



Publication Analysis 1996-2007

Cardiovascular and Circulation Research

Germany and the United Kingdom are head-to-head leaders of European heart and circulation research. Most effective in terms of citations, however, were the Scandinavian countries and The Netherlands.

It all began with a minor defect. More than half a billion years ago, somewhere in the depths of ancient oceans, a small worm-like animal suddenly found itself with cells that had formed a vague cavity or even a small tube-like structure inside its body. However, the “defect” was to have a positive effect. Whilst this creature unwittingly swam around, contracting its primitive muscles, the fluid within its body spread a little more and a little faster through this cavity or space. In this way, the oxygen absorbed from the surrounding water and dissolved in the body fluid, seeped deeper into its tissues. The animal, therefore, was able to take in more oxygen than its fellow worms – and, hence, grew a little larger.

Our worm led a happy life and left an ocean full of offspring. Some of this offspring inherited papa worm’s fluid cavity, which meant they could survive with a slightly larger body than that of their cavityless siblings, due to the oxygen-distributing power of this first primitive vessel.

A brief tribute to Charles Darwin

The evolution of circulatory systems – and, ultimately, of the heart – had commenced. Through thousands and millions of generations, the cavity gradually developed, eventually forming an actual tube. Over the same period, the small worms had become larger worms and some of them started developing tubes with contractile regions – that is, a section of the tube that can actually squeeze and pump.

Well, in a nutshell, that’s *why* (not *wherefore*) we have hearts and vessels. Being Darwin Year, this short evolutionary introduction was more or less obligatory.

Today, apart from the brain and neurons, the cardiovascular system constitutes the organ system most frequently addressed

by biomedical research. That is, of course, due to the prevalence and severity of heart and circulatory diseases, which, according to the World Health Organisation (WHO), account for one-third of all deaths in modern societies and remain the leading cause of hospitalisation. So, it’s no wonder that for the period 1996-2007 the scientific publication database *Scopus* lists almost 290,000 documents in its subject category “Cardiology and Cardiovascular Medicine”. In terms of human diseases, only research into cancer produces even more publications.

Some are weak, some are strong

For this reason, many of the top papers of the field are usually published in multidisciplinary science or medical journals like *Nature*, *Science* or *Lancet* and the *New England Journal of Medicine*. This, in turn, poses a specific problem for our publication analysis of cardiovascular and circulation research during the period 1996 to 2007: the publication platform *SCImago Journal & Country Rank (SCImagoJR)*, used for this analysis, doesn’t list these journals in the subject category “Cardiology and Cardiovascular Medicine” but under “Multidisciplinary” or “Medicine (miscellaneous)” instead. Since *SCImagoJR* doesn’t provide any tools to extract relevant cardiovascular articles with sufficient reliability, we weren’t able to include the articles from these journals in the performance analysis of individual countries (see tables p. 39).

Subsequently, some of the most prominent papers in the field were not included in this part of the analysis. Despite this limitation, we believe that a survey restricted to the 231 “cardiovascular” journals listed by *SCImagoJR*, nevertheless, provides sufficiently valid indicators for countries’ overall productivity in cardiovascular research. On the contrary, rankings of the most-cited

researchers and papers (see tables p. 40) could be analysed from publications in all journals.

According to this scheme, like in almost all biomedical fields, Germany and the United Kingdom emerged as the leading European research nations in cardiovascular and circulation research. The difference between them is only marginal, in terms of total publications as well as overall citations. Other “strong performers” were Italy (3rd), The Netherlands (5th) and Sweden (6th). Spain and Israel, on the other hand, slipped down the scale when compared to other biomedical disciplines.

Different publication cultures

When ranking by average number of citations per article, Finland comes out as the clear number one, followed by The Netherlands, Sweden, Denmark and Norway – upholding the usual Scandinavian dominance.

In comparison to the rest of the scientific world, Europe falls behind the USA in terms of overall citations, despite a considerably higher number of total articles. The reason being that articles with at least one co-author from the US were cited more frequently on average than those with a European colleague in the authors' list (16.9 vs. 10.8). Remarkably strong: Australia with 18.7 citations per article, thus equalling the European number two, The Netherlands.

Let's finally turn to papers and authors. As could be expected, three of the five most-cited papers in European cardiovascular and circulation research constitute huge clinical multicentre trials on the treatments of hypertension (1st and 4th) and chronic heart failure (3rd). The most-cited work from basic research, dealing with the regulation of blood vessel development, came in at fifth place. Finally, second place was occupied by an epidemiological study on the connection between diabetes and coronary heart disease.

This methodological diversity in cardiovascular research is also reflected by the list of Europe's most-cited authors of the field. Among the Top 5 are two Dutch epidemiologists (Albert Hofman from Rotterdam in first place and Diederick Grobbee from Utrecht in 4th), two clinical cardiologists (Patrick Serruys from Rotterdam, 3rd, and Andreas Zeiher from Frankfurt, 5th) and molecular cell biologist Peter Carmeliet from the Catholic University of Leuven (2nd). Comparability is, of course, a bit distorted since the publication cultures differ widely between these disciplines. In contrast to lab scientists, for example, who study basic molecular or cellular processes in small teams; clinical researchers very often collect the majority of their citations through comparatively small individual contributions to extensive collective clinical trials.

Hot topics? Not for the pioneers!

Apart from that, however, the research questions addressed by the most-cited papers and authors again mirror quite well the current hot topics of the field: regulation of blood pressure, arteriosclerotic and thrombotic diseases, myocardial infarction, stroke, cardiac stem cell therapy, regulation of angiogenesis or nitric oxide (NO)-induced vasodilatation – to name but a few of the most prominent.

Each one of these topics, however, was far beyond the horizon when, all those years ago, worm-like creatures first pumped body fluid through some primitive cavities. In a certain sense, this also reflects the power of evolutionary development.

RALF NEUMANN

Europe...

Country	Citations	Articles	Cit./Art.
1. Germany	290,242	22,037	13.7
2. UK	288,178	21,236	14.6
3. Italy	173,275	17,074	11.0
4. France	152,743	12,881	11.9
5. Netherlands	151,371	9,175	18.7
6. Sweden	78,777	4,625	17.9
7. Switzerland	55,669	4,214	14.6
8. Belgium	55,129	3,601	16.6
9. Spain	54,208	6,977	8.8
10. Finland	43,029	2,084	21.5
11. Denmark	34,383	2,038	17.8
12. Austria	33,796	3,358	11.3
13. Israel	32,334	2,729	12.4
14. Norway	27,095	1,736	17.5
15. Greece	20,638	3,322	7.6
16. Turkey	16,921	5,704	4.4
17. Poland	16,440	3,984	5.1
18. Ireland	9,937	785	14.8
19. Hungary	7,480	773	10.6
20. Czech Rep.	6,088	791	11.6

Articles appeared between 1996 and 2007 in journals as listed by *Scopus*. Numbers for articles and citations were taken from the portal *SCImago Journal & Country Rank* (www.scimagojr.com) applying the subcategory “Cardiology and Cardiovascular Medicine”. A country's figures are derived from articles where at least one author working in the respective European nation is included in the author's list. Israel is included because it is a member of many European research organisations and programmes (EMBO, FP7 of the EU,...).

... and the World

	Citations	Articles	Cit./Art.
Europe	1,294,943	119,410	10.8
USA	1,345,316	85,380	16.9
Japan	210,414	21,623	9.9
Canada	158,536	10,438	17.3
Australia	56,443	4,380	18.7
Taiwan	20,340	2,587	9.0
Brazil	19,690	3,514	7.4



Publication Analysis 1996-2007 – Cardiovascular and Circulation Research

Most Cited Authors...

	Cit-ations	Art-icles		
1. Albert Hofmann , Epidemiol. & Biostat. Univ. Rotterdam	25,515	537		
2. Peter Carmeliet , Transgene Technol. & Gene Therapy KU Leuven	23,445	250		
3. Patrick W. Serruys , Thoraxctr. Erasmus Med. Ctr. Rotterdam	19,244	452		
4. Diederick Grobbee , Clin. Epidemiol. Med. Ctr. Univ. Utrecht	19,026	587		
5. Andreas M. Zeiher , Cardiol. Internal Med. Univ. Frankfurt	18,944	212		
6. Desire Collen , Mol. & Vasc. Biol. KU Leuven	18,218	295		
7. Giuseppe Mancia , Clin. Med. Univ. Milan	16,698	284		
8. Stefanie Dimmeler , Mol. Cardiol. Grp. Internal Med. Univ. Frankfurt	16,529	176		
9. Peter J. Schwartz , Cardiol. Univ. Pavia	15,679	142		
10. Kalevi Pyörälä , Dep. Med. Univ. Hosp. Kuopio	14,899	118		
11. Björn Dahlöf , Dep. Med. Sahlgrenska Hosp Univ. Gothenburg	14,707	345		
12. Frits R. Rosendaal , Clin Epidemiol. & Hematol. Univ. Leiden	14,152	335		
13. Alberto Zanchetti , Ctr. Clin Physiol. & Hypertension Univ. Milan	13,904	197		
14. Günter Breithardt , Internal Med. Univ. Hosp. Univ. Münster	13,697	328		
15. Jan A. Staessen , Dep. Cardiovasc. Dis. Univ. Leuven	13,580	253		
16. Alan John Camm , Cardiol. St. George Hosp. Med. Sch. London	13,173	221		
17. Thomas F. Lüscher , Cardiovasc. Ctr. Univ. Hosp. Zurich	12,977	272		
18. Antonio Colombo , San Raffaele Hosp. Univ. Milan	12,580	296		
19. Frans van de Werf , Cardiol. Univ. Hosp. Gasthuisberg Leuven	12,445	229		
20. Keith A.A. Fox , Ctr. Cardiovasc. Sci. Royal Infirmary Univ. Edinburgh	12,437	189		
21. Marteen L. Simoons , Cardiol. Thoraxctr. Univ. Rotterdam Hosp.	12,383	239		
22. Werner Risau , Max Planck Inst. Physiol. & Clin Res. Bad Nauheim	11,937	63		
23. John J.V. McMurray , Cardiol. Western Infirm. Univ. Glasgow	11,890	268		
24. Albert Schömig , Deutsch. Herzzentrum Tech. Univ. Munich	11,733	337		
25. Coen D.A. Stehouwer , Cardiovasc. Res. Inst. Univ. Maastricht	11,622	303		
26. Karl Swedberg , Inst. Med. Sahlgrenska Acad. Univ. Gothenburg	11,326	163		
27. Lars Wallentin , Cardiol. Univ. Uppsala	11,199	173		
28. Silvia G. Priori , Mol. Cardiol. Lab. Univ. Pavia	11,110	144		
29. Franz-Josef Neumann , Herz Zentrum Bad Krozingen (Ger)	10,941	180		
30. John J.P. Kastelein , Vasc. Med. Univ. Amsterdam	10,815	292		
				

Citations of articles published between 1996 and 2007 were recorded until Feb. 2009 using the database *Web of Science* from Thomson Scientific. The "most cited papers" had correspondence addresses in Europe or Israel.

... and Papers

	Citations
1. Hansson, L; Zanchetti, A; ...; SG; Dahlöf, B; ...; H; Westerling, S (HOT Study Grp) Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: principal results of the hypertension optimal treatment (HOT) randomised trial. <i>LANCET</i> , 351 (9118): 1755-1762 (1998)	2,409
2. Haffner, SM; Lehto, S; Rönnemaa, T; Pyörälä, K; Laakso, M Mortality from coronary heart disease in subjects with type 2 diabetes and in nondiabetic subjects with and without prior myocardial infarction. <i>NEW ENGLAND JOURNAL OF MEDICINE</i> , 339 (4): 229-234 (1998)	1,945
3. Hjalmarson, A; ...; Yellin, L (MERIT-HF Study Grp) Effect of metoprolol CR XL in chronic heart failure: Metoprolol CR XL Randomised Intervention Trial in Congestive Heart Failure (MERIT-HF). <i>LANCET</i> , 353 (9169): 2001-2007 (1999)	1,822
4. Dahlöf, B; Devereux, RB;... Nieminen, MS; Omvik, P; Oparil, S; Wedel, H (LIFE Study Grp) Cardiovascular morbidity and mortality in the Losartan Intervention For Endpoint reduction in hypertension study (LIFE): a randomised trial against atenolol. <i>LANCET</i> , 359 (9311): 995-1003 (2002)	1,783
5. Carmeliet, P; Ferreira, V; Breier, G; ...; Risau, W; Nagy, A Abnormal blood vessel development and lethality in embryos lacking a single VEGF allele. <i>NATURE</i> , 380 (6573): 435-439 (1996)	1,769