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THE ROLE OF SCIENCE IN THE AVENUES OF UNDERSTANDING AND APPRECIATING NATURE

Summary. Scientific explanation is not a "tower," in which one layer explains or completely accounts for another. It is a network of mutually informing concepts and languages. The language of physics describes things and processes which can *support* the things and processes described by biology. Biology meanwhile has its own coherent discourse which is not rendered redundant, nor even fully explained, by the physical processes which support it. In order to show that this is not a contradiction, I examine the role of symmetry principles in physics where similar statements can be made. Next I elucidate a logical fallacy (the "Babel fallacy") which is often at work when people make unsupported claims about the scope of a given physical model, and I argue for the reasonableness of treating human persons as subjects and moral beings. But in our schools the impression is given that science seeks to, and could, replace the languages of justice, mercy, and moral insight by a machine-like model of all that happens. This is a false vision of science. A true vision places it correctly in the landscape of discourse, and offers a more liberating, humane and coherent picture of the whole setting of human life. We now have an educational task, and an opportunity, to teach this. It is a welcome part of a more creative and less exploitative outlook on the whole natural world and our place in it.

Resumen. La explicación científica no es un "edificio" en el cual cada nivel explica o complementa los otros. Es una red de conceptos y lenguajes mutuamente informativos. El lenguaje de la física describe los objetos y procesos que pueden *sustentar* los objetos y los procesos descritos por la biología. Al mismo tiempo, el discurso de la biología, propio y coherente, no puede ser considerado ni redundante, ni completamente dilucidado por los procesos físicos que lo sustentan. A fin de mostrar que en esto no existe contradicción, examino las mismas afirmaciones que se pueden realizar en la física, mediante el papel de los principios de simetría. Después abordo un artificio lógico (la falacia de Babel), siempre utilizada cuando se hacen aseveraciones sin sustento en el campo de aplicación de algún modelo físico, y argumento la sensatez de tratar a las personas humanas como sujetos y seres morales. Sin embargo, en nuestras escuelas se da la impresión que la ciencia intenta y cree poder reemplazar los lenguajes de justicia, de misericordia, y de percepción moral con un modelo mecánico de la realidad. Esto es una falsa visión de la ciencia. Una visión verdadera coloca la ciencia de manera correcta en el paisaje discursivo, ofreciendo además una imagen más liberadora, humana y coherente de todo el escenario de la vida humana. En esto encontramos ahora

una tarea educativa, y una oportunidad para la enseñanza. Esto abre la posibilidad al desarrollo más creativo y menos dominate en la consideración del mundo natural y nuestro lugar en él.

> How wonderful is the certainty that each human life is not adrift in the midst of hopeless chaos, in a world ruled by pure chance or endlessly recurring cycles!
>
> Pope Francis, *Laudato si'*, n. 65

This paper explores the nature and role of science, and introduces some proposals for education. Much of the discussion is set out at greater length in *Science and Humanity*[1]. The present publication gives me an opportunity to summarize this; readers can then explore the longer version or not, as they choose. In the present essay I shall draw out lessons which are relevant to the educational possibilities indicated by the encyclical *Laudato si'* of Pope Francis[2].

My own scientific background lies mainly in areas of quantum information and quantum computing, including experimental and theoretical work, and I have also done some work in relativity (classical electrodynamics) and thermal physics. So I write as a physicist rather than a philosopher by training. But this long experience with areas of physics which I have also taught, and for which I have written textbooks, gives me expertise in the way scientific explanation functions in those areas, and I think a general knowledge of other areas of science such as chemistry and evolutionary biology is sufficient to see that similar lessons apply there.

1. The structure of science

The first point I wish to make concerns the structure of scientific explanation. It is that this structure is not like a tower in which each layer explains the one above it, but rather it is a network in which there are multiple areas of discourse, with two-way, not one-way, links between

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[1] A. M. Steane, *Science and humanity - A humane philosophy of science and religion*, Oxford University Press, Oxford 2018.

[2] Francis, Encyclical Letter *Laudato si'* on the care for our common home, May 24, 2015.