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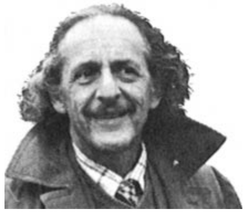

Current Comments®

See Reprint on p. 265, Essays, Vol:6

Third World Research. Part 2. High Impact Journals, Most-Cited Articles, and Most Active Areas of Research

Number 34 August 22, 1983

Last week we reprinted the first part of the Magnus Pyke Lecture I delivered at the US Embassy in London last December.[1] The lecture was sponsored by the Science Policy Foundation, Ltd. (SPF), a nonprofit organization devoted to the study of the social impact of science and technology. The complete text of the lecture recently appeared in *Science and Public Policy*,[2] an SPF publication.

The first part of the lecture examined 353,000 articles indexed in the 1973 *Science Citation Index®* (*SCI®*) by the nationality of the first author. We found that 16,000 articles were authored in 93 Third World nations. The data showed that India was the "superpower" of Third World science—it accounted for half of all articles *authored* in developing countries, and 60 percent of all articles *published* in the Third World scientific press. But the average 1973 article authored by Indian *scientists* received only two citations from 1973 to 1978. In comparison, the small number of articles from Jamaica and Thailand averaged seven citations over the same period. However, the average article published in an Indian *journal* received only one citation, but this was enough to rank India first among all Third World publishing nations in terms of impact. We also found that English-language articles dominated the total output of Third World authors, and they had the highest impact.

The second part of the lecture identifies the journals that published at least 50 articles from the Third World in 1973, and the journals with the highest impact for these articles. We also examine the most-cited articles by authors from developing nations. The lecture concludes with a discussion of the clusters of research in which Third World scientists were most active in 1981. This gives us an idea of the current areas of research activity in the developing world.

I should point out that we are updating this study, using 1978 as a source year. But we will not be limited to Third World nations only. Instead, we can isolate any nation or block of nations and determine research productivity, impact, and areas of expertise. In addition, we can identify the nationality and language of the citing articles, which will provide valuable insights into the international *and* interlingual links in the world scientific literature.

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1. **Garfield E.** Third World research. Part 1. Where it is published, and how often it is cited. *Current Contents* (33):5-15, 15 August 1983.
2. -------------. Mapping science in the Third World. *Sci. Publ. Policy* 10(3):112-27, 1983.

Mapping Science in the Third World*
Part 2

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Journals

We can now identify the journals from the developed countries that published at least 50 articles from the Third World. Nineteen journals are shown (see Table 1). Included is the overall number of articles each journal published to give an idea of the proportion from the Third World.

Six of these journals were published in the UK, the US has five, and the Netherlands three. Switzerland and Italy account for two journals each, and one journal was published in East Germany.

Twenty-one Third World journals published at least 50 articles from the developing countries (see Table 2). More than half (13) are Indian journals. The remaining eight were published in Central or South America: two each in Argentina, Chile, and Mexico; and one each in Costa Rica and Venezuela. These journals published Third World articles almost exclusively. Ninety-six percent of all articles in these journals, taken together, were from the Third World.

When we rank journals that published Third World articles by impact (see Table 3), no Third World journal appears among the top 25. The US accounts for two-thirds of the journals with the highest impact for Third World articles. Seven were published in the UK, and one each in Denmark and Switzerland.

For 17 of these journals, the impact of Third World articles was greater than the journal's overall impact. That is, Third World research reported in their pages added to the overall impact of these journals.

Of the 52 Third World journals covered in the 1973 *SCI*, 14 had an impact of 1.0 or greater for articles it published from developing countries (see Table 4). The highest impact for any Third World journal was 2.3. Nine Indian journals are listed. Argentina accounts for three. Mexico and Costa Rica account for one journal each.

Most-Cited Articles

We now examine the Third World articles that were cited at least 50 times from 1973 to 1978. Full bibliographic information is given for 23 articles, including the institutional affiliations of all authors (see Table 5). First authors who were based in India, Argentina, and Thailand each account for five most-cited Third World articles. Brazilian authors contributed four articles. Uganda, Chile, Iran, and Jamaica account for one article each.

We also checked to see if these first authors listed different institutional affiliations on other articles. For example, some may have been visiting researchers at institutions in the developed countries. On the other hand, they may have been researchers from developed countries who worked in Third World institutions for a time. We found that four first authors also listed addresses at institutions in developed countries—K.H. Graefe, R. Edelman, R.D. Keynes, and V.A. Bokisch.

In addition, five of the 23 articles were *co*authored with researchers from devel-

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Table 1: Journals that published 50 or more Third World articles, 1973 *SCI®*.

Journal	Third World Articles	Total Number of Articles	Third World Impact
Journal of Inorganic and Nuclear Chemistry (US)	138	634	3.6
Phytochemistry (UK)	121	655	3.6
Experientia (Switzerland)	104	1114	1.9
Transactions of the Royal Society of Tropical Medicine and Hygiene (UK)	100	312	3.6
Lancet (UK)	88	2626	6.9
Notices of the American Mathematical Society (US)	78	2236	0
International Journal of Electronics (UK)	76	201	.5
Genetics (US)	73	1033	0
Pure and Applied Geophysics (Italy)	68	224	.6
Biochimica et Biophysica Acta (Netherlands)	66	2311	13.0
Physical Review B—Solid State (US)	66	1382	4.9
Bulletin of the World Health Organization (Switzerland)	60	177	4.0
Lettere al Nuovo Cimento (Italy)	60	571	1.3
Physica Status Solidi B—Basic Research (GDR)	60	669	1.5
Physics Letters A (Netherlands)	57	996	2.0
British Medical Journal (UK)	56	1776	7.4
Journal of Tropical Medicine and Hygiene (UK)	52	72	2.1
Tropical and Geographical Medicine (Netherlands)	52	66	1.8
Tetrahedron Letters (US)	51	1406	0

Table 2: Third World journals that published 50 or more Third World articles, 1973 *SCI®*.

Journal	Third World Articles	Total Number of Articles	Third World Impact
Current Science (India)	620	629	.8
Acta Physiologica Latinoamericana (Argentina)	613	647	.3
Indian Journal of Chemistry (India)	544	553	1.9
Acta Cientifica Venezolana (Venezuela)	431	473	.1
Medicina (Argentina)	359	374	.2
Indian Journal of Pure and Applied Physics (India)	335	340	1.1
Journal of the Indian Chemical Society (India)	309	312	1.2
Indian Journal of Medical Research (India)	269	272	1.5
Indian Journal of Agricultural Sciences (India)	261	266	.4
Indian Journal of Experimental Biology (India)	221	230	1.3
Revista Medica de Chile (Chile)	181	185	.6
Indian Journal of Technology (India)	157	188	.4
Indian Journal of Physics and Proceedings of the Indian Association for the Cultivation of Science (India)	108	112	.7
Archivos de Biologia y Medicina Experimentales (Chile)	102	103	0
Indian Journal of Biochemistry and Biophysics (India)	98	98	2.3
Revista de Investigacion Clinica (Mexico)	73	76	.4
Indian Journal of Genetics and Plant Breeding (India)	72	75	.4
Archivos de Investigacion Medica (Mexico)	60	65	.5
Journal of Scientific and Industrial Research (India)	57	79	1.2
Proceedings of the Indian Academy of Sciences Section B (India)	57	57	.9
Turrialba (Costa Rica)	50	71	1.2

oped countries. Thus, including a scientist from a developed country on the research team may be an effective strategy for increasing the impact of Third World research.

Although we have listed the overall number of citations each article received from 1973 to 1978, we can identify the "nationality" of these citations. That is, we can tell how many citations were given by authors from the same developing nation of the first author, from other Third World countries, and from developed countries.

Table 3: Top 25 journals with highest impact for Third World articles, 1973 *SCI®*.

Journal	Impact of Third World Articles	Impact of All Articles	Third World Articles	Number of Citations
Physiological Reviews (US)	192.0	103.5	1	192
Reviews of Modern Physics (US)	59.0	86.9	2	118
Proceedings of the National Academy of Sciences of the USA (US)	57.0	46.8	2	114
Journal of Immunology (US)	44.2	22.6	5	221
Proceedings of the Nutrition Society (UK)	39.0	3.1	1	39
Journal of Clinical Investigation (US)	37.5	41.6	2	75
Hormones and Behavior (US)	36.0	12.8	2	72
Journal of Lipid Research (US)	33.7	19.2	4	135
Cell and Tissue Kinetics (UK)	28.0	14.3	1	28
Tissue Antigens (Denmark)	25.0	13.9	1	25
Astrophysical Journal Supplement Series (US)	24.0	30.3	1	24
Infection and Immunity (US)	23.3	13.5	10	233
Biochemistry (US)	23.0	26.0	4	92
Proceedings of the Royal Society Series B—Biological Sciences (UK)	23.0	15.8	1	23
Chemical Society Reviews (UK)	21.5	34.9	2	43
Human Pathology (US)	20.5	8.0	2	41
Nephron (Switzerland)	20.5	6.5	2	41
Journal of Membrane Biology (US)	20.0	14.8	7	140
Inorganic Chemistry (US)	19.4	11.9	9	175
Philosophical Transactions of the Royal Society of London Series A—Mathematical and Physical Sciences (UK)	19.0	7.9	2	38
Blood (US)	18.3	12.0	3	55
Annual Review of Microbiology (US)	17.5	30.9	2	35
Endocrinology (US)	17.4	21.4	7	122
Clinical and Experimental Immunology (UK)	16.8	23.0	5	84
Journal of Physiology—London (UK)	16.4	11.0	16	262

Table 4: Third World journals with an impact of 1.0 or greater for Third World articles, 1973 *SCI®*.

Journal	Impact of Third World Articles	Impact of All Articles	Third World Articles	Number of Citations
Indian Journal of Biochemistry and Biophysics (India)	2.3	2.3	98	223
Indian Journal of Chemistry (India)	1.9	1.9	544	1027
Anales de la Asociacion Quimica Argentina (Argentina)	1.8	1.8	39	71
Acta Endocrinologica Panamericana (Argentina)	1.6	1.2	7	11
Indian Journal of Medical Research (India)	1.5	1.5	269	404
Phyton (Argentina)	1.5	1.1	8	12
Indian Journal of Experimental Biology (India)	1.3	1.2	221	286
Journal of the Indian Chemical Society (India)	1.2	1.2	309	381
Journal of Scientific and Industrial Research (India)	1.2	1.3	57	71
Phytomorphology (India)	1.2	1.6	4	5
Turrialba (Costa Rica)	1.2	1.0	50	58
Indian Journal of Pure and Applied Physics (India)	1.1	1.1	335	384
Patologia (Mexico)	1.1	1.3	16	18
Nucleus (India)	1.0	1.3	26	25

Table 5: Third World articles cited at least 50 times from 1973 to 1978, *SCI*®. A=total citations. B=first author's country citations. C=Third World citations. D=Developed World citations.

A	B	C	D	Bibliographic Data
192	8	1	183	**Paintal A S.** Vagal sensory receptors and their effects. *Physiol. Rev.* 53:159-227, 1973. Delhi Univ., Vallabhbhai Patel Chest Inst., Delhi, India.
166	13	1	152	**Mendes N F, Tolnai M E A, Silveira N P A, Gilbertsen R B & Metzgar R S.** Technical aspects of the rosette tests used to detect human complement receptor (B) and sheep erythrocyte-binding (T) lymphocytes. *J. Immunol.* 111:860-7, 1973. Escola Paulista Med., Dept. Microbiol. Immunol. Parasitol., Sao Paulo, Brazil; Duke Univ. Med. Ctr., Dept. Microbiol. Immunol., Durham, NC.
118	1	0	117	**Punsalang A P & Sawyer W D.** Role of pili in the virulence of *Neisseria gonorrhoeae*. *Infec. Immunity* 8:255-63, 1973. Mahidol Univ., Dept. Microbiol.; Rockefeller Found., Bangkok, Thailand.
109	16	0	93	**Behrens N H, Carminatti H, Staneloni R J, Leloir L F & Cantarella A I.** Formation of lipid-bound oligosaccharides containing mannose. Their role in glycoprotein synthesis. *Proc. Nat. Acad. Sci. US* 70:3390-4, 1973. Univ. Buenos Aires, Inst. Invest. Bioquim. "Fundacion Campomar," Buenos Aires, Argentina.
88	10	16	62	**Sirisinha S, Suskind R, Edelman R, Charupatana C & Olson R E.** Complement and C3-proactivator levels in children with protein-calorie malnutrition and effect of dietary treatment. *Lancet* 1:1016-20, 1973. Mahidol Univ., Dept. Microbiol.; SEATO Med. Res. Lab., Dept. Virol., Bangkok, Thailand; Chiang Mai Univ., Anemia Malnutr. Res. Ctr., Chiang Mai, Thailand; St. Louis Univ. Sch. Med., Dept. Biochem. Pediat., St. Louis, MO.
80	2	2	76	**Jacob G & Maris Th A J.** Quasi-free scattering and nuclear structure. II. *Rev. Mod. Phys.* 45:6-21, 1973. Univ. Fed. Rio Grande Sul, Inst. Fis., Porto Alegre, Brazil.
80	2	9	69	**Karim S M M, Carter D C, Bhana D & Ganesan P A.** Effect of orally administered prostaglandin E_2 and its 15-methyl analogues on gastric secretion. *Brit. Med. J.* 1:143-6, 1973. Makerere Univ. Med. Sch., Kampala, Uganda.
79	4	2	73	**Garay R P & Garrahan P J.** The interaction of sodium and potassium with the sodium pump in red cells. *J. Physiol.—London* 231:297-325, 1973. Univ. Buenos Aires, Dept. Quim. Biol., Buenos Aires, Argentina.
79	23	0	56	**Graefe K H, Stefano F J E & Langer S Z.** Preferential metabolism of (—)-^{3}H-norepinephrine through the deaminated glycol in the rat vas deferens. *Biochem. Pharmacol.* 22:1147-60, 1973. Consejo Nac. Invest. Cientif. Tecn. Inst., Invest. Farmacol., Buenos Aires, Argentina.
72	10	0	62	**Ramachandran G N, Lakshminarayanan A V & Kolaskar A S.** Theory of the nonplanar peptide unit. *Biochim. Biophys. Acta* 303:8-13, 1973. Indian Inst. Sci., Mol. Biophys. Unit, Bangalore, India; Univ. Chicago, Dept. Biophys., Chicago, IL.
70	3	0	67	**Raheja R K, Kaur C, Singh A & Bhatia I S.** New colorimetric method for the quantitative estimation of phospholipids without acid digestion. *J. Lipid Res.* 14:695-7, 1973. Punjab Agricult. Univ., Dept. Chem. Biochem., Ludhiana, India.
68	10	11	47	**Edelman R, Suskind R, Olson R E & Sirisinha S.** Mechanisms of defective delayed cutaneous hypersensitivity in children with protein-calorie malnutrition. *Lancet* 1:506-8, 1973. SEATO Med. Res. Lab., Dept. Virol., Bangkok, Thailand; Chiang Mai Univ., Anemia Malnutr. Res. Ctr., Chiang Mai, Thailand; St. Louis Univ. Sch. Med., Dept. Biochem. Pediat., St. Louis, MO; Mahidol Univ., Dept. Microbiol., Bangkok, Thailand.
68	3	4	61	**Keynes R D, Rojas E, Taylor R E & Vergara J.** Calcium and potassium systems of a giant barnacle muscle fibre under membrane potential control. *J. Physiol.—London* 229:409-55, 1973. Univ. Chile, Lab. Cell. Physiol., Casilla, Chile.
65	1	0	64	**Thongthai C & Sawyer W D.** Studies on the virulence of *Neisseria gonorrhoeae*. I. Relation of colonial morphology and resistance to phagocytosis by polymorphonuclear leukocytes. *Infec. Immunity* 7:373-9, 1973. Mahidol Univ., Dept. Microbiol.; Rockefeller Found., Bangkok, Thailand.
61	5	6	50	**Bokisch V A, Top F H, Russell P K, Dixon F J & Muller-Eberhard H J.** The potential pathogenic role of complement in dengue hemorrhagic shock syndrome. *N. Engl. J. Med.* 289:996-1000, 1973. SEATO Med. Res. Lab., Dept. Virol., Bangkok, Thailand; Scripps Clin. Res. Found., Dept. Exp. Pathol., La Jolla, CA; Walter Reed Army Inst. Res., Div. Commun. Dis. Immunol., Washington, DC.

A	B	C	D	Bibliographic Data
61	14	0	47	**Leloir L F, Staneloni R J, Carminatti H & Behrens N H.** The biosynthesis of a N,N′-diacetylchitobiose containing lipid by liver microsomes. A probable dolichol pyrophosphate derivative. *Biochem. Biophys. Res. Commun.* 52:1285-92, 1973. Univ. Buenos Aires, Inst. Invest. Bioquim. "Fundacion Campomar," Buenos Aires, Argentina.
58	8	3	47	**Reinhold J G, Nasr K, Lahimgarzadeh A & Hedayati H.** Effects of purified phytate and phytate-rich bread upon metabolism of zinc, calcium, phosphorus, and nitrogen in man. *Lancet* 1:283-8, 1973. Pahlavi Univ. Sch. Med., Inst. Nucl. Med., Shiraz, Iran.
58	5	1	52	**Seakins M, Gibbs W N, Milner P F & Bertles J F.** Erythrocyte Hb-S concentration. An important factor in the low oxygen affinity of blood in sickle cell anemia. *J. Clin. Invest.* 52:422-32, 1973. Univ. West Indies, Dept. Chem. Hematol., Kingston, Jamaica; St. Luke's Hosp. Ctr., Hematol. Div., New York, NY.
57	4	7	46	**Chandra R K.** Reduced bactericidal capacity of polymorphs in iron deficiency. *Arch. Dis. Child.* 48:864-6, 1973. All India Inst. Med. Sci., Dept. Paediat., New Delhi, India.
54	10	0	44	**Karniol I G & Carlini E A.** Pharmacological interaction between cannabidiol and Δ^9-tetrahydrocannabinol. *Psychopharmacology* 33:53-70, 1973. Escola Paulista Med., Dept. Psicobiol., Sao Paulo, Brazil.
53	7	3	43	**Blaquier J A & Calandra R S.** Intranuclear receptor for androgens in rat epididymis. *Endocrinology* 93:51-60, 1973. Inst. Biol. Med. Exp., Lab. Esteroides, Buenos Aires, Argentina.
53	2	0	51	**Srivastava R K, Kulshrestha V K, Singh N & Bhargava K P.** Central cardiovascular effects of intracerebroventricular propranolol. *Eur. J. Pharmacol.* 21:222-9, 1973. Univ. Lucknow, King George's Med. Coll., Lucknow, India.
52	14	7	31	**Toma H E & Malin J M.** Properties and reactivity of some pentacyanoferrate (II) complexes of aromatic nitrogen heterocycles. *Inorg. Chem.* 12:1039-45, 1973. Univ. Sao Paulo, Inst. Quim., Sao Paulo, Brazil.

These 23 articles received about 1,800 citations. Eighty-six percent were from authors in developed countries. Ten percent were from the first author's developing country. Only four percent were from authors in other Third World nations. Thus, whether or not a Third World article is highly cited depends on the recognition it gets from authors in the developed countries.

Part of the reason for this is that no Third World journal published the most-cited articles from the developing countries. Thirteen of the 23 most-cited articles appeared in US journals. Seven were published in the UK. Two were published in the Netherlands, and one in West Germany.

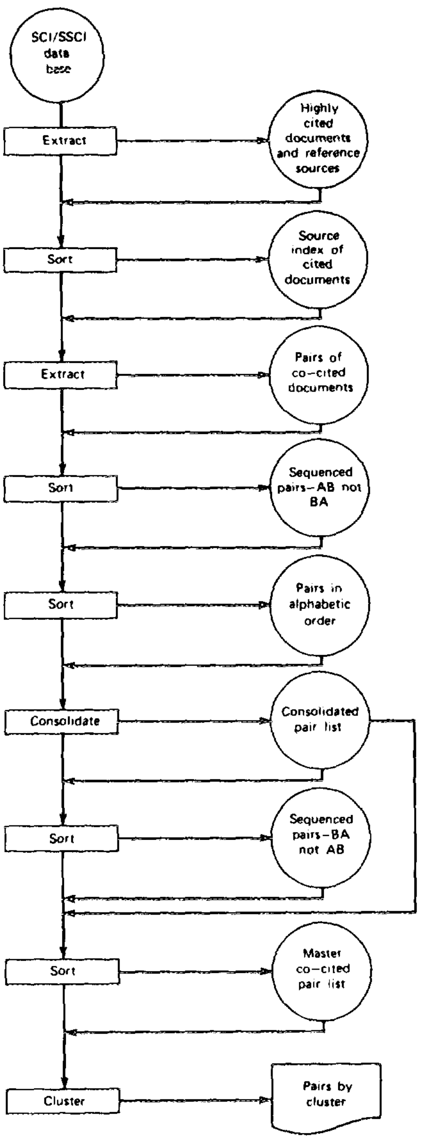
We have not yet discussed, in a cognitive sense, the most active areas of Third World research. We have shown some research their scientists do best by examining the most-cited articles from the Third World. But any conclusion drawn from such a limited sample of Third World articles would be tentative, at best.

Clustering Method

At ISI®, a method has been developed to bring into view the cognitive structure of science.[1] Here, I limit myself to a brief explanation of what is actually a complex procedure (see Figure 1).

When we record the references in an article, we also keep track of the *pairs* of papers it cited together, or co-cited. When the same pairs of papers are cited together with other papers by many authors, a cluster of research begins to form. The idea underlying this method is that co-cited articles share a common topic, subject area, or method. That is, when an author cites two papers together, he or she indicates that both papers applied to some aspect of the research he or she performed. When the same cluster of papers is co-cited by several authors, a cognitive link is established between the research these authors perform. That is, the citing authors reveal what research area they "belong to" through their citations. By examining the titles of the citing articles, we get an idea of the cognitive content of their

Figure 1: Diagram of ISI®'s clustering method.



research concentration. That is, the citing authors themselves provide the words to define what their research area is about.

At another level, we can also identify co-citation links between clusters. This is possible when authors cite articles included in different clusters together. Again, we assume that authors who use the same clusters of articles are engaged in similar types of research. The more frequently two clusters of articles are co-cited, the closer they are in subject area or methodology. In fact, when we generate maps of co-cited clusters, we use this relationship to determine how close or far apart clusters should be depicted in relation to each other.

We used the 1981 *SCI* file to see what clusters were cited in articles from Third World countries. This gives an understanding of the *current* areas of activity in Third World science. We started by identifying all articles from Third World countries in the 1981 *SCI*. We then identified all the articles they cited that year. We then determined which 1981 articles from developed countries referred to the same group of papers cited by Third World authors. These data were entered into our computer, and more than 2,000 clusters of co-cited papers were generated.

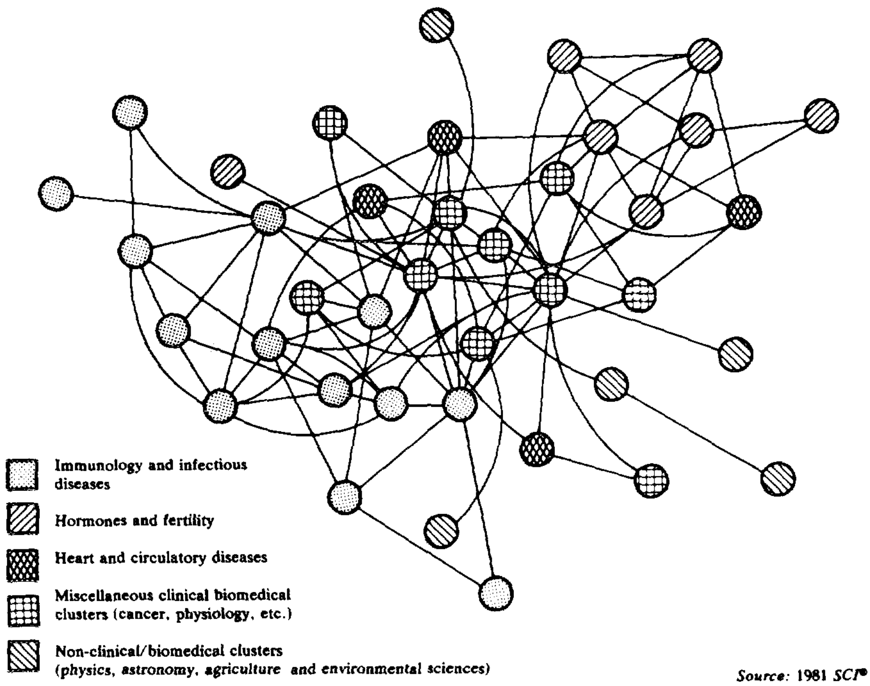
Before we identified clusters that were cited by Third World articles, we decided to separate India from the developing countries. As we have seen, India overshadows the rest of the Third World in the number of scientific articles it authors and publishes. By considering India separately, we have a clearer picture of Third World scientific activity.

Maps of Clusters

Thirty-nine clusters were cited by at least 15 articles from the Third World, excluding India (see Figure 2). Each circle represents a single cluster. The shading indicates different disciplines of research. Connecting lines indicate co-citation links between these disciplines.

The clusters are densely packed and highly interconnected for a good reason. Ninety percent of them deal with topics in closely related fields—clinical and biomedical science. Thirteen clusters concentrate on various aspects of im-

Figure 2: Clusters of research cited by 1981 articles from Third World countries, excluding India.



Source: 1981 *SCI*®

munity, particularly to viral and bacterial diseases; seven deal with hormones and fertility; and four discuss circulatory and heart diseases. The ten clusters on "miscellaneous" topics in clinical medicine and biomedicine concern cancer, neurotransmission, physiology, metabolism, and other topics. The remaining five clusters in this figure are in fields other than clinical medicine and biomedicine—two in physics, one in astronomy, and two in agricultural and environmental sciences.

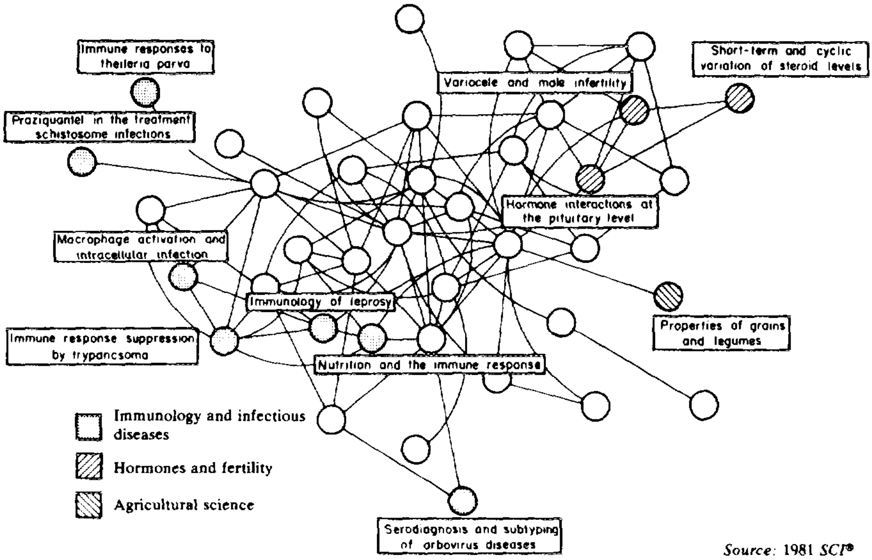
Obviously, Third World research activity is focused on clinical and biomedical science. That is, developing country scientists tend to cite clusters of articles in clinical and biomedical research almost exclusively. But what specific areas of clinical and biomedical research are cited *most* frequently by Third World scientists? This can be determined by considering the *proportion* of all articles citing these clusters that were from the Third World.

Third World articles amounted to at least 15 percent of all citing articles for 11 clusters. As we can see in Figure 3, the level of Third World participation is significant in seven clusters of research on immunology and infectious diseases.

Another area of Third World scientific expertise is in hormone and fertility research. Third World scientists also accounted for a significant proportion of all papers citing research in the agricultural cluster.

The cluster names read like an agenda of Third World concerns: diseases transmitted by parasites, bacteria, and viruses; immune responses to these and other infectious diseases; hormones, steroids, and fertility; and grains and legumes. Except for the last, all Third World science is focused on clinical and biomedical research. Of course, Third

Figure 3: Names of clusters for which Third World articles amount to at least 15 percent of all 1981 citing articles.



Source: 1981 *SCI*®

World scientists do research in physics, chemistry, mathematics, and other fields. But they are *most* active in clinical and biomedical research.

Indian Clusters

When we examine Indian science and exclude the rest of the Third World (see Figure 4), we see that 32 clusters were cited by at least 16 articles from India. The smaller structure that stands apart to the left includes seven clusters. They are all in chemistry: these clusters discuss valence states, electron density, and phase transitions of various crystals and liquids.

The larger structure to the right includes 25 clusters. They can be organized into three separate fields of concentration. Eleven clusters deal with the synthesis and properties of various metal and ligand complexes. For convenience, we categorize them as being in organometallic chemistry.

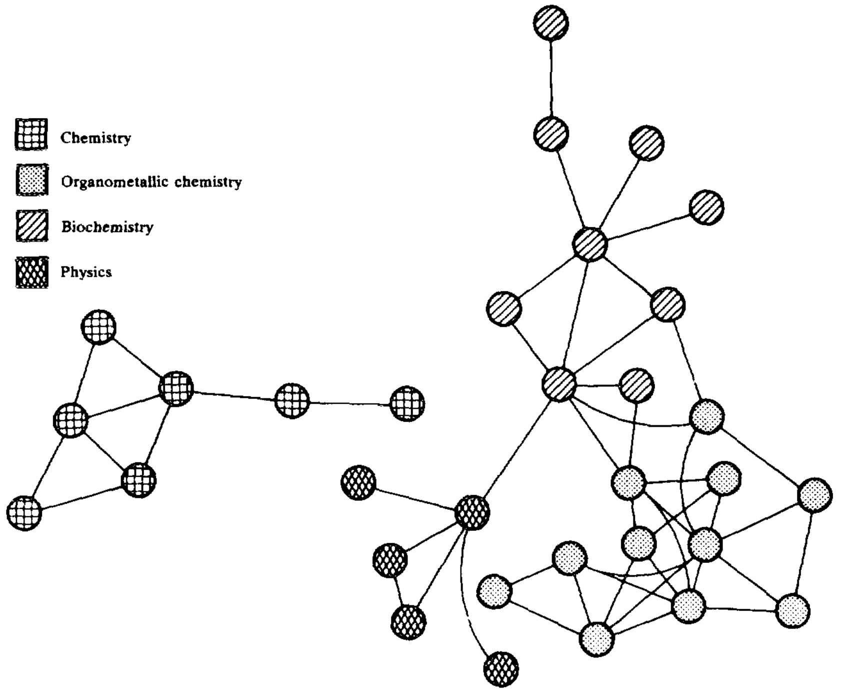
Nine clusters concentrate on biochemistry, and deal with protein analysis, plant genetics, DNA conformation, and the structure and bioactivity of various substances. One of these discusses viral gastroenteritis, the only biomedical cluster on the map of Indian science. But only three percent of the articles citing this cluster were from India.

The remaining five clusters deal with physics. They discuss quantum chromodynamics, quark models, unified field theories, and other topics.

Unlike the other developing countries, Indian science is not focused on any one field. It is interesting that Indian science was not active in clinical and biomedical research, which preoccupied the rest of Third World science. Instead, Indian scientists cited research in biochemistry, physics, chemistry, and organometallic chemistry. But Indian research activity was concentrated in organometallic chemistry.

Indian articles amounted to at least 25 percent of all citing articles for 13 clusters (see Figure 5). Nine of these clusters deal with metal and ligand com-

Figure 4: Clusters of research cited by 1981 articles from India, excluding the rest of the Third World.



Source: 1981 *SCI*®

plexes, which we have categorized as topics in organometallic chemistry. In the cluster named "Stability constants of metal complexes with asymmetric multidentate ligands," the level of Indian participation was very high. More than 100 articles published in 1981 cited this cluster, and 77 percent were from India.

Chemistry is another active area of Indian science. These clusters deal with chemical properties of alcohol and various crystals. And one cluster in biochemistry showed a significant level of participation by Indian researchers. Of the 108 articles that cited the cluster "Diallyl analysis and other biometrical genetics studies," 27 were from India.

Conclusions

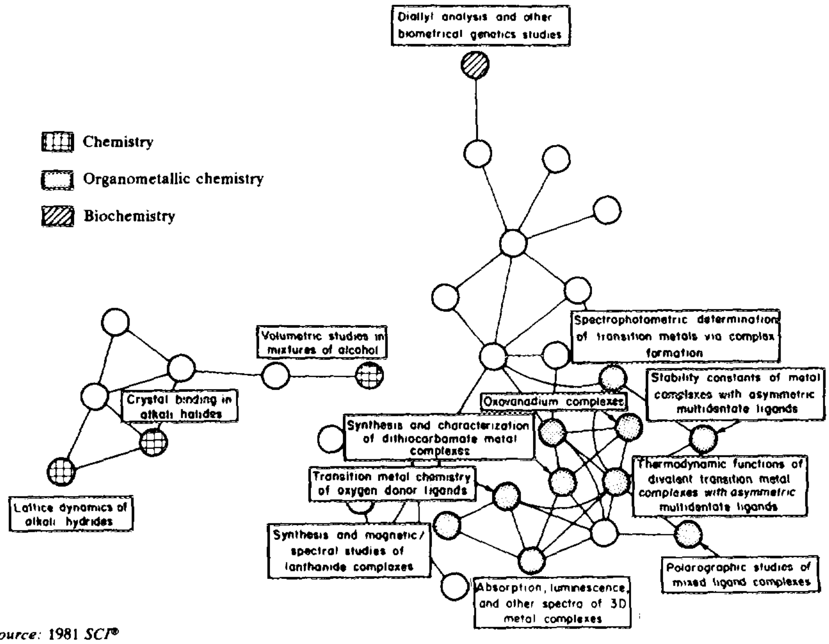
When we talk about Third World science, we have to distinguish between India and the rest of the developing world. In many respects, Indian science is unlike the mainstream of Third World research.

First, Indian science is not clustered in clinical or biomedical research. Of course, Indian scientists do research in clinical and biomedicine, but they are not the *most* active areas of Indian research. In contrast, the rest of the Third World actively participates in clinical and biomedical research.

Also, Indian science is clustered in research fields that other Third World scientists have not significantly penetrated—biochemistry, physics, chemistry, and organometallic chemistry. And the level of participation of Indian scientists in organometallic chemistry is especially remarkable.

India also stands apart from all other developing nations in the number of articles its scientists authored. Remember

Figure 5: Names of clusters for which Indian articles amount to at least 25 percent of all citing articles.



Source: 1981 *SCI*®

that half the 16,000 Third World articles in the 1973 *SCI* were authored in India. And India's dominant position in the Third World has remained constant over the years. For example, there were 22,000 Third World articles in the 1978 *SCI* data base. Of these, 52 percent were authored in India. The 1981 *SCI* data base included 27,000 Third World articles, and 49 percent of these were from India.

India overshadows the rest of the Third World in the number of articles published in its scientific press, as well. Indian journals accounted for 60 percent of all 1973 articles published in the Third World.

Thus, we get a skewed impression of Third World science when we do not take separate account of India. For example, five percent of the 353,000 articles in the 1973 *SCI* were authored in the Third World. But when India's contribution is subtracted, the proportion of Third World articles drops to only two percent. And two percent of the 1973 *SCI* articles were published in Third World journals. But this drops to less than one percent when India is excluded.

When we consult data from other indexing services that claim to be comprehensive for the world's publications in physics, chemistry, and biology, India's position remains the same. For example, the number of particle physics papers from India accounted for three percent of the input to *Physics Abstracts* in 1982.[2] Indian chemistry papers represented another three percent of the *Chemical Abstracts* file in 1981. And Indian biology papers again accounted for three percent of the *BIOSIS* file from 1978 to 1981.

It is interesting to note the USSR's position in this context. In 1970, Soviet chemistry papers represented 24 percent of the *Chemical Abstracts* file. This number declined to 17 percent in 1981. This decline can be traced to the Soviet practice of depositing papers instead of publishing them.[3] In fact, the USSR passed a resolution in 1979 to *reduce* the number of their journal publications. The result has been a ten percent decrease in the amount of Soviet literature in various areas of science and technology.[3]

I cannot say whether the data presented indicate that Third World research, with or without India, is "underrepresented" in international scientific journals. Granted, articles authored and published in Third World countries amount to a very small proportion of the international scientific press. But this might be explained in several ways.

For example, Third World countries cannot afford to devote a large percentage of their gross national products to scientific research. This has an obvious effect on the availability of scientific instruments, supplies, and materials in developing countries. Without all this, the conduct of research in the Third World is diminished.

Or, Third World countries may not have a large enough research community to generate significant numbers of articles. This would also affect the number of scientific journals the research community can support.

I am sure there are many other factors that might explain why Third World scientific output amounts to such a small proportion of the international scientific output. Until these factors are analyzed, we cannot decide if the coverage of Third World research is equitable. And until we make that decision, we cannot talk about the need for restructuring the world scientific press. This lecture is intended to serve as a point of departure for what I hope will be a continuing analysis of the level and impact of Third World science. It remains to be seen whether or not a New Scientific Information Order is needed.

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