



Publication Analysis 1996-2007

Basic Neurosciences



In Europe, the highest citation numbers were achieved with neuroimaging studies rather than by applying methods from molecular or cell biology to neuroscience. Apparently, this fact has also contributed to England's dominance of the field.

The famous German free-climber Wolfgang Güllich once stated, "The brain is the most important muscle for climbing." Okay, you don't have to be a neuroscientist to know what's wrong with that statement. We can, however, surmise that Güllich intentionally chose the misconception of the "brain muscle" in order to make one point fundamentally clear: the enormous importance of the brain (and the whole nervous system) in controlling, coordinating and integrating the functioning and the behaviour of a whole organism. Even when it comes to such a specialised activity as free-climbing.

No wonder, therefore, that trying to understand the *basics* of how this "control centre" and its information pathways work has been and still is one of the topmost issues of life science research.

Basics – that's an important keyword here since in this publication analysis we tried to separate research into *basic* neuroscience from research into *clinical* neuroscience, which has its focus on the diseases, defects and malfunctions of the nervous systems including their therapies.

How did we try to achieve that? The main problem was that even in clinical institutes (neurology, psychiatry...) a significant portion of research has to be regarded as basic neuroscience. So, how does one decide whether the research of a scientist working at a clinical institute is *basic* or *clinical* without having to check all their papers individually?

Muscle? What muscle?

Help was provided by the *Web of Science* citation database from Thomson Reuters, which was used for this analysis. *Web of Science* divides the whole bunch of neuroscience journals into the two categories "neuroscience" and "clinical neurology". Thus, it's

comparatively easy to check, in which of these two categories a certain author has published more articles. And despite the notion that the boundaries between basic and clinical neuroscience certainly are fluid, we made this publication focus in "neuroscience" journals our key criterion for including individual researchers in our publication analysis "basic neuroscience".

Who's "basic"?

The papers published between 1996 and 2007 in the 221 journals of *Web of Science's* category "neuroscience" formed the basis for the comparison of the performances of the individual European countries in basic neuroscience research (see "blue" table, p. 33). Certainly, many of the "top papers" in basic neuroscience are published in multidisciplinary science journals like *Nature*, *Science*, *Cell* or *Proc. Natl. Acad. Sci.*, nevertheless, we had to omit them from this part of the analysis since *Web of Science* doesn't provide any reliable tools to automatically extract relevant neuroscience articles from those multidisciplinary journals. Despite this limitation, however, we believe that a survey, restricted to the specialist journals only, still provides sufficiently valid indicators for the countries' overall productivity in neuroscience research. On the contrary, rankings of the most-cited researchers and papers (see tables, p. 34) could be analysed from publications in all journals.

Applying this directive, England emerged as Europe's number one in basic neuroscience research in terms of overall citations. All papers published in the period from 1996-2007, with at least one author from an English lab, were cited more than 740,000 times in total up until November 2009. Germany, the runner-up, came in at slightly less than 690,000 citations, whereas France

and Italy followed relatively far behind (390,000 and 290,000 citations, respectively).

Interestingly, the fact that Germany produced the highest overall number of articles in the neuroscience journals (almost 35,000) did not prevent England's lead in total citations. The reason was England's excellent mean citation rate: each article was cited 22.2 times on average up until November 2009. Only Switzerland achieved a better rate with 23.6 citations per article; Sweden and Wales were the only other European countries rating over 20.

Two dominating camps

When compared to the USA (see yellow table on this page), Europe once again were forced to follow in the shadows. Despite publishing more articles in the neuroscience journals than their US colleagues (165,000 vs. 153,000), the papers with European (co-)authors were clearly cited less frequently in total (2.9 million vs. 3.7 million). One consequence being that with a grand average of 23.8 citations per paper, the USA even outperformed England's and Switzerland's good average citation rates.

On the other hand, the European "Top Two", England and Germany, kept well ahead of Japan and Canada in the neurosciences – in contrast to the situation in quite a few other life science disciplines.

When turning to the most-cited European authors and papers in neuroscience (see tables on next page), one thing becomes immediately obvious: almost the whole tip of the field can easily be split into two camps when it comes to methodology.

One camp comprises researchers (and their papers) digging into the questions of brain and nerve function by means of molecular and cell biology. The most-cited paper about the involvement of the brain's serotonin metabolism in anxiety-related traits belongs to this camp, as do the papers placed 2nd and 5th. Representatives from the "top 30"-cited authors are, for example, Florian Holsboer (6th), Vincenzo di Marzo (7th), Michel Goedert (8th), Michel Ladzunski (11th) or Adriano Aguzzi (17th). Altogether, this result is another documentation of how enormously successful molecular and cell biology have been during the last decades in elucidating key mechanisms of neuronal function.

"Neurons don't sleep but brains do"

More recently, however, technologies of imaging the activity of whole brains (or large areas of it) have improved to such an extent that the camp of researchers applying these methods has even overtaken the molecular and cellular neuroscientists – at least according to our analysis. The five most-cited European authors come from this field; the top three – Karl Friston, Raymond Dolan, Christopher Frith – all work in the same institute, the Wellcome Trust Centre for Neuroimaging in London.

One reason for this might be that, if you have the equipment at hand, a certain amount of data can be generated at faster rates by imaging methods than by applying the tools of molecular and cell biology.

Another reason, however, might be the increasing awareness that some higher levels of neuronal and brain function are too complex to be tackled and explained by a reductionistic view on cells and molecules alone. This notion is aptly documented, for example, by the following recent statement of a sleep researcher in response to some obvious "over-interpretation" of a cellular/molecular study, "Neurons don't sleep but brains do."

RALF NEUMANN

Europe...

Country	Citations	Articles	Cit./Art.
1. England	741,280	33,395	22.2
2. Germany	688,167	34,937	19.7
3. France	392,193	20,620	19.0
4. Italy	293,034	17,436	16.8
5. Switzerland	172,842	7,315	23.6
6. Netherlands	169,043	9,399	18.0
7. Sweden	167,659	8,195	20.5
8. Spain	156,436	11,119	14.1
9. Israel	96,274	5,545	17.4
10. Scotland	86,418	4,621	18.7
11. Belgium	73,717	4,281	17.2
12. Finland	67,335	3,487	19.3
13. Denmark	66,936	3,425	19.5
14. Austria	60,224	3,404	17.7
15. Hungary	49,981	3,035	16.5
16. Norway	36,568	1,906	19.2
17. Poland	32,960	3,776	8.7
18. Wales	29,968	1,478	20.3
19. Ireland	25,828	1,531	16.9
20. Russia	23,616	3,557	6.6

Articles appearing between 1996 and 2007 in neuroscience journals as listed by Thomson Scientific's *Web of Science*. The numbers of citations are accurate as of November 2009. 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

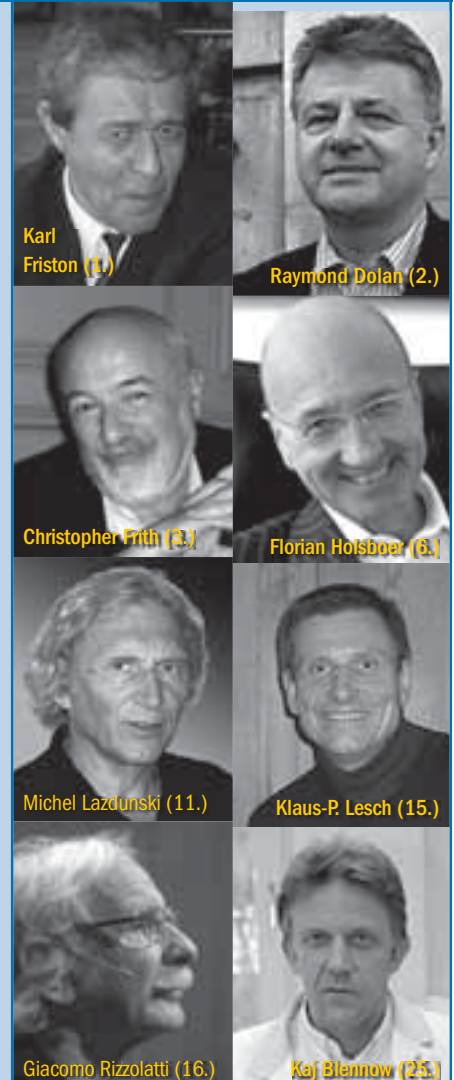
	Citations	Articles	Cit./Art.
Europe	2,891,616	165,014	17.5
USA	3,652,260	153,286	23.8
Canada	482,488	22,140	21.8
Japan	472,962	35,215	14.7
Australia	163,397	9,511	17.2
China	66,327	6,299	10.5
Brazil	50,843	6,069	8.4



Publication Analysis 1996-2007 – Basic Neurosciences

Most Cited Authors...

	Cit-ations	Art-icles
1. Karl J. Friston , Wellcome Trust Ctr. Neuroimaging UCL London	27,342	277
2. Raymond J. Dolan , Wellcome Trust Ctr. Neuroimaging UCL London	23,332	242
3. Christopher D. Frith , Wellcome Trust Ctr. Neuroimaging UCL London	23,022	221
4. Trevor W. Robbins , Expt. Psychol. Univ. Cambridge	22,733	311
5. Richard S.J. Frackowiak , Cognit. & Brain Sci. Unit MRC/Cambridge	19,483	186
6. Florian Holsboer , Max Planck-Inst. Psychiat. Munich	15,130	345
7. Vincenzo di Marzo , Endocannabinoid Res. Grp. CNR/Naples	15,102	223
8. Michel Goedert , MRC Mol. Biol. Lab Cambridge	14,090	134
9. Steve C.R. Williams , Ctr. Neuroimaging Sci. Kings Coll. London	13,785	233
10. Hans Lassmann , Neuroimmunol. Ctr. Brain Res. Med. Univ. Vienna	13,594	231
11. Michel Lazdunski , Mol. & Cell. Pharmacol. CNRS/Univ. Nice	12,719	175
12. Karl Zilles , Inst. Brain Res. Univ. Düsseldorf & Res. Ctr. Jülich	12,492	300
13. John C. Rothwell , Motor Neurosci. & Movement Disord. UCL London	12,317	296
14. Barry J. Everitt , Expt. Psychol. Univ. Cambridge	11,904	133
15. Klaus-Peter Lesch , Psychiat. Univ. Würzburg	11,370	219
16. Giacomo Rizzolatti , Human Physiol. Univ. Parma	11,331	56
17. Adriano Aguzzi , Neuropathol. Univ. Zurich Hosp.	11,234	247
18. Konrad Beyreuther , Ctr. Mol. Biol. Univ. Heidelberg	10,625	178
19. Christian Haass , Biochem. Univ. Munich	10,552	159
20. Reinhard Jahn , Max Planck-Inst. biophys. Chem. Göttingen	10,520	114
21. Tomas Hökfelt , Neurosci. Karolinska Inst. Stockholm	9,790	284
22. Bert Sakmann , Max Planck-Inst. Med. Res. Heidelberg	9,719	101
23. Giorgio Bernardi , Dept. Neurosci. Univ. Tor Vergata Rome	9,617	372
24. Jean Pierre Changeux , CNRS Inst. Pasteur Paris	9,524	172
25. Kaj Blennow , Neurosci. Sahlgrenska Univ. Hosp. Gothenburg	9,513	260
26. John Ashburner , Wellcome Trust Ctr. Neuroimaging UCL/London	9,419	60
27. Thomas J. Jentsch , Leibniz-Inst. & Max-Delbrück-Ctr. Berlin	9,216	102
28. Maria Grazia Spillantini , Ctr. Brain Repair Univ. Cambridge	9,203	78
29. Edmund T. Rolls , Expt. Psychol. Univ. Oxford	9,161	157
30. Stanislas Dehaene , Cogn. Neuroimag. Unit INSERM/Univ. Paris-Orsay	8,662	109



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

... and Papers

	Citations
1. Lesch, KP; Bengel, D; Heils, A; Sabol, SZ; Greenberg, BD; [...]; Muller, CR; Hamer, DH; Murphy, DL Association of anxiety-related traits with a polymorphism in the serotonin transporter gene regulatory region. <i>SCIENCE</i> , 274 (5292): 1527-1531 NOV 29 1996	1,818
2. Spillantini, MG; Schmidt, ML; Lee, VMY; Trojanowski, JQ; Jakes, R; Goedert, M alpha-synuclein in Lewy bodies. <i>NATURE</i> , 388 (6645): 839-840 AUG 28 1997	1,641
3. Ashburner, J; Friston, KJ Voxel-based morphometry - The methods. <i>NEUROIMAGE</i> , 11 (6): 805-821 Part 1 JUN 2000	1,546
4. Logothetis, NK; Pauls, J; Augath, M; Trinath, T; Oeltermann, A Neurophysiological investigation of the basis of the fMRI signal. <i>NATURE</i> , 412 (6843): 150-157 JUL 12 2001	1,450
5. Ophoff, RA; Terwindt, GM; Vergouwe, [...]; vanOmmen, GJB; Hofker, MH; Ferrari, MD; Frants, RR Familial hemiplegic migraine and episodic ataxia type-2 are caused by mutations in the Ca ²⁺ channel gene CACNL1A4. <i>CELL</i> , 87 (3): 543-552 NOV 1 1996	1,122