# The Jones polynomial and Public Good Science

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The designation of Professor Vaughan Jones as the first recipient of the newly established New Zealand Science and Technology Medal could scarcely be more appropriate, coming at a time of almost frenetic discussion of the restructuring of science and technology and the curious coining of the ambiguous phrase Public Good Science. The discovery of the Jones polynomial must be counted as one of the great discoveries of this century and its far reaching implications are even yet barely explored. Like all truly great discoveries it reaches well beyond the narrow bounds of the discipline in which the discovery occurred - that of Von Neumann algebras. We already know that the Jones discovery is leading to entirely new links between many areas of physics at a most fundamental level and important practical applications in molecular biology.

The Jones discovery raises many issues relevant to the organisation of science and technology. The objective of any restructuring of science and technology must be to develop a fertile environment for new discoveries. The banality of current attempts to formulate science and technology policy may be seen in the recent Membership Survey of the New Zealand Royal Society. Appendix A attempts to use the thoroughly out-of-date Dewey Decimal Classification while Appendix B tries to neatly develop pigeon holes for describing the outputs of science and technology. The Jones discovery, as with most great discoveries, including the equally important Kerr metric discovery, fits neither into A or B. Significant discoveries seldom, if ever, fit the prescriptions of the planners who normally lack the necessary breadth of vision. Eastern Europe is a monument to the planners dreams and tunnel vision - not the stuff of great discoveries.

In a particularly beautiful article[1], the mathematician, Joan Birman, herself a major figure in the story of the Jones discovery, has outlined some of the flow-on effects of the discovery and also some of the historical developments that preceded it. It is difficult to imagine that any of the historical developments would have found sympathy with the planners. The interest in the whole subject of knots and links developed from the mistaken theory of Lord Kelvin that the elements of the chemical periodic system could be related to knotting in the misconcieved ether. The Scottish physicist, Peter Guthrie Tait devoted a significant part of his scientific career to the classification of knots. His voluminous tables are used to this day[2]. And yet, the Jones discovery occurred in a completely different area of mathematics initially thought to be totally unrelated to knots and braids.

There are, I believe, many lessons to be learnt from the Jones discovery, as indeed with all great discoveries, it is however doubtful that these have been learnt by the planners of today who are all to often woefully ignorant of the nature and history of scientific and technological development. Truly great discoveries are, by their very nature, unpredictable. Planners like predictability which is why they are usually wrong. History shows that great discoveries usually arise under conditions that permit a maximization of unfettered curiosity, something that is an anathema to the planner.

Great discoveries seldom involve a direct attack on a particular problem. The direct attack on the classification of knots by P. G. Tait involved much use of pencils and erasers and subsequent very clever mathematical attacks on the problem proved unsuccessful until Jones, coming from an entirely different area of mathematics, of entirely unsuspected relevance, created the tools required to not only revolutionize the whole subject of knots, braids and links but probably more importantly a whole range of new applications in areas of science and technology that appeared to be unrelated.

To conclude, I earnestly hope we will learn from the Jones discovery and develop opportunities for young New Zealand scientists and technologists to be creative in an atmosphere that encourages discovery so that eventually they can make their great discoveries in New Zealand. Breadth of vision that transcends the pigeon holes of the planners and a deep appreciation of the historical conditions that have led to great discoveries are in my view essential. We need people of great imagination who can step out from the narrow confines of the ordinary, and to the planners the relevant, and can appreciate that the development of science and technology is far more sophisticated and subtle than simplistic ideas anbd crude jargon of the planners who with every new word coined reveal their fundamental ignorance.

1. J. S. Birman, *Recent developments in braid and link theory* The Mathematical Intelligencer **13** 52-60 (1991).
2. P. G. Tait, *On knots I, II, III, IV in Collected Scientific Papers* Camb. Univ. Press (1898).