

REVIEW ARTICLE

## Why We Explain

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Review of Anya Plutynski, 2018. *Explaining Cancer: Finding Order in Disorder*. Oxford University Press.

Since its initial publication in 2018, Professor Anya Plutynski's *Explaining Cancer: Finding Order in Disorder* has garnered a great deal of accolades.<sup>1</sup> In 2021, The London School of Economics and Political Science conferred Professor Plutynski the Lakatos Award, recognizing the book's significant contribution to the philosophy of science. On the heels of its recent reissuing as a paperback, it is an ideal time to revisit this remarkable work.

*Explaining Cancer* is a sustained and rigorous philosophical analysis of the methodological and conceptual issues concerning cancer. As with most medical concepts, "cancer" is a messy amalgam shaped by the inertia of past usages, pragmatic considerations, new empirical discoveries, and broad background models of disease. This naturally lends analysis of cancer a multifaceted approach, that is, the appropriateness of an understanding of cancer depends on one's interests. Is one trying to identify a genetic marker that can help lower an individual's risks of cancer? Is it a matter of understanding the social determinants that can affect population health? Are we trying to distinguish cell growths that are pathological from those that are not? As Professor Plutynski points out, cancer can be seen as a metabolic phenomenon, a genetic disease, an environmental disease, and so on. Each way of understanding cancer is adequate only relative to the interests of the investigator; there is no single context-independent explanation of cancer. This pragmatic theme runs through much of *Explaining Cancer* and it echoes Peter Lipton's contrastive theory of explanation (i.e., instead of explaining why P, we always explain why P rather than Q with the contrastive foil determined by the interests of the inquirer).<sup>2</sup>

The first five chapters of the book carefully examine a plethora of related conceptual and epistemological issues ranging from whether cancer is a natural kind to the theory that cancer is a genetic disease to what counts as better or worse evidence that environmental factors influence neoplasm. Familiar debates in the philosophy of science over the nature of causation, evidence, modeling, and explanation make their appearances as readers follow along Professor Plutynski's journey. Given the range of topics covered, *Explaining Cancer* serves as an advanced undergraduate or early graduate student teaching tool that illustrates nicely the relevance of philosophical concepts in research and clinical medicine. The ultimate goal of these chapters, however, is to lay the groundwork for Chapter 6 in which Professor Plutynski undertakes the task of characterizing scientific explanations of cancer and progresses in such research as a problem-solving enterprise, where criteria of adequacy are local and contextual.

Professor Plutynski offers a unique critical perspective that combines analytic philosophy with a deep understanding of the science of cancer. Clearly, she benefited from classes at the University of Utah School of Medicine and at Washington University of Saint Louis. Take her analysis of cancer as a "homeostatic property cluster" (HPC) kind. According to the HPC view, heterogeneous members can belong to the same HPC kind so long as these members share some stable underlying homeostatic mechanisms that mutually favor the presence of one another. Properties A, B, and C can form an HPC just in case there is an underlying mechanism that causes the cluster to emerge together. No one property is necessary or sufficient for an HPC but the presence of one makes it more likely that the others are present as well. HPCs are like a tight-knitted group of friends who tend to congregate together because of their mutual affection (e.g., if one friend shows up, other friends are also more likely to show up, and vice versa).

The need to see cancer as a kind is of philosophical importance. Traditionally, kinds are necessary because only they can participate in scientific laws and scientific laws provide us with justification for inductive reasoning; they are projectable, to use a term from Nelson Goodman. Jade, for instance, is not a kind because there are no underlying properties that all samples of jade share. The molecular composition of jade consists of two distinct types: the pyroxene jadeite and the tremolite nephrite. Because of this, there is no scientific law about jade. If cancer is not a kind, then its role in scientific law becomes suspected which in turn undermines whatever predictive confidence we have regarding cancer and cancer treatments.

Researchers have proposed a number of underlying mechanisms for cancer as an HPC. One theory, for instance, identifies chronic inflammation as the underlying feature. In essence, this view tells us that cancer *is* ultimately an inflammatory disease. Professor Plutynski rightly points out that, although inflammation is associated with some types of cancer, it is not so for all forms of cancer. Genetic mutations, viral pathogens, and environmental determinants are likewise only partially successful. The most plausible candidate, she argues, is Muhammad Ali Khalidi's attempt to ground cancer *qua* HPC on the basis of mutations in caretaker genes—those genes that are responsible for DNA repairs, keeping out mutagenic genes, and other functions that ensure proper cell cycles.<sup>3</sup> One problem with Khalidi's approach, Professor Plutynski argues, is that mutations of caretaker genes are neither necessary nor sufficient for the presence of cancer. For example, mutations in genes that lead to uncontrolled neoplasm exist in many cells in our body and the vast number of them does not become cancerous. Her familiarity with cellular biology shines through in her analysis.

Khalidi's approach also shares a fundamental philosophical difficulty with other HPC attempts, that is, we do not have a clear understanding of what constitutes a mechanism. She writes,

While mutations may be one of several *events* properly characterized as a *part* of one of many mechanisms for cancer, they are not themselves mechanisms. Mutations are neither organized nor decomposable into parts and activities; nor do they perform a (discrete) function, except insofar as they are enabled to do so via the activity of other entities in their intra- and extracellular context. The pathways associated with “cancer” genes are often coregulated with other pathways. For instance, the same pathway may halt the initiation of apoptosis (cell death), initiate the growth (or breakdown) of an extracellular matrix (a structure that enables tissues to remain relatively stable), enable cell motility (which enables invasion), or attract fibroblasts (other structural features of some tissues, some of which may be co-opted in cancer development). Many of the same “hub” genes are associated with several of these pathways. That is, they are pleiotropic in their effects, and many of these pathways—when disrupted—can overactivate processes associated with cancer. Such overlapping and interacting causal processes raise the following puzzle: how many mechanisms are there in this set of pathways?<sup>4</sup>

For a complex process such as malignant neoplasm, it is unsurprising that a view of the mechanism that suffices for Rube Goldberg apparatuses fails utterly for cancer. Rather than attempting to refine our philosophical understanding of mechanisms, a better tack is to concede that cancer likely consists of a multitude of mechanisms. The identification of a salient mechanism for an individual patient depends on our pragmatic and epistemic interests; for example, what do we want to do with the identification of the mechanism? What is it that we want to understand? We see again the strong pragmatic character of Professor Plutynski's overall approach.

In some respects, *Explaining Cancer* is a misleading title. Professor Plutynski rightly notices that a plethora of factors make the explanation of cancer inappropriate, if not impossible. Explanations are interest-dependent, that is, what we aim to explain (the explanandum) can only be identified relative to what puzzled the inquirer in the first place. Why did Wilma develop salivary gland cancer? Is it that she has no obvious risk factors for this rare form of cancer? Is it that of all the individuals who worked at the watch factory painting radium dots, she was the only one who developed it? Is it that we want to know the exact cellular processes that caused the development of malignant tissue growth? The answer to one question is not *ipso facto* appropriate to another. Moreover, given the fact that cancer, as a disease state,

has been recognized since the days of Hippocrates and that it has survived cultural changes and scientific revolutions, the very historic legacy of cancer virtually guarantees that the term we have today is utterly gerrymandered, making it highly resistant to any homogeneous philosophical treatment. Professor Plutynski recognizes this and she concludes in the final chapter that

...the vast majority of cancer research is better described as addressing *particular* questions about patterns, processes, and aspects of cancer, rather than arriving at “general theories” of carcinogenesis. This conclusion runs contrary to one very intuitive picture of science. On this view, the aim of scientific inquiry is arriving at true general theories, and a successful explanation is guaranteed, provided we have the right theories...cancer is not a single fact to be explained or a single problem with a single solution. As in much of biology, the phenomena can be decomposed in different ways, leading to different questions.<sup>5</sup>

Perhaps the title of the book should be the far less elegant: *Explaining Explaining Cancer*.

One of the most important features of Professor Plutynski’s project is that she takes the actual practice of research and clinical medicine as integral to a proper analysis of cancer. As the quotation above illustrates, she appreciates the importance that philosophical work on applied areas like medicine ought to be informed by how the practice is actually done. And, given her pragmatic orientation, it is curious that Professor Plutynski does not embrace pragmatism “all the way down” so that issues of realism become at best secondary. She assures us that

the diverse, cross-cutting classifications we find in scientific practice do not require that we endorse anti-realism about kinds...Scientists know that the exhibition of properties broadly shared by such cancers are context-sensitive in their realization, and multiply realizable. It seems problematic that we should be forced to the odd view that such kinds, properties, and regularities are not “real” or “natural” simply because the world does not cooperate by giving us uniformity, much less “necessity.” While in the paradigmatic cases, philosophers have tended to focus their attention on having (or seem to have) essences, it is not clear that most examples of the kinds of kinds scientists investigate do (if any).<sup>6</sup>

She is quite right. Just because there are different ways to slice an observation such that our ontological commitments become dependent on the interests of the observers, it does not follow that there are no kinds or any other natural metaphysical joints. For the limited experience I have with oncologists, I am quite certain that the question of whether a theory of cancer has *really* marked out something real (albeit relative to interests) is a question that rarely, if ever, arises. The focus for cancer researchers and clinicians is problem-solving, be it extending a patient’s life or lowering cancer risks in a population. Perhaps they are just not accustomed to indulging in the realism/anti-realism debate. But at the very least, it tells us that oncology can be done without worrying that unless we adopt a quasi-realist view, all the success in science and medicine would thus be a miracle. Professor Plutynski’s interest-dependent form of realism is akin to Hilary Putnam’s internal realism; that is, things exist, really exist, relative to a conceptual scheme.<sup>7</sup> I have always been skeptical that internal realism can do the heavy metaphysical lifting that explains the success of science. Given my sympathy for pragmatism, the need to ensure that we got our ontology right, even if it is only relative to some conceptual scheme, strikes me as an unnecessary bridge too far. As pragmatists like to say, “The search for justifications and the search for truths are indistinguishable.” If this is so, why bother with the latter? It is not as if we can look up the answer keys at the end of the book of nature to make sure we got things right.

I will end my review of Professor Plutynski’s brilliant book with a personal remark. Years ago, a friend told me that all research is personal. In the introduction of *Explaining Cancer*, Professor Plutynski reveals that the project was sparked by her experience of being diagnosed with breast cancer at a young age. She had neither a relevant family history of cancer nor any known risk factors. Her reaction to the diagnosis was understandable, “Why did I get cancer? Was this simply a matter of bad luck? Had I done something that led to this cancer diagnosis? What role—if any—did my actions and choices play?”<sup>8</sup> Like Professor

Plutynski, cancer is deeply personal to me. During the final year of my doctoral education, my mother who was merely 63 years old was diagnosed with stage IV gastric cancer. At that time, the median life expectancy for someone in her position was 9 months. And, like Professor Plutynski, I too overwhelmed myself with learning as much about the science of neoplasm, clinical results, and possible risk factors that could explain why an otherwise healthy woman would develop a deadly disease. Had I read Professor Plutynski's book at the time, I would have learned a great deal about cancer and found in her an example of how to use philosophy to understand the seemingly inexplicable. Indeed, in some respects, the thoroughly interest-relative account that she offers would have left me thinking that there was no *single* answer as to why my mother developed cancer. It would have brought solace for me to realize that to explain it, I needed to determine what I cared about first. We are not innocent victims of an inexplicable universe; rather, the epistemic friction requires two parties and there is plenty for me to do to make sense of it all.

Pace Lipton and other advocates of the interest-dependent nature of explanation, I wonder if an interest-relative theory of explanation fits our psychology. At the time of my mother's diagnosis, I was too bewildered to know what was so puzzling about the whole thing. I was nowhere close to being capable of articulating the (Liptonian) contrastive foil that narrows the why question. Why did my mother develop cancer rather than... what? At least for me, the relationship between question and answer was far more bidirectional and dynamic. Instead of starting with bewilderment (captured via a contrastive why question) and searching for the proper answer, I found the answers that I liked and adopted the corresponding why question as *my* bewilderment. For better or for worse, it was "Ah ha! That's what was bothering me!" that best described my search for an explanation that was equally a search for the right bewilderment.

A pragmatic theory of explanation tells us that an explanation is more complex than the simple offering of a sound deductive argument that includes at least one law-like premise, as Carl Hempel thought. An explanation is at the very least about addressing some perplexity that prompted the epistemic need in the first place. To identify the proper explanandum, we need to know the epistemic situation of the inquirer. To be sure, if demystification were a sufficient condition for an adequate explanation, then it seems that ingesting a bottle of bourbon might do the trick. The key here is that whether something counts as an explanation requires that it conforms to other beliefs we have. Drinking a bottle of bourbon does not count as a scientific explanation because drinking bourbon is not an acceptable way to do science according to our scientific paradigm. What distinguishes a pragmatic theory of explanation from metaphysically centric accounts (e.g., causal theories of explanation) is that the inquirer's epistemic position plays an indispensable role in the adequacy of an explanation. This pragmatic expansion, however, might not be enough. The search for an explanation is surely just one part of our overall attempt to make sense of the world around us. We strive to form a picture of the world (consciously or subconsciously) by balancing what we believe, what we feel, and what we observe.<sup>9</sup> If an adequate explanation is one that properly addresses the inquirer's epistemic perplexity, it behooves us to keep in mind that the perplexity sits within this broader psychological web. Perhaps the criterion for proper epistemic revisions is coherence (broadly construed) or perhaps it is minimizing predictive errors advocated by Bayesian brain theorists. Regardless of what it is, one thing is clear: The search for explanations ought to be seen on a par with other ways we have to make sense of the world and ourselves. The proper resolution might be epistemic, it might involve the demystification of some perplexity, or it might mean committing oneself to activism to alleviate the suffering of other people. A pragmatic theory of explanation encourages intellectual humility; in the face of tragedies, there might be many different ways to make sense of the world. Professor Plutynski's appreciation of the multifaceted nature of cancer and explanation goes a long way to argue for the necessity of philosophical tolerance.

*Explaining Cancer* is easily one of the most insightful, rigorous, and rewarding books I have read in the past few years. Professor Plutynski's ability to explain complex philosophical ideas and the challenging science of cancer to nonexperts is likewise impressive. Untangling the messiness of a medical concept that has been around for almost 2,000 years is certainly an incredibly ambitious undertaking. Her project tells us as much about this dreadful disease (or disease types) as it does about *how* one ought to go about doing so. It is a must-read for anyone in the philosophy of medicine.

## Notes

1. Plutynski A. *Explaining Cancer: Finding Order in Disorder*. New York, NY: Oxford University Press; 2018.
2. Lipton P. *Inference to the Best Explanation*. London: Routledge; 1991.
3. Khalidi MA. *Natural Categories and Human Kinds: Classification in the Natural and Social Sciences*. Cambridge: Cambridge University Press; 2013.
4. See [note 1](#), Plutynski 2018, at 44.
5. See [note 1](#), Plutynski 2018, at 192.
6. See [note 1](#), Plutynski 2018, at 57.
7. For an explication of internal realism, see Putnam H. *Reason, Truth and History*. Cambridge: Cambridge University Press; 1981.
8. See [note 1](#), Plutynski 2018, at 11.
9. For an account of how our brain constructs emotions, see Barrett LF. *How Emotions are Made: The Secret Life of the Brain*. New York, NY: Mariner Book; 2018.