

Chapter XI

Medical Applications of Nanotechnology in the Research Literature¹

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ABSTRACT

The medical applications literature associated with nanoscience and nanotechnology research was examined. About 65,000 nanotechnology records for 2005 were retrieved from the Science Citation Index/Social Science Citation Index (SCI/SSCI) using a comprehensive 300+ term query. The medical applications were identified through a fuzzy clustering process. Metrics associated with research literatures for specific medical applications/ applications groups were generated.

INTRODUCTION

During 2003–2005, a comprehensive text mining study was performed to overview the technical structure and infrastructure of the global nanotechnology research literature, as well as the seminal nanotechnology literature (Kostoff, Stump, Johnson, Murday, Lau & Tolles, 2005a;

Kostoff, Murday, Lau & Tolles, 2005b; Kostoff, Stump, Johnson, Murday, Lau & Tolles 2006a; Kostoff, Murday, Lau & Tolles, 2006b). Based on the global interest generated by these reports, it was decided to update and expand the study using more recent data, a much more comprehensive query, and more sophisticated analytical tools. A

detailed report from the updated study is contained in Kostoff, Koytcheff, and Lau (2007).

In the updated study, text mining was used to extract technical intelligence from the open source global nanotechnology and nanoscience research literature (Science Citation Index/Social Science Citation Index (SCI/SSCI) databases (SCI, 2006)). Identified were: (1) the nanotechnology/ nanoscience research literature infrastructure (prolific authors, key journals/ institutions/ countries, most cited authors/ journals/ documents); (2) the technical structure (pervasive technical thrusts and their interrelationships); (3) nanotechnology instruments and their relationships; (4) potential nonmedical nanotechnology applications, and (5) potential health applications.

Most importantly, in the updated study, all of the technical structural analyses of the total nanotechnology database show medical and nonmedical applications being a key driver in nanoscience and nanotechnology research. The objectives of this paper are to examine the nanotechnology medical applications literature in depth, and especially show medical applications relationships to each other and to the underlying science disciplines.

In order to place the nanotechnology medical applications analyses and findings in their proper context, the overall nanotechnology study will first be summarized.

SUMMARY OF OVERALL NANOTECHNOLOGY STUDY

Bibliometrics

Global nanotechnology research article production has exhibited exponential growth for more than a decade. The most rapid growth over that time period has come from East Asian nations, notably China and South Korea. While the U.S. remains the leader in aggregate nanotechnology research article production, in some selected nano-

technology subareas China has achieved parity or taken the lead in research article production.

The main institutional copublishing groups are East Asian: one each from China, Japan, and South Korea. However, publication connectivity among institutions is much weaker than common interest or citation connectivity. Correlation of institutions by the journals they cite reveals four nationality-based (or locality-based) clusters: Chinese, Japanese, American, and European. Institutions from the same nationality group cite the same focused journals (primarily, but not exclusively, domestic). Correlation of institutions by documents they cite reveals that *only the Chinese institutions constitute a strongly-connected network*.

The dominant country copublishing network is a complex web of mainly European nations roughly following geographic lines: Nordic, Central Europe, Eastern Europe, and a Western Europe/Latin American group of romance language nations. There is also a UK component country network, but it is not linked to the interconnected continental members of the European Union. Correlation of countries by common thematic interest shows two major poles: U.S. and China. The U.S. pole is strongly connected thematically to a densely connected network of English-speaking North American representatives, Western/Central European nations, and most of the East Asian allies. China is relatively isolated except for India, and the Eastern European and Latin American representatives are outside the main network as well.

There is a clear distinction between the publication practices of the three most prolific Western nations and the three most prolific East Asian nations. The Western nations publish in journals with almost twice the weighted average impact factors (Journal Impact Factor is a metric that reflects the average citations received by papers published recently in the journal) of the East Asian nations. However, much of the difference stems from the East Asian nations publishing a

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