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TRACKING TRENDS & PERFORMANCE IN BASIC RESEARCH


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FEATURED ANALYSIS, January/February. 2009

Despite Slide in World Share, U.S. Impact Still Looks Strong

by Christopher King



The United States continues to see its share of world science erode, particularly in the face of a steady rise by the collective nations of the Asia Pacific region, but the citation impact of U.S. scientific papers still surpasses the world average by a healthy margin in the major fields of science, according to a new *Science Watch* survey.

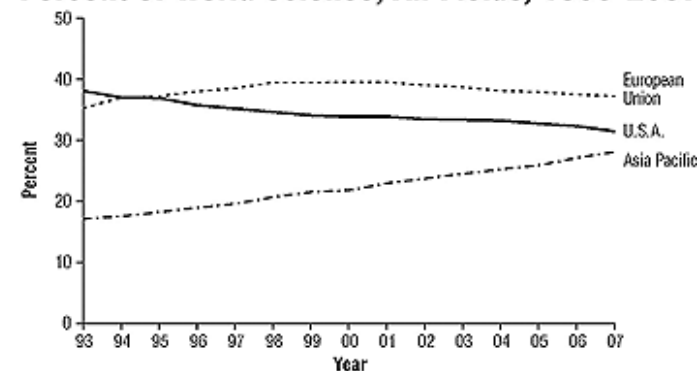
Science Watch has been monitoring this trend for a dozen years now, most recently in [July/August of 2005](#). On that occasion, as in the graph to the right, the U.S. percent share of world science was tracked against that of the Asia Pacific bloc and the nations making up the European Union. The current graph adds another three years of data to the last survey, reflecting figures through 2007.

For this study, as with the previous installments, *Science Watch* turned to the *Thomson Reuter's National Science Indicators*, a database containing publication and citation statistics for more than 100 subfields of science and the social sciences. In addition to covering upwards of 170 individual countries, the database contains aggregate figures for the Asia Pacific region, the European Union, and the collective nations of Latin America (a region not included in the present graph).

In the 2005 report, which covered year-by-year world share through 2004, the graph showed the U.S. percentage sliding gradually while the Asia Pacific share rose steadily. The current graph finds these trends continuing, with the two geographic entities now close to convergence on their present paths. The Asia Pacific percentage has increased apace: 25.9% in 2005, 27.2% in 2006, and 28.2% in 2007. The U.S. share, meanwhile, has ticked downward, from 32.8% in 2005 to 32.4% in 2006 to 31.5% in 2007. And the European Union is also trending downward: after a considerable stretch in the 39%-share range in the late 1990s, the EU was at 38.0% in 2005, 37.6% in 2006, and 37.3% in 2007.

Undoubtedly, an increasing scientific output by the nations of Asia, along with an ever-growing degree of international collaboration and coauthorship on scholarly papers, account significantly for the Asia Pacific group exhibiting a greater presence in world science and appropriating a greater percentage of world share. (See, for example, the recent survey of China's science surge, *Science Watch*, [July/August 2008](#).) So it's not necessarily a story of U.S. decline. But one trend bears watching: in the last two years, the absolute number of Thomson Reuters-indexed scientific papers from the U.S. has edged downward: from a high

Percent of World Science, All Fields, 1993-2007



SOURCE: Thomson Reuters National Science Indicators

of roughly 291,500 in 2005 to approximately 286,000 in both 2006 and 2007.

Meanwhile, by the measure of citation impact, U.S. science still appears quite healthy. **Table 1** below shows U.S. world share and citation impact in 21 main fields of science, ranked according to those fields in which U.S. "relative impact" is strongest compared to the world average over a recent five-year period.

Topping the list is Physics, in which the U.S. impact mark of 6.15 cites per paper surpassed the world mark of 3.96 cites by 55%. In all the fields shown, and particularly in the physical-sciences fields atop the list, U.S. impact registers well above the world mark.

For another snapshot of current U.S. science, *Science Watch* turned to Thomson Reuters' unique store of **Research Fronts**. These emerging areas of research are identified by a foundational "core" of previous papers that are frequently cited together by a group of more-recent reports.

Table 2 below offers a sampling of eight Research Fronts that each feature comparatively recent core literature and, more important, a predominance of U.S.-based institutions listed among the collective author addresses for each grouping of core papers. Thus, the list constitutes a small selection of U.S. concentration in recent research.

Atop the list, with its core papers showing more than an 87% preponderance of U.S. addresses, is a Research Front involving a related array of topics centering on genome-wide mapping of chromatin state in the cell, on factors initiating and controlling transcription, and on the regulation of embryonic **stem cells**, along with other aspects of cellular differentiation. One of the core papers for this front (T. Mikkelsen, *et al.*, "Genome-wide maps of chromatin state in pluripotent and lineage-committed cells," *Nature*, 448[7153]: 553-60, 2007) has been sufficiently cited to figure in a recent Biology Top Ten and was discussed by Biology correspondent Jeremy Cherfas in the **November/December 2008** issue.

Another recent U.S.-centric Research Front deals with processes for creating zirconium diboride and silicon carbide ceramics—materials suited for hypersonic flight and other applications involving exposure to extremely high temperatures.

Third on the list, also with more than 80% representation of U.S. institutions, is a Research Front examining phase 0 trials in cancer therapy. The phase 0 trial, a relatively recent designation, typically involves a small number of patients given microdoses of a compound in order to evaluate its basic biochemical efficacy before proceeding to phase I and subsequent trials. The papers in this core discuss the practicalities—not to mention the ethics—of phase 0 trials in the development of anti-cancer agents.

Elsewhere on the list, separate Fronts involving **graphene**, **quantum dots**, and ultraviolet surveys of the heavens exemplify what appears to be currently healthy U.S. research in the physical sciences.■

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Table 1

U.S. Output and Impact by Field					
(Ranked by relative citation impact compared to world, 2003-07)					
Rank	Field	U.S. world share, 2003-07 (%)	U.S. # of papers, 2003-07	U.S. citation impact	Relative impact vs. world (%)
1	Physics	23.26	125,406	6.15	+55
2	Chemistry	20.70	125,799	7.33	+52
3	Materials Science	18.10	30,590	4.23	+47
4	Geosciences	34.62	44,846	5.40	+42
5	Computer Science	35.27	20,732	2.10	+40
6	Microbiology	34.01	31,693	9.90	+39
7	Clinical Medicine	36.92	367,956	7.84	+36

8	Biology & Biochemistry	37.10	111,479	10.33	+35
9	Space Science	49.17	25,606	10.48	+34
10	Pharmacology	30.84	27,515	7.23	+34
11	Economics & Business	48.19	31,870	2.75	+32
12	Engineering	28.06	102,445	2.59	+31
13	Agricultural Sciences	23.88	24,401	3.81	+30
14	Molecular Biology. & Genetics	45.96	53,682	15.45	+29
15	Mathematics	29.86	26,186	1.85	+28
16	Neuroscience & Behavior	43.44	69,397	10.15	+26
17	Immunology	45.51	29,104	13.57	+26
18	Ecology/Environmental	35.65	43,661	5.10	+26
19	Plant & Animal Sciences	30.27	77,547	4.00	+25
20	Psychology/Psychiatry	51.97	59,095	4.80	+18
21	Social Sciences	52.29	85,084	2.51	+17

Source: Thomson Reuters *National Science Indicators*

Table 2

Selected, Recent Research Fronts with High U.S. Representation (among those that published = 100 papers, 1998-2008)		
Front	Mean core year	Percent U.S. addresses
Chromatin state, transcription, and regulation of cellular differentiation	2007	87.5
Pressureless sintering of zirconium diboride/silicon carbide ceramics	2006	84.6
Designing phase 0 clinical trials for cancer therapy	2007	83.3
G protein-coupled receptor kinase, tau pathology, and neurodegenerative disease	2006	79.7
Microfluidics and single-cell-on-a-chip technology for biosensing	2006	75.8
Synthesis of graphene oxide sheets for conduction and other applications	2007	74.0
Quantum dots in medical imaging and cancer therapy	2007	73.4
UV-survey results from the Galaxy Evolution Explorer (GALEX) mission	2007	70.8

Source: Thomson Reuters Research Front Database

Related information: view [Emerging Research Fronts](#), and [Fast Moving Fronts](#) on *ScienceWatch.com*. Fronts are selected from

the Research Fronts section of *Essential Science Indicators*SM from Thomson Reuters which is updated every two months.

Research fronts are clusters of highly cited papers, and research front maps are diagrammatic representations of the co-citation links among the highly cited papers that comprise the cluster. In addition, some Special Topics have associated maps that are selected from the current Research Front set that are relevant to the featured special topic. View a list of all [Research Front Maps](#) within *ScienceWatch.com*.

Keywords: U.S. research, scientific output, world share of science, Asia Pacific, U.S. impact, U.S. world share.



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