

“Science of Natural Processes” by Frederick Engels



Frederick Engels

About the author. . . . Frederick Engels (1820-1895), as the son of a German textile manufacturer who owned factories in England, became so concerned about fate of textile workers he published *The Condition of the Working Classes in England*. He saw the textile worker as a new societal force leading to a rational ordering of social life, superseding capitalism. In collaboration with Karl Marx, Engels produced a number of works in social philosophy, including the *Communist Manifesto* which recounts the history of the working class in a dialectical fashion based on materialistic conflict. At the heart of Marxism is this thesis: The modes of production in any society uniquely determine the so-called higher ideologies of politics, ethics, religion, and philosophy. Engels financially supported Marx and edited most of his work. The contribution of the philosophy of historical materialism, the perspective expressed in *Ludwig Feuerback*, is generally credited to Engels.

About the work. . . . In this reading from the second publication of *Ludwig*

Feuerbach and the Outcome of Classical German Philosophy,¹ Frederick Engels argues that three recent discoveries in the sciences provide the basis by which *all* aspects of the universe can be understood in terms of the philosophy of materialism. Wöhler’s synthesis of urea proves that organic processes are explainable in terms of inorganic processes. The theory of the cell discovered by Schwann and Schleiden proves that the physiological basis of all living things is the same, and Darwin’s theory of evolution indicates no difference in kind between human and all other forms of life. Finally, the discovery of the mechanical equivalent of heat (that heat is just matter in motion), proved that subjective properties (heretofore considered mental qualities) are equivalent to material processes. On Engels’ proposal, soul, spirit, and ideas are part of the material processes of nature. One arguable consequence of the unification of science provided by the theory of mechanistic materialism is the impossibility of the discipline of an ethics based on choice. How could free will be possible in a deterministic and materialistic world?

From the reading...

“ Three great discoveries, however, were of decisive importance. ”

Ideas of Interest from *Ludwig Feuerbach*

1. Explain the significance of the discovery of the transformation of energy in terms of the classical “mind-body” problem.² In Engels’ terms, what are the two kinds of “motions” that are now understandable as

1. Frederick Engels. *Ludwig Feuerbach and the Outcome of Classical German Philosophy*. 1888.

2. The mind-body problem arises from the doctrine that physical and mental things are essentially two distinct kinds of substances with uniquely different properties. Mental objects, unlike physical objects, have no size, shape, and weight. How, then, do these two entirely different substances interact?

mechanistic materialism? How, then, are mental qualities to be explained?

2. Why was the discovery by Schwann and Schleiden that the biological cell is the basis of all living things such a revolutionary theory?
3. What is the unifying role of Darwin’s theory of evolution in the philosophy of mechanistic materialism?
4. Prior to Wöhler’s discovery, scientists thought that organic molecules could only be synthesized by living organisms. Explain Engels’ argument that when Friedrich Wöhler accidentally created the organic compound urea by heating the inorganic compound ammonium cyanate, vitalism³ was disproved.
5. Engels is claiming that scientific law applies with equal measure to nature and society. Explain whether or not the free choice of human beings would be possible if all life processes are subject to deterministic scientific laws.

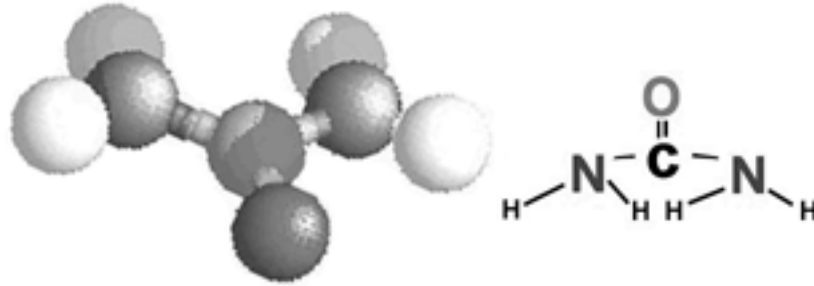
The Reading Selection from *Ludwig Feuerbach*

[Unification of Science of Natural Processes]

... empirical natural science made such an advance and achieved such brilliant results that not only did it become possible to overcome completely the mechanical one-sidedness of the eighteenth century, but natural science itself was, through the proof of the inter-relation existing in nature itself between the various spheres of investigation (mechanics, physics, chemistry, biology, *etc.*), transformed from an empirical into a theoretical science and, by the integration of the results achieved, into a system of materialistic knowledge of nature. The mechanics of gasses; newly created organic chemistry, which stripped the last remnants of incomprehensibility from the so-called organic compounds, one after the other, by preparing

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3. Vitalism is the doctrine that all living organisms have a non-physical aspect or unique life-force which animates them such that living processes are not reducible to mechanistic materialism and therefore cannot be completely explained by scientific laws.

them from inorganic materials; the science of embryology which dates back to 1818; geology, palaeontology and the comparative anatomy of plants and animals—all of them provided new material to an unprecedented extent. Three great discoveries, however, were of decisive importance.



Structure of Urea

[Transformation of Energy and Motion]

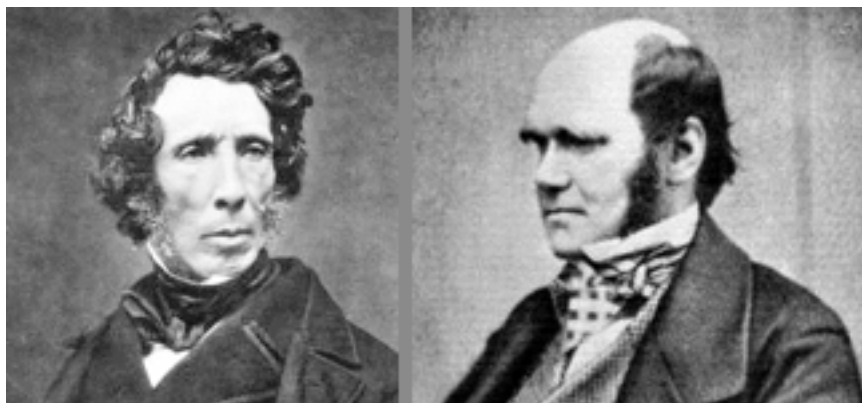
The first was the proof of the transformation of energy obtained from the discovery of the mechanical equivalent of heat (by Robert Mayer, Joule and Colding). All the innumerable operative causes in nature, which until then had led a mysterious inexplicable existence as so-called “forces”: mechanical, force, heat, radiation (light and radiant heat), electricity, magnetism, the force of chemical combination and dissociation—are now proved to be special forms, modes of existence of one and the same energy, *i.e.*, motion. We are not only able to demonstrate their perpetual transformation in nature from one form into another, but we can carry out this transformation itself in the laboratory and in industry and this in such a way that a given quantity of energy in one form always corresponds to a given quantity of energy in this or that other form. Thus we can express the unity of heat in kilogram-meters, and again the units of any quantity of electrical or chemical energy in unity of heat and vice versa. Similarly we can measure the consumption and supply of energy to a living organism, and express these in any unity desired, *e.g.*, in units of heat. The unity of all motion in nature is no longer a philosophical assertion but a fact of natural science.

[Life Explained by Scientific Law]

The second—chronologically earlier—discovery was that of the organic cell by Schwann and Schleiden—of the cell as the unity, out of the multiplication and differentiation of which all organisms, except the very lowest, arise and develop. With this discovery, the investigation of the organic, living products of nature—comparative anatomy and physiology, as well as embryology—was for the first time put upon a firm foundation. The mystery was removed from the origin, growth and structure of organisms. The hitherto incomprehensible miracle resolved itself into a process taking place according to a law essentially identical for all multicellular organisms.

[Origins of the Varieties of Organisms]

But an essential gap still remained. If all multi-cellular organisms—plants as well as animals, including man—grow from a single cell according to the law of cell-division, whence, then comes the infinite variety of these organisms? This question was answered by the three great discovery, the theory of evolution, which was first presented in connected form and substantiated by Darwin. However numerous the modifications in details this theory will yet undergo, it nevertheless, on the whole, already solves the problem in a more than satisfactory manner. The evolutionary series of organisms from few and simple to increasingly manifold and complex forms, as we see them today before our eyes, right up to and including man himself, has been proved in all its main basic features. Thereby not only has an explanation been made possible for the existing stock of the organic products of nature, but the basis has been given for the announced-history of the human mind, for following all its various stages of evolution from the protoplasm, simple and structureless yet responsive to stimuli, of the lower organisms right up to the thinking human brain. Without this prehistory, however, the existence of the thinking human brain remains a miracle.



Friedrich Wöhler and Charles Darwin, adapted from Annenberg Rare Book and Manuscript Library

[Origin of Life]

With these three great discoveries, the main processes of nature are explained and traced back to natural causes. Only one thing remains to be done here: to explain the origin of life from inorganic nature. At the present stage of science, that means nothing else than the preparation of albuminous bodies from inorganic materials. Chemistry is approaching ever closer to this task. It is still a long way from it. But when we reflect that it was only in 1828 that the first organic body, urea, was prepared by Wöhler from inorganic materials and that innumerable so-called organic compounds are now artificially prepared without any organic substances, we shall not be inclined to bid chemistry halt before the production of albumen. Up to now, chemistry has been able to prepare any organic substance the composition of which is accurately known. As soon as the composition of albuminous bodies shall have become known, it will be possible to proceed to the production of live albumen. But that chemistry should achieve over night what nature herself even under very favorable circumstances could succeed in doing on a few planets after millions of years—would be to demand a miracle.

[Scientific Materialism]

The materialist conception of nature, therefore, stands today on very different and firmer foundations than in the last century. Then it was only the motion of the heavenly bodies and of rigid terrestrial bodies under the influence of gravity that was thoroughly understood to some extent. Almost the whole sphere of chemistry and the whole of organic nature remained an incomprehensible secret. Today, the whole of nature is laid open before us as a system of interconnections and processes which have been, at least in their main features, explained and comprehended. Indeed, the materialistic outlook on nature means no more than simply conceiving nature just as it exists without any foreign admixture, and as such it was understood originally among the Greek philosophers as a matter of course. But between those old Greeks and us lie more than two thousand years of an essentially idealistic world outlook and hence the return to the self-evident is more difficult than it seems at first glance. For the question is not at all one of simply repudiating the whole thought-content of those two thousand years but of criticizing it in order to extricate from within the false, but for its time and the process of evolution even inevitable, idealistic form, the results gained from this transitory form. And how difficult that is, is demonstrated for us by those numerous scientists who are inexorable materialists within their science but who, outside it, are not only idealists but even pious, nay orthodox, Christians.

From Frederick Engels’ *Anti-Dühring*...

“All religion, however, is nothing but the fantastic reflection in men’s minds of those external forces which control their daily life, a reflection in which the terrestrial forces assume the form of supernatural forces.”

Related Ideas

Marxists Internet Archive (<http://www.marxists.org/>). *Marxist Writers and History*. Comprehensive reference and sources for the philosophy of Marxism—useful for many online sources not available elsewhere.

Cosmology Today (<http://www.flash.net/~csmith0/index.htm>). A series of accessible articles by scientists on the present and future state of science including present concerns of “a theory of everything”

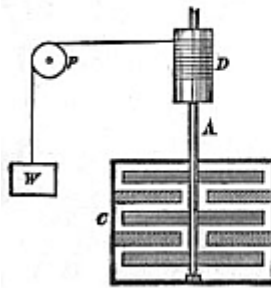
From the reading...

“Today, the whole of nature is laid open before us as a system of interconnections and processes which have been, at least in their main features, explained and comprehended.”

Joule's mode of determining this value of the mechanical equivalent is the following:

A weight W (Fig. 311), by means of a cord passing over a pulley p and around a drum D ,

FIG. 311.



gives to the vertical axis A a rapid rotation. Attached to this axis are a number of radial arms, or paddles, as shown in the figure; projecting from the sides of the cylinder C , in which these arms rotate, are fixed arms, as shown, to arrest any tendency to a rotary motion of the water in the cylinder.

If one pound of water at 60° F. be put into the cylinder C , it will require the expenditure of 772 foot-pounds of energy on the part of

the falling weight W to raise its temperature by agitation to 61° F.

Mechanical Equivalent of Heat, from Denison Olmsted, *An Introduction to Natural Philosophy*, 1844, 341.

Søren Kierkegaard, Journals, 1850

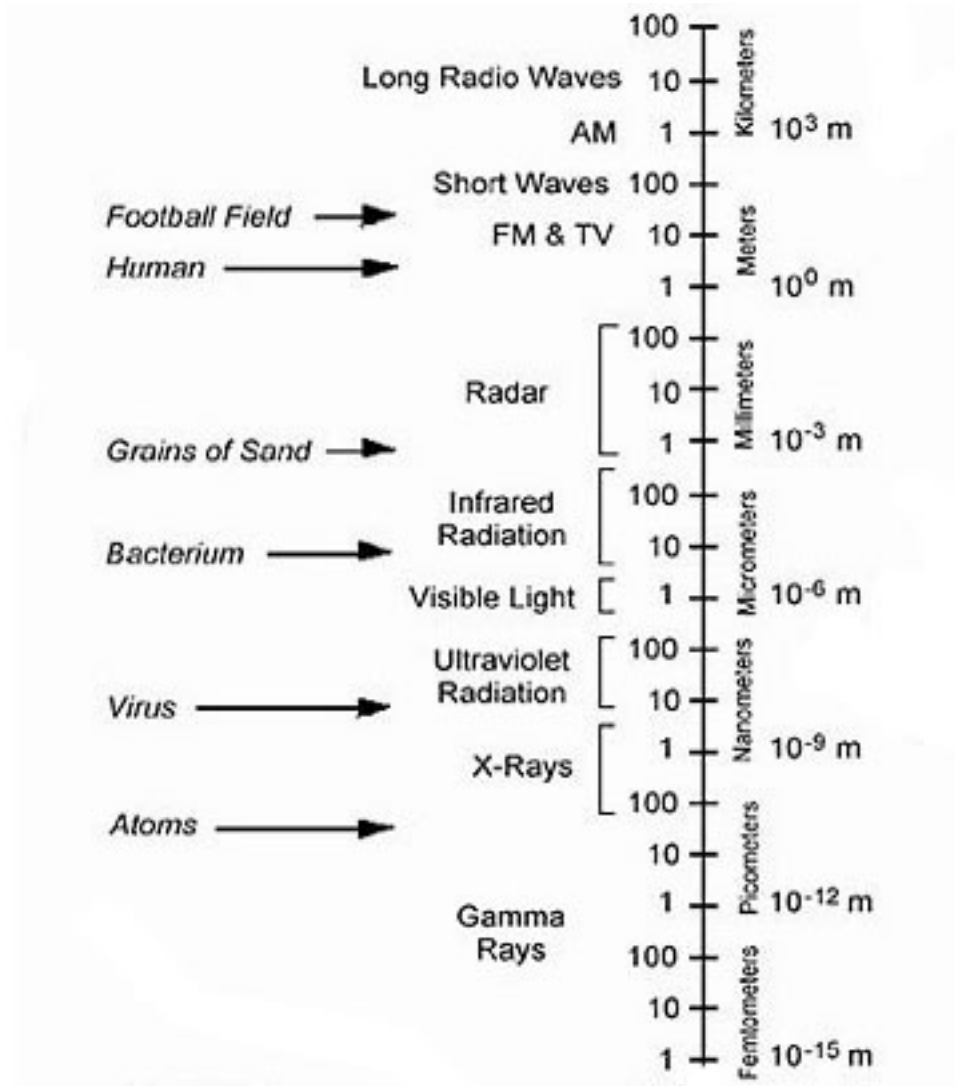
“It is clear enough that ‘this generation’ tends to put natural science in the place of religion.”

Topics Worth Investigating

1. What are some of the advantages of a philosophy of mechanistic materialism?⁴ What are some disadvantages?
2. What are the implications of the unification of the sciences for the possibility of a theory of ethics? Is political science reducible to psychology, psychology reducible to biology, biology reducible to biochemistry, and chemistry reducible to physics? Are all human achievements, then, ultimately just patterns of matter and motion?
3. Has life been chemically created from “non-living” molecules in the laboratory? How precise can the distinction between living things and non-living things be made? How is it made by contemporary science?
4. If science were to develop “a theory of everything,” would religion still be an essential part of the human experience? First explain and then justify your position.

4. The term “dialectical materialism” was not originally used by either Marx or Engels. “Historical materialism” is essentially an economic thesis. *Ed.*

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Electromagnetic Spectrum, NASA, Jet Propulsion Laboratory

Index

- cause
 - natural, 6
- cell, organic
 - discovery of, 5
- Colding, Ludvig, 4
- energy
 - and motion, 4
- Engels, Frederick, 1
- evolution
 - theory of, 5
- Joule, James Prescott, 4
- life
 - foundation of, 5
 - origin of, 6
- Marx, Karl, 1
- Marxism, 1
- materialism, 3
 - early Greek, 7
 - historical, 1
 - scientific, 7
- Mayer, Robert, 4
- mechanical equivalent of heat, 4
- mind-body problem, 2
- motion
 - unity of, 4
- Schleiden, Matthias, 5
- Schwann, Theodor, 5
- science
 - empirical, 3
 - unity of, 2
- transformation of energy, 4
- vitalism, 3
- Wöher, Friedrich, 6