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FEATURED ANALYSIS, May/June 2009

Thought Leaders in the Unthinkable

by Christopher King, Editor



If *Science Watch's* content usually reflects humankind's higher aspirations to advance knowledge and improve life, then the subject at hand surely represents the opposite impulse: bioterrorism.

Science Watch herewith examines highly cited research on bioterrorism over the last decade. A data extraction based on a special list of pertinent keywords produced upwards of 12,000 bioterrorism-related papers published in Thomson Reuters-indexed journals between 1999 and 2008. From this set of papers, *Science Watch* identified the most-cited institutions, authors, and journals.

The two tables below rank institutions according to two separate measures: in [table #1](#), by total citations, and, [table #1b](#), by average citations per paper (among those institutions that fielded 25 or more papers pertaining to bioterrorism during the decade). Highly cited authors and journals are highlighted in the table to the right..

The most-cited paper in this collection dates from 2001 and reports the genome sequence of *Yersinia pestis*, the causative agent of plague (S. Baker, *et al.*, *Nature*, 413: 523-7, 2001; now cited nearly 500 times). The next-most-cited paper appeared in the *New England Journal of Medicine* with the succinct title "Anthrax" (T.C. Dixon, *et al.*, 341: 815-26, 1999)—two years before the incidents in the fall of 2001 in which anthrax-tainted mail killed five people; this paper has now been cited more than 400 times.

Ranking at #3 is another report from 1999, published in *JAMA*: "Smallpox as a biological weapon: Medical and public health management," (M.S. Ascher, *et al.*, 281: 2127-37, 1999; with more than 375 citations to date). This is just one of a prominent core of highly cited *JAMA* papers published between 1999 and 2002 by the Working Group on Civilian Biodefense, a body whose 20-odd members included academic, government, and military experts in biomedicine, public health, and emergency management. Along with the smallpox study, the Working Group produced similarly titled papers examining the potential bio-weapon implications of anthrax, tularemia, plague, botulinum toxin, and hemorrhagic fever.

Other topics within the larger body of papers include examinations of

Most-Cited Journals in Bioterrorism Research, 1999-2008

(Ranked by citations to papers published and cited between 1999 and 2008)

Rank	Journal	Citations
1	PNAS	4,054
2	JAMA	3,295
3	Nature	2,935
4	Infection and Immunity	2,866
5	Analytical Chemistry	2,728
6	Emerging Infectious Diseases	2,585
7	Biosensors & Bioelectronics	1,871

the specific sequences and basic biochemical actions of anthrax and other agents; the development of bio-sensors and detection devices based on microarrays, nanotubes, and other technologies; assessments of health and environmental fallout from the 9/11 attacks; and general discussions of readiness and emergency management.

Among institutions in **table #2** below, the U.S. Army distinguishes itself by the measure of total citations, posting nearly 10,000. Contributing to the high placement is this survey's most-cited author, Arthur M. Friedlander, of the U.S. Army Medical Research Institute for Infectious Diseases. Among many other papers, Friedlander contributed to the reports from the Working Group on Civilian Biodefense. (Other names among the numerous Working Group contributing authors in the table are Inglesby, Eitzen, Bartlett, Henderson, Parker, Tonat, Russell, Ascher, Perl, Osterholm, Hauer, McDade, Layton, Hughes, and Lillibridge.)

By the measure of citations per paper, The Institute for Genomic Research (TIGR) scores highest, thanks in part to its participation in a 2002 report on the sequence of *Bacillus anthracis* Ames—a strain that causes inhalational anthrax, implicated in the 2001 attacks—and its comparison to closely related bacteria (T.D. Read, *et al.*, *Nature*, 423: 81-6, 2002, with more than 340 citations). Friedlander also contributed to this report, as did some of the other authors featured here: Timothy D. Read, Philip C. Hanna, and TIGR's then-president, Claire M. Fraser-Liggett. ■

8	Science	1,704
9	Journal of Biological Chemistry	1,675
10	Vaccine	1,515
11	Applied and Environmental Microbiology	1,175
12	Journal of Chromatography A	1,120
13	Journal of Clinical Microbiology	1,102
14	Clinical Infectious Diseases	1,059
15	New England Journal of Medicine	996
SOURCE: Thomson Reuters <i>Science Citation Index</i> .		

Christopher King is the Editor of the *Science Watch*® Newsletter, Thomson Reuters.

Table 1a 

Bioterrorism Research: Institutions Ranked by Citations and Citation Impact		
Rank	Institution	Citations 1999-2008
1	U.S. Army	9,637
2	Centers for Disease Control & Prevention	6,912
3	Johns Hopkins University	5,006
4	Harvard University	4,859
5	NIAID	2,716
6	Institut Pasteur	2,407
7	U.S. Navy	2,350
8	Defence Science & Technology Laboratory	2,190
9	University of Michigan	2,026
10	New York City Department of Health	1,826
11	California Department of Health Services	1,721
12	Emory University	1,575
13	The Institute for Genomic Research	1,566
14	U.S. Department Health & Human Services	1,507
15	Texas A&M University	1,502
16	University of Wisconsin	1,431
17	University of California, San Diego	1,312
18	University of Maryland	1,300
19	University of California, Riverside	1,282
20	U.S. Food & Drug Administration	1,161
21	National Cancer Institute	1,150
22	George Washington University	1,141

23	University of Texas, Houston	1,025
24	University of Washington	1,021
25	NIDCR	967

SOURCE: Thomson Reuters *Science Citation Index*.

Table 1b 

Bioterrorism Research: Institutions Ranked by Citations and Citation Impact		
Rank	Institution (≥ 25 papers)	Impact 1999-2008
1	The Institute for Genomic Research	62.64
2	New York City Department of Health	57.06
3	Imperial College of London	31.55
4	Institut Pasteur	30.47
5	NIDCR	30.22
6	New Mexico State University	29.71
7	Johns Hopkins University	27.97
8	University of Padua	27.89
9	University of Texas, Houston	26.28
10	Defence Science & Technology Laboratory	24.61
11	University of California, San Diego	24.30
12	Harvard University	21.89
13	Geo-Centers, Inc.	21.64
14	NIAID	21.56
15	University of Michigan	20.89
16	George Washington University	20.75
17	University of Wisconsin	20.74
18	University of California, Riverside	20.35
19	National Cancer Institute	20.18
20	Kansas State University	19.72
21	Centers Disease Control & Prevention	18.53
22	Emory University	17.90
23	University of Oxford	17.74
24	Duke University	17.32
25	University of Chicago	17.15

SOURCE: Thomson Reuters *Science Citation Index*.

Table 2: 

Highly Cited Authors in Bioterrorism Research, 1999-2008

(Ranked by total citations)

Rank	Name	Institution	Concentration	Papers	Citations
1	Arthur M. Friedlander	U.S. Army	Infectious Disease	42	2,788
2	Stephen H. Leppla	NIAID	Bacterial Disease	96	2,594
3	Thomas V. Inglesby	University of Pittsburgh Medical Center	Biosecurity	42	2,534
4	Tara O'Toole	University of Pittsburgh Medical Center	Biosecurity	37	2,493
5	R. John Collier	Harvard University	Bacterial Disease	74	2,449
6	Edward M. Eitzen	Martin, Blanck & Associates	Public Health	20	2,344
7	John G. Bartlett	Johns Hopkins University	Epidemiology	21	2,298
8	Donald A. Henderson	University Pittsburgh Medical Center	Public Health	22	2,251
9	Gerald W. Parker	U.S. Department of Health & Human Services	Public Health	10	2,207
10	Kevin Tonat	U.S. Department of Health & Human Services	Emergency Management	9	2,169
11	Philip K. Russell	Johns Hopkins University (Emer.)	Public Health	9	2,123
12	Michael S. Ascher	University of California, Davis	Infectious Disease	9	2,119
13	Trish M. Perl	Johns Hopkins University	Epidemiology	9	2,118
14	Michael T. Osterholm	University of Minnesota	Epidemiology	9	2,113
15	Jerome Hauer	Hauer Group	Emergency Management	8	2,105
16	Michele Mock	Institut Pasteur	Bacterial Disease	41	1,974
17	Joseph E. McDade	Centers for Disease Control and Prevention (ret.)	Infectious Disease	7	1,706
18	Marcelle Layton	New York City Department of Health	Public Health	14	1,564
19	Philip C. Hanna	University of Michigan	Microbiology	22	1,272
20	Claire M. Fraser-Liggett	University Maryland	Microbiology / Genomics	12	1,247
21	Richard W. Titball	University of Exeter	Bacterial Disease	21	1,244
22	Ashok Mulchandani	University of California, Riverside	Chemical Engineering	58	1,223
23	Timothy D. Read	Emory University	Infectious Disease	10	1,205
24	James M. Hughes	Emory University	Infectious Disease	9	1,184
25	Scott R. Lillibridge	University of Texas, Houston	Public Health	9	1,081

SOURCE: Thomson Reuters *Science Citation Index*.

KEYWORDS: BIOTERRORISM, TERRORISM, BIOWEAPONS, BIODEFENSE, ANTHRAX, SMALLPOX, TULAREMIA, PLAGUE, U.S. ARMY, THE INSTITUTE FOR GENOMIC RESEARCH, ARTHUR M. FRIEDLANDER, CLAIRE M. FRASER-LIGGETT, WORKING GROUP ON CIVILIAN BIODEFENSE.

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