A summation of the Symposium on Evolutionary Biology: The Social and Scientific impact of Darwin's Theory of Evolution – a phenomenonological perspective

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Throughout Human history there have been events and discoveries that have changed the thinking, consciousness, perspectives and life styles in Western Society. Leaving aside theological considerations, a time-axis has been provided of what I consider to be some of the major scientific and philosophical events and discoveries between 500 BC and the present that have impacted on Society and Science (Figure 1); these are associated with Socrates, Galileo, Newton, Maxwell, and Darwin.

Newton, "The Father of Modern Physics", stands significantly in the history of Science. His discoveries at the time of the English Scientific Renaissance were readily accepted by the Scientific establishment: his equations of motion, developing the mathematics behind planetary orbits, and his investigation of light were profound. Impressed by Newton's contributions, Alexander Pope (later) wrote: "*Nature and nature's laws lay hid in night; God said 'Let Newton be' and all was light*". Of course, there were a number of significant scientific discoveries prior to Newton, such as those by Copernicus, Galileo, and Kepler, and many more afterwards resulting, for example, in formulation of the Laws of Thermodynamics, formulation of the Theory of Quantum Mechanics, the discovery of subatomic particles, and the discovery of DNA structure which, while significant in advancing Science, arguably did not have such a profound effect on Society at large. From this latter group, Maxwell has been chosen as typical of a scientist contributing to knowledge as part of a larger Scientific Community. By solving the equations of electromagnetic waves, he paved the way for the development of radio communication and the other uses of electromagnetic waves, the Theory of Relativity, and much of the technology of today.

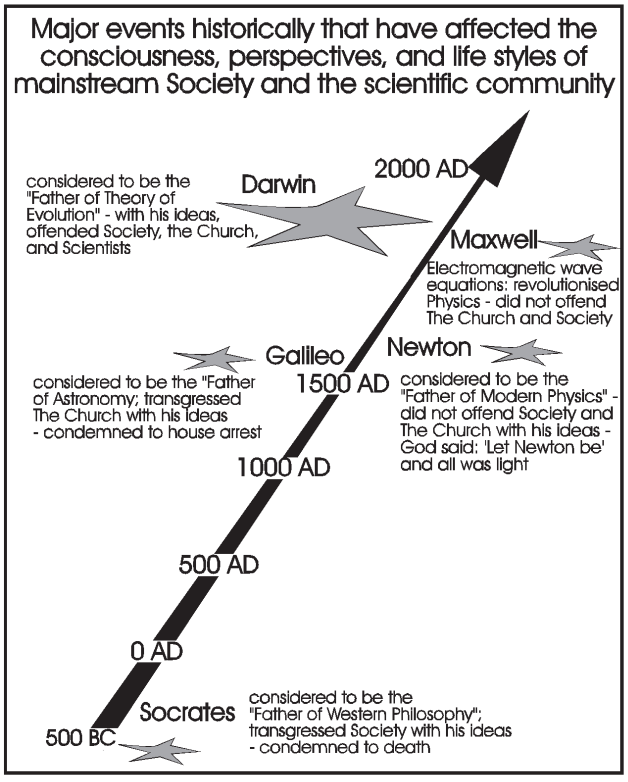

Figure 1. The "arrow of time" from ~ 500 BC to the present, with some of the major events historically that have affected the consciousness, perspectives, and life styles of mainstream Society, the Church, and the Scientific Community. The "impact" marks are meant to indicate the degree of the effect of a particular event.

In contrast to Socrates, Galileo and Darwin, the research of Maxwell did not lead to a negative reaction from Society, Church, and Scientists, and regardless of who one might choose to fit the role of major contributing scientist in the place of Maxwell along the time-line of Figure 1 (be they Banks, Bohr, or Planck, amongst others), their work, generally, did not offend Society, Church and Scientists (though their work and results *did* have some Sociological effects, and there *were* conflicts and disagreement *amongst* the scientists). Many of the discoveries in the History of Science, in fact, have been directly beneficial to Society and, in time, useful to the development of an understanding of the world and how it operates, or resulting in knowledge and technology leading to such benefits as better navigation, or radio communication, or improvement in Human health. Western Society has welcomed such adventures in that they aided, enriched and helped the Human lot. But most of such discoveries were external, *i.e.*, not focused on "the nature of Man", nor his place in the Universe, *e.g.*, discovering the nature of light, or its speed, did not challenge the teachings of the Church.

Focusing on Socrates, Galileo and Darwin: these three were controversial and had impacts on Society, the Church and Scientists. One can see that their thinking and results appeared to displace Man from his perceived privileged position. Socrates, "The Father of Western Philosophy", transgressed Society with his style, ideas and logic, effectively showing Humanity their fuzzy logic. He was condemned to death, and drank hemlock.

Galileo, "The Father of Astronomy", removed Earth, and implicitly Mankind, from the centre of the Universe, offending the Church. Though he escaped burning at the stake for heresy, he was placed under a life-long house arrest. Darwin, considered to be "The Father of the Theory of Evolution", displaced Man as the pinnacle of Creation, thus offending Society, Church, and Scientists. One could be a fuzzy thinker, and one could dwell on a planet that was not at the centre of the Universe, but it was unpalatable that Humankind was not the quintessence of Creation and the epitome of Evolution (if it existed as a process). The impact of Darwin's Theory was enormous, and inadvertently had drawn attention to the Nature of Man. Implicit, though not necessarily intended, was the conclusion that Man was just another cog in an unscripted history of Life on Earth. As such, I have made Darwin's Theory of Evolution (notwithstanding that I agree with Stefan Revets that it should be the Darwin-Wallace Theory of Evolution), as presented in "*On the Origin of Species*", the largest impact along this time axis because the effects were manifold: it struck at the core of Human self-perception, and spawned a range of studies that continue to today. The reactions and fall-out to Darwin's Theory of Evolution, at that time, and leading to the present, can be summarised in the following ideas, notions, conclusions, and outcomes:

1. Man is a monkey
2. Man may not be the pinnacle of evolution
3. the Theory provided a unifying framework to Biology
4. the Theory provided a unifying framework to Palaeontology
5. Church and Science were in collision (again)
6. scientists were in disagreement over the Theory
7. prove it! – spawns hosts of scientific studies
8. good Theory! – spawns hosts of other scientific studies
9. as a Theory, it spills over to Sociology
10. as a Theory, it influenced how scientists now dealt with Biology, Palaeontology, Genetics, and Biochemistry, amongst other disciplines
11. as a phenomenon, because of its ramifications, it even spills over to other disciplines such as History, the History of ideas, Philosophy, and Theology
12. as a phenomenon, it spills over directly into Society, with commentary from learned scholars, editors, social commentators, and cartoonists, amongst others – in other words, it was not ignored.

For these reasons, in Figure 1, Darwin's Theory of Evolution is treated as a major phenomenon in the history of Science.

The effect of Darwin's Theory of Evolution continues to the present (Figure 2). At this Symposium, we have seen that the Science and other disciplines deriving from and influenced by the Theory of Evolution radiate and diversify. Science dealing with evolution has been approached from a wide range of perspectives, and even those within the same discipline, such as palaeontology, or genetics, have very different approaches and levels of detail. The Theory of Evolution, thus, more than most scientific endeavours, has spawned a host of studies and disciplines. Since it is core to so many disciplines, it holds scope to be a unifying theme, not only for different aspects of Biology, but also to bring together disparate sciences and to forge multi-disciplinary approaches. As Kate Bryant has pointed out at the Symposium in her presentation on "Evolution for undergraduates – fostering critical thinkers", the Theory of Evolution can be a galvanising framework for students to learn the process of science.

Many disciplines are inter-related and can be assembled under a unifying banner of the Theory of Evolution; they are: Taxonomy, Terminology and classification, Autoecology, Ecology and Palaeoecology, Genetics/Biochemistry/Molecular Biology, Palaeontology,

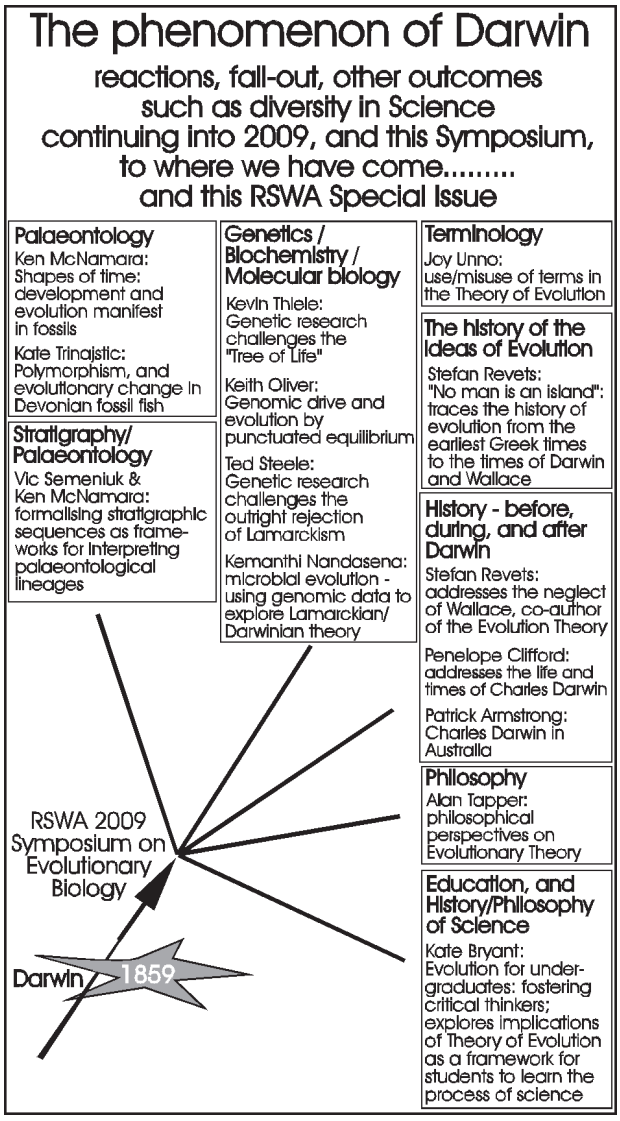

Figure 2. The diversity of presentations and poster displays at the Symposium on Evolutionary Biology in October 2009.
(The title of Ken McNamara contribution is the one presented at the Symposium. Patrick Armstrong's contribution is published in this Special Issue).

Stratigraphy, Biogeography and Palaeobiogeography, Geology *sensu lato*, Climatology, Geophysics, Physics, Chemistry, Astronomy, Education, Philosophy, History and Philosophy of Science, History of the ideas of Evolution after publication of "*On the Origin of Species*", Social History (the times before and after Darwin and Wallace to explain how the Theory of Evolution developed), Anthropology (and the development of cultures), Palaeo-anthropology, Archaeology, Theology, and the list goes on. To cite an example of how inter-linked Science can be, consider what influence Geophysics, and patterns in Astronomy, would have on Evolutionary Biology – an understanding of the geophysical workings of the Earth and the cycles of astronomic events may hold a key to the external drivers that influence evolutionary changes (*e.g.*, magnetic pole reversals and periodic collapse of the Van Allen Belt). The same principles can be applied to the other disciplines – they can be underpinning evolutionary processes, or lead to an understanding of processes that influence or drive evolution, or be involved in the gross scale to fine scale biochemical or genetic mechanisms involved in evolution. Or hold the key to new techniques to more deeply explore evolutionary biology and palaeontology.

With the idea that the Theory of Evolution holds scope to bring together such disparate Sciences, and to forge multi-disciplinary approaches, let us apply the title of Stefan Revets' presentation: "No man is an island" (in which he refers to the fact that Darwin did not come to his conclusion in isolation nor without a rich personal history), to Science itself and say that: "No science should be an island". Multidisciplinary science is very important to obtaining an understanding of natural systems and how the World works. In this context, multi-disciplinary science is very important to obtaining an understanding of biological evolution.

Keith Oliver, the co-convenor for this Symposium, has suggested that we use this gathering as the first step to founding an interdisciplinary Society of Scientists for furthering the field of Evolution Studies. Such a Society would draw on scientists working in the field of Evolution from a range of disciplines. Like sub-groups in other Scientific Societies, this group for Evolution Studies may in fact be taken up as a sub-group, or section, under the banner of The Royal Society of Western Australia, a contingency already allowed for in the Constitution of The Royal Society of Western Australia. As a dedicated group, it would allow scientists from disparate fields to meet under the auspices of The Royal Society of Western Australia, and become enriched by information and insights from outside their immediate speciality