenge to global health security and demands our attention and responsibility. By integrating these perspectives into drug development and public health policies, we can broaden our societal responsibilities. This means ensuring not only the safety and effectiveness of medications but also fostering their acceptance by the general public.

Indeed, many of these socio-psycho-cultural studies have been carried out during and after the recent pandemic, for instance on compliance, on taking precautionary measures and on vaccination hesitancy. They are not alone in the literature. For instance, it is often a conundrum to some pharmaceutical scientists as to why many patients prefer unproven herbal remedies or even homeopathic preparations over exhaustively studied modern medications. In such cases, personal preferences and convictions, cultural traditions and beliefs, the social environment and peer-pressure may outpace the hard yet impersonal scientific evidence [45,46].

Community pharmacists, for instance, play an important role in raising awareness about the use of medications [47,48]. They participate in educating the public on managing chronic conditions and encourage vaccinations [49,50]. Many cultures place great trust in community pharmacists helping patients to handle conflicting information and cultural beliefs [51,52]. Online pharmacies, often hailed as the future in dispensing medications effectively and economically, may or may not fulfil these tasks.

Clinical pharmacists, meanwhile, work with patients, who may have complex medication regimens. They must not only consider the pharmacological effects but also the cognitive, psychological and social factors which influence adherence and ensure therapeutic outcomes [53–55]. In the case of diabetic patients, for instance, clinical pharmacists often face the challenge of ensuring medication adherence whilst also considering the psychological burden of chronic disease management, where factors such as self-efficacy, depression and social support play significant roles [56,57].

Sometimes, even changing our perspective in such complex situations can be remarkably beneficial. The salutogenesis framework, for instance, provocatively invites us to shift our focus from diseases and pathology to quality of life and the origins of health [58]. Just a few days ago, the Federal Government of Germany has drafted a “Healthy heart” law which aims to prevent rather than treat cardiovascular diseases in an entire—and rapidly ageing—population of over 80 million [59]. These social aspects of pharmacy are not minor; they reflect a certain social dynamic and thus may eventually dominate the debate and decisions made on the ground, and therefore need to be addressed in full and in earnest.

5. Time for a More Holistic Approach

To take a positive view on these challenges, the multidisciplinary field(s) opening up in front of us are equally complex and fruitful. They can bring together a wealth of expertise from many vastly different disciplines and may provide a fertile ground for relevant discussions [60]. To make this point, a few additional lines of thought ought to suffice.

As for pharmacy and aesthetics, one may realize that, besides active pharmaceutical ingredients and excipients, size, shape and colour also matter, from blue pills that promise a sizeable *yin* and hope, to dark green ones that pretend to be especially natural. Hardly any tablets or pills are coloured in red (and few in light green), and the reasons behind this are not related to activity and pharmaceutical technology, but to colour (blindness) and in some instances also to aesthetics. While it may seem farfetched at first, there is even evidence for the impact of the appearance of medications on the therapeutic outcome [61,62].

Modern experimental setups, including negative and positive controls, on the other side, are in essence a matter of logical deliberation and can be traced in their development to ancient Greece, the Arabic Golden age and even some religious medieval thinkers. Similarly, debates about the perceived benefits of antioxidants *in vitro* and *in vivo* may not be purely experimental and can find an answer within semantics, thus falling within the remit of philosophy of language and into the territory of Ludwig Wittgenstein and Noam Chomsky. Talking about language, it has always amazed us in Germany why cosmetics containing urea say they contain “urea” (the English word) and not simply “Harnstoff”, yet, considering that the latter translates to “piss stuff”, aesthetics again may beat a—scientifically correct—terminology, and for rather obvious reasons.

6. Conclusions

In this brief essay, we have aimed to highlight a gap in our understanding of the broader influence of pharmacy as a science, profession, trade and an art. We propose the addressing of these issues under the umbrella of pharماسophy, an inter- and multi-disciplinary project-in-progress attempting to formalize the systematic integration of philosophy and social sciences into pharmacy. The originality of pharماسophy results from redefining and broadening the perspective on pharmacy, thus causing the demand for a more holistic view on pharmacy which also integrates philosophy and social sciences. This calls for a structured, formalized and professional framework, which is what pharماسophy aims to provide.

Yet there are also limitations which command closer attention. Such a holistic attempt still requires more concrete steps towards its practical implications, whether in educational curricula, where it is notably missing, scientific or professional practice. Although there are benches and bedsides, there are no chairs of pharماسophy teaching and no researching pf these topics in a more structured manner.

Moreover, the scope for applying pharosophy is currently rather broad and not fully defined. Collaboration, resources, time and effort must be invested to shape it and to refine it. Fortunately, the field has a positive heuristic and thus is likely to thrive and take on its specific shape as it evolves during the years to come.

Indeed, whilst we have generally adopted a conceptual, thought-provoking attitude in the lines above to emphasize the wider impact of pharmacy and to inspire reflection, we also acknowledge that further scientific rigor and practical applications are inevitable so as to fully realize the potential of pharosophy.

From this perspective, the pharmacy of the 21st Century has to take a much wider and perhaps more holistic view on the matter of “pharmaceuticals”. It needs to accept that producing a miracle drug is one thing, yet patients eventually taking it is quite another. It is, therefore (a good) time to venture into the field of pharosophy, where pharmacy meets wisdom, be it from the social sciences, humanities and, indeed, philosophy

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