

# **Evidence of a New and Evolving Discipline: Neuroethics Literature, 2002-2007**

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The current study applies bibliometric techniques to the study of the emerging field of Neuroethics, which saw its official formation only seven years ago, in 2002 . The object of Neuroethics as a discipline is to understand the impact that neuroscience and neurotechnology have on both the medical professions and society in general. The first goal of the study is to identify and characterize the core literature of Neuroethics as it exists today; this segment of the research has been completed. The second goal of the study is to track the gradual infusion of Neuroethics ideas into the general literature of Medical Ethics and Bioethics; this phase of the research is in progress.

## **Introduction**

Bibliometrics offers a means to understand how new fields of knowledge arise, evolve, and interact with their established parent disciplines (McCain, 1995; Proctor and Weber, 2007) and provide measures of specialization and integration between fields of study (Porter et al., 2008).

The current study applies bibliometric techniques to the study of the emerging field of Neuroethics, which saw its official formation only seven years ago, in 2002<sup>1</sup>. The object of Neuroethics as a discipline is to understand the impact that neuroscience and neurotechnology have on both the medical professions and society in general. In broad, humanistic terms, Neuroethics gives voice to society's concerns about the ability of science and technology to affect the human mind:

“Today, we embrace a new challenge. We wade into the very seat of social, cultural, and physical understanding—the human brain—and we contemplate the ramifications of meddling with that most precious organ.” (Toope 2009, p.1)

More specifically, the concerns of Neuroethics can be divided into two main categories (Roskies 2002). The first has been coined “the ethics of neuroscience,” and focuses on the ethical issues of how neuroscientific studies are conducted, as well as what influence the results of those studies will have on medical treatment, social policy and legal decision-making. For example, one important question in this area is whether it is ethical to use drugs to enhance an individual's mental capabilities, or whether pharmaceutical technology should be limited to drugs that treat defects in normal brain function.

The second main category of Neuroethics can be termed “the neuroscience of ethics,” and it considers how philosophical issues interact with our understanding of how the human brain functions (and by extension how the brain can be affected to produce specific thought patterns and behaviors). This branch of Neuroethics grapples with questions such as how the concepts of human free will and personal identity are changed when viewed through the lens of neuroscience. Roskies contends that “Advances in neuroscience in relevant areas may change the very fabric of our philosophical outlook on life” (Roskies 2002, p.22). As medical science and technology continue to develop new ways to examine the brain and treat its injuries and malformations, these and many other contentious issues will continue to surface with increasing regularity. If we accept that the brain is essentially what human life is all about, the continued and growing importance of the field of Neuroethics, and its potential impact on contemporary social, legal and medical issues is clear.

The current study is designed to serve two purposes. The first is to identify and characterize the core literature of Neuroethics as it exists today; this segment of the research has been completed. The second goal is to track the gradual infusion of Neuroethics ideas into the general literature of Medical Ethics and Bioethics. Given the relative youth of Neuroethics as a discipline, there is a great opportunity to observe its transformation from a protologicistic concept to a viable

research field. This phase of the research is currently in progress.

## **Part I: Characterizing the Literature**

As a new discipline, Neuroethics has a small and well-defined core literature base of 184 published items. Despite the small size, however, publishing in the field has been quite active relative to the larger universe of medical and bioethics research. During this first phase of the investigation, DIALOG's "Medicine" superfile, PubMed, and the ISI Web of Science were all evaluated for their coverage of Neuroethics literature, and it was determined that DIALOG provided the best single source of data in this case. The composition of the core literature was determined by selecting articles published between 2002-2007 which specifically made use of the term "neuroethics" (as opposed to, for example, "neuroscience ethics"). Other literature attributes were also tracked: for example, the annual increase in citation frequency, as well as the number of authors, journals and descriptors assigned to each publication's database entry. Articles were also tagged to indicate the major area of Neuroethics enquiry to which they belonged, the "ethics of neuroscience," or the "neuroscience of ethics." Results of the analysis show that while most literature attributes (e.g., authors, journals) increased steadily but at a measured rate in proportion with annual publishing activity, the number of descriptors assigned to published items per year increased at a much higher rate. This is of particular interest as there are currently no Medical Subject Headings (MeSH) available for Neuroethics concepts. Further investigation into this phenomenon suggests that its cause is related to growing acceptance of Neuroethics literature into mainstream bioethics literature – in effect, a result of changing perceptions of Neuroethics from a mere neologism, to an understanding, or at least acceptance of it as a defined discipline.

## **Part II: Neuroethics and its Relationship with Bioethics Literature**

The second phase of the study focuses on Neuroethics' relationships with other fields and literatures, but most particularly the influence or extent of intellectual penetration of Neuroethics concepts into the much larger universe of bioethics literature. General relationships with other literatures are being determined through a citation analysis of the Neuroethics core literature. Intellectual penetration is being gauged by examining the presence of neuroethics concepts in the broader literature. First, a group of neuroethicists were canvassed to identify a core set of terms (Chalfin 2007) which represent the current phenomena, issues and events of interest to Neuroethics researchers. This list of concepts was then used in a broad search of neuroscience literature. The concept list will be reviewed and approved by a peer group of Neuroethicists, and

utilized in a second data mining process, which will search the contents of a selected set of appropriate bioethics journals in an attempt to map an anticipated increase in topical discussion related to Neuroethics research. Specific attention will also be paid to whether growth in research output favors the “ethics of neuroscience” or the “neuroscience of ethics.” The final stage of the study will analyze the most frequently used Neuroethics concepts and organize them for submission as candidates for new MeSH terms.

The study will demonstrate the extent of publication in the emerging field of Neuroethics, how it borrows from broader fields such as philosophy, medicine and law, as well as how ethical principles are represented in patterns of ongoing discourse in the parent fields of neuroscience and bioethics. As a description and analysis of a small and specialized field of research, the results will add to our understanding of innovation in science and medicine, and the patterns by which the literature of a new field develops and its contributions are integrated into the literature of related fields.

## Acknowledgements

Funding from the National Institutes for Health is gratefully acknowledged.

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## **Footnotes**

<sup>1</sup> Neuroethics' formative conference, Neuroethics: Mapping the Field, was held in San Francisco, May 13-14, 2002.