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FEATURED ANALYSIS - AN ADVANCE LOOK AT MAY/JUNE 2010

South African Science: Signs of Progress

by Christopher King, Editor

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The nation of South Africa, after more than a decade of comparative stasis in terms of research output, has seen its annual yield of papers rise discernibly in recent years. Concurrently, the nation's citation impact in main fields of science has risen considerably compared to its performance as gauged through the early 1990s.

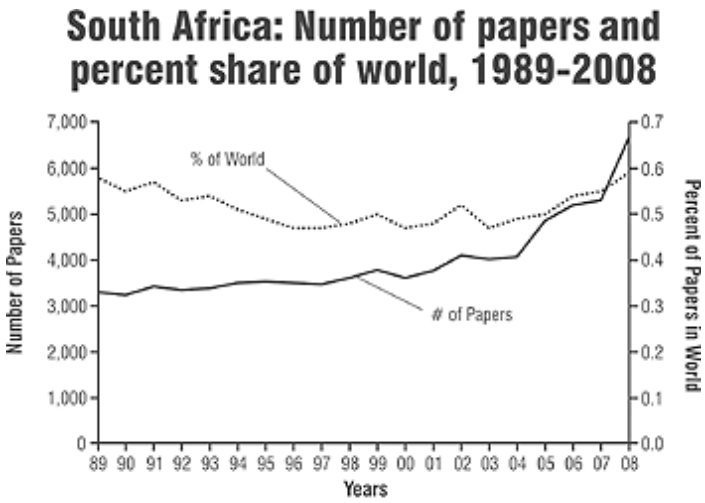
It's been 15 years since *Science Watch* examined the state of research in South Africa (6[3]: 1-2, March 1995). At that time, the nation had only recently emerged from the pariah status occasioned by the racial policies of apartheid. As *Science Watch* noted at the time, South Africa's scientific profile appeared to reflect a high cost of isolation from the world community, as evinced by a low representation of published papers and low citation impact compared to the world.

As *Nature* recently reported, despite the nation's stature as by far the largest research base on the continent, and despite the sense of optimism and renewal upon the ending of apartheid, South African science continues to face many problems. These include a lack of strong policy leadership, inadequate funding, and what some observers view as excessive emphasis on applied research (M. Cherry, *Nature*, 463[7282], 726-8, 11 February 2010).

To assess South Africa's recent research performance, *Science Watch* turned to Thomson Reuters *National Science Indicators*, which tracks publication and citation statistics for more than 180 countries. The graph to the right shows South Africa's output of papers in all fields, along with its percent share of world science during the same period, as reflected in papers indexed by Thomson Reuters between 1989 and 2008.

As the graph indicates, South Africa's output of papers was essentially flat throughout the 1990s—from roughly

3,300 papers in 1989 to approximately 3,800 in 2001, with minor fluctuations in between. After 2001, however, the numbers rose significantly, exceeding 4,100 in 2002, topping 4,800 in 2005, and winding up above 6,600 in 2008. South Africa's overall percentage of world papers, meanwhile, dipped slightly in the course of the 20-year period, but finished on an upward trajectory, roughly at its starting point of 0.60%.



SOURCE: Thomson Reuters National Science Indicators

For a closer look at South Africa's recent output, *Science Watch* examined the country's output from 2004 to 2008 in 21 main fields of science. In table 1 (below), the fields are ranked according to South Africa's percentage share of each during the five-year period.

South Africa's largest share of any main discipline, as the table shows, was in Plant & Animal Sciences, with the nation's 4,179 papers constituting 1.55% of world output in the field. That sum of papers is just shy of South Africa's highest output during the five-year period, in pure numerical terms, of any of the fields shown here: 4,183 papers in Clinical Medicine, representing 0.41% of the field.

The table's right-hand column shows the relative-impact scores for South Africa—that is, the nation's cites-per-paper mark compared to the world average. In Plant & Animal Science, for example, papers bearing at least one author address in South Africa registered at 14% below the world mark (2.73 cites per paper for South Africa versus 3.17 for the world).

On the other hand, papers from South Africa-based researchers exceeded the world average in several fields, including Computer Science, Environment/Ecology, Space Science, Immunology, and Clinical Medicine. Impact was also respectably close to the world average in Agricultural Sciences and Mathematics. This pattern is strikingly different from the previous *Science Watch* survey in 1995, when South Africa's relative-impact figures for 1981-93 bested the world in only one field, Agricultural Sciences. Although the nation still has some progress to make in terms of impact in Molecular Biology & Genetics, Biology & Biochemistry, and other life-science fields, the overall improvement is notable.

If the period of apartheid exacted a cost in terms of international collaboration, table 2 (below) shows how far South Africa has come in recent years in terms of coauthorship with other countries. The table ranks collaborating nations, according to number of papers, in two five-year spans, 1994 to 1998 and 2004 to 2008, with the percentage of papers for the latter period shown in the right column. The roster of countries doesn't change markedly between the two periods, but the general increases are significant, with papers coauthored with the United States rising from 1,700 papers to nearly 5,000, and the other listed nations showing a similar pattern.

South Africa's most-cited paper of the last five years reflects international collaboration, specifically the contribution of South African authors to a large, multicenter study of breast cancer therapy (O. Abe, *et al.*, *Lancet*, 365[9472]: 1687-1717, 2005). The report has now been cited more than 1,300 times.

In all, while challenges remain, the present evidence suggests that South African science appears to be moving in the right direction.

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Table 1

South Africa: Output and Impact by Field
(Ranked by percent share of Thomson Reuters-indexed papers, 2004-08)

Rank	Field	World share (%), 2004-08	Number of papers, 2004-08	Citations per paper	Relative impact vs. world (%)
1	Plant & Animal Science	1.55	4,179	2.73	-14
2	Environment/Ecology	1.29	1,707	5.08	+15
3	Geosciences	1.13	1,534	3.42	-13
4	Social Sciences	1.06	2,107	1.63	-18
5	Space Science	0.93	556	7.89	+11
6	Immunology	0.86	518	10.21	+3
7	Agricultural Sciences	0.69	692	2.74	-4
8	Economics & Business	0.69	507	0.72	-66
9	Microbiology	0.66	534	6.29	-11
10	Psychiatry/Psychology	0.56	667	2.59	-39
11	Mathematics	0.52	652	1.34	-1
12	Biology & Biochemistry	0.46	1,242	5.37	-27
13	Clinical Medicine	0.41	4,183	6.27	+9
14	Pharmacology & Toxicology	0.41	375	3.91	-28
15	Chemistry	0.35	2,059	3.76	-26
16	Engineering	0.35	1,385	1.67	-16
17	Physics	0.26	1,194	3.53	-15
18	Computer Science	0.24	359	2.13	+41
19	Materials Science	0.23	524	2.23	-26
20	Neuroscience & Behavior	0.21	310	4.84	-40
21	Molecular Biology & Genetics	0.20	276	6.42	-43

Source: Thomson Reuters *National Science Indicators*

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Table 2

Papers Collaborative with South Africa

1994-1998	2004-2008	Share (%) of South Africa total, 2004-08

USA	1,738	USA	4,914	14.7
UK	1,178	UK	3,454	10.4
Germany	661	Germany	1,710	5.1
Australia	437	Australia	1,365	4.1
Canada	351	France	1,179	3.5
France	297	Canada	1,008	3.0
Israel	192	Netherlands	949	2.8
Italy	188	Switzerland	634	1.9
Netherlands	160	Belgium	592	1.8
Belgium	158	Italy	512	1.5

Source: Thomson Reuters *National Science Indicators*

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KEYWORDS: South Africa, science in South Africa, South African science, science in Africa, African science.

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