



Publication Analysis 1999-2005

# Plant Science

Germany is the the leading country in European plant science by publication performance.

Most-cited is research on RNA interference, a field where many felt that the particular achievements of plant scientists were overlooked for last year's medicine Nobel.

Plant scientists are easy to identify, one might think. That's surely true when comparing them to the sometimes rather colourful variety of people gathered under the umbrellas of certain other biodisciplines. Okay, plant scientists do not only work in explicit plant science institutes; you'll find them in biochemistry, genetics and developmental biology institutes as well, although that doesn't matter. Actually, you only have to check which organism each researcher uses for her or his experiments – and you'll easily filter out the plant scientists.

Well, that certainly makes sense. Nevertheless, you might still encounter a problem or two. What to do for example with the structural biologist who particularly likes to pick photosynthetic membrane proteins for his NMR studies? Or the computational biologist who has just co-published a couple of software tools designed for the analysis of plant genome sequences? Are they "plant scientists"?

We said 'no' for two main reasons. Firstly, we think that those people don't place their main research focus on *understanding* plants but rather on understanding proteins or gene structures or on genome analysis as examples. The second, more practical, reason follows directly from this "shift of focus". These researchers usually do not publish the majority of their papers in plant science journals. This means that they want their results to be discussed by another species of bioscientists at first hand – and demonstrates that they don't regard themselves as belonging to the plant science community.

## Understanding plants not proteins

These considerations, however, will show their importance when listing the most-cited authors and papers in European plant science (see table, page 36). They don't have much influence when analysing and comparing the national performances in plant science.

For this latter purpose we took the specialist plant science journals included in the Thomson Scientific "Web of Science" citation database as a data source. Regrettably, we had to exclude from the analysis multidisciplinary journals such as *Nature* and

*Science* because "Web of Science" provides no tools to exclusively extract from them the plant science articles with sufficient reliability. Indeed, the most prominent papers in the field might thus have been omitted from this part of the analysis. However, we believe that their performance in the specialist journals leads to a feasible comparison between countries' productivity in plant science.

Now that the principles are clear, let's take a look at the results. Germany, a country with a particularly rich tradition in plant science, is still on top in Europe. German authors co-signed more than 9,200 articles in plant science journals between 1999 and 2005. These articles in turn gave them the highest overall number of citations in Europe, namely more than 92,000.

## England achieves the highest average value

England in second place, a traditional leader in plant research as well, "only" produced 6,200 articles between 1999 and 2005 – 3,000 less than Germany. However, the gap between the two considerably narrows when comparing citation numbers: more than 80,000 citations for England's plant scientists. Thus, it's clear that England outperforms Germany when it comes to finally calculating the average number of citations per article: England 12.94 versus 9.97 for Germany.

In fact, in this category England achieved the highest value of all European countries, immediately followed by Switzerland (12.80). Behind those two a little gap opens up before the next six countries who still perform with citations per article ratios of more than 10: Scotland (10.82), Wales (10.76), the Netherlands (10.46), Sweden (10.31), France (10.27) and Belgium (10.07).

Moreover, when compared to the analyses of other biomedical research disciplines in earlier issues of *Lab Times*, surprisingly high rankings by overall numbers of citations resulted for Spain (4th), Wales (14th) and the Czech Republic (16th). Italy (7th) comes off worse than usual; Ireland and Turkey this time didn't make it into the top twenty at all.

Altogether European plant scientists held a rather big lead over their US colleagues for the publication period 1999-2005

– at least concerning numbers of publications and citations. US plant scientists co-authored only about 45% fewer articles compared to the 45,000 articles in plant science journals with at least one author working in Europe. At the same time these European papers earned nearly 380,000 citations whereas the US articles came in with almost 270,000. That means, however, that the US plant scientists are in the lead in terms of the average number of citations per article: 10.81 versus a European 8.40.

#### Did the Nobel committee screw plant research?

Let's take a short look at the other four large non-European research nations. Australia, by number of publications is still behind Canada, who outran its North-American colleagues by collecting more citations altogether. In a worldwide chart of nations Japan would rank 2nd behind the USA by number of publications and 4th by number of citations, well ahead of France. Australia and Canada would follow in 6th and 7th place. Finally, China performs quite strongly publishing more articles than England, and 10th worldwide by number of citations.

Back to Europe. Identifying the most-cited European authors and papers always provides a good insight into which top-

## ... and the world

	Citations	Articles	Cit./Art.
<b>Europe</b>	<b>378,471</b>	<b>45,049</b>	<b>8.40</b>
<b>USA</b>	<b>267,164</b>	<b>24,705</b>	<b>10.81</b>
<b>Japan</b>	<b>73,618</b>	<b>11,818</b>	<b>6.23</b>
<b>Australia</b>	<b>40,792</b>	<b>4,896</b>	<b>8.33</b>
<b>Canada</b>	<b>35,791</b>	<b>5,275</b>	<b>6.79</b>
<b>China</b>	<b>25,383</b>	<b>6,786</b>	<b>3.74</b>

ics are "hot" in the field. In plant sciences, one hot topic immediately jumps out: RNA interference, or RNAi. Papers about RNAi in plants rank in 1st and 4th place among the most-cited European plant papers of 1999-2005, and five RNAi-researchers made it into the 30 most-cited plant scientists.

In fact, when last year's Nobel award was announced for the discovery of the mechanisms of RNA interference, there were quite a few complaints that no plant scientist was considered in addition to the two worm researchers Craig Mello and Andrew Fire. The critics argued that the phenomenon had already basically been discovered as homology dependent gene silencing in plants years before the worm studies of Mello and Fire – one of the very first being Marjorie Matzke (8th) and her husband Antonius Matzke 1989 in Salzburg, Austria. "Plants got screwed" was, for example, one of the comments in *Science*. However, one of the plant gene silencing pioneers himself, Richard Jorgensen from Tucson, clarified in the same journal: "Of course, there were also many other very important discoveries in the RNAi field, by researchers working with plants, animals, and fungi, but none of them had the same catalytic impact on biology as did Fire and Mello's key insight and elegant experimentation."

#### Thanks to molecular tools

Anyway, another plant gene silencing pioneer, who had earlier been included with Mello and Fire for other awards (e.g. Wiley Prize 2003, Massry Prize 2005), at least made it to Europe's most-cited plant scientist in our analysis: David Baulcombe of the John Innes Centre's Sainsbury Laboratory in Norwich. In addition, his 1999 paper, in which Baulcombe and his postdoc Andrew Hamilton showed for the first time that the cells themselves in plants produce small interfering RNAs, earned by far the most citations of all European plant science papers.

All in all, the list of the 30 most-cited plant scientists is clearly dominated by plant molecular biologists. The majority of those in turn focus mainly on four fields: mechanisms of plant development, regulation of crop yield and plant productivity, disease resistance and chemical plant communication. Another class includes evolutionary plant scientists like William Martin (26th) and systematicists like Mark Chase (2nd) who today predominantly use comparative molecular methods as well.

That leaves only one species of completely non-molecular biologists among the 30 most-cited plant researchers: the field ecologists, who are represented by Bernhard Schmid from Zurich (12th), Reinhart Ceulemans from Antwerp (17th) and Ernst-Detlef Schulze from Jena (22nd).

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## Europe...

Country	Citations	Articles	Cit./Art.
1. Germany	92,218	9,251	9.97
2. England	80,682	6,234	12.94
3. France	56,807	5,531	10.27
4. Spain	30,963	4,629	6.69
5. Netherlands	29,096	2,781	10.46
6. Switzerland	23,425	1,830	12.80
7. Italy	22,884	3,364	6.80
8. Sweden	19,053	1,848	10.31
9. Belgium	16,460	1,634	10.07
10. Scotland	16,421	1,517	10.82
11. Israel	14,016	1,481	9.46
12. Denmark	12,369	1,290	9.59
13. Austria	8,696	979	8.88
14. Wales	7,521	699	10.76
15. Finland	7,408	850	8.72
16. Czech Rep.	6,623	1,211	5.47
17. Poland	5,802	1,809	3.21
18. Hungary	4,855	700	6.94
19. Norway	4,781	695	6.88
20. Russia	4,755	1,414	3.36

Articles appeared between 1999 and 2005 in plant science journals as listed by Thomson ISI. Their citation numbers were recorded up until December 2006. 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 (EMBO, FEBS etc.), as well as participating in the EU Research Framework Programmes.



## Publication Analysis 1999-2005 – Plant Science

# Most Cited Authors...

	Citations	Articles
1. <b>David Baulcombe</b> , John Innes Ctr Plant Sci Res Norwich	4,760	59
2. <b>Mark W. Chase</b> , Jodrell Lab Royal Bot Gardens Kew Richmond	3,977	129
3. <b>Jonathan D.G. Jones</b> , John Innes Ctr Plant Sci Res Norwich	3,871	74
4. <b>Dirk Inzé</b> , Plant Syst. Biol VIB Ghent Univ.	3,785	141
5. <b>Marc van Montagu</b> , Genetics VIB Ghent Univ.	3,443	140
6. <b>Detlef Weigel</b> , Max Planck Inst. Dev. Biol. Tübingen	3,440	62
7. <b>Gerd Jürgens</b> , Ctr. Mol. Biol. Plants Univ. Tübingen	2,872	61
8. <b>Marjorie A. Matzke</b> , Gregor Mendel Inst. Mol. Plant Biol. Vienna	2,389	47
9. <b>Ian T. Baldwin</b> , MPI Chem. Ecol. Jena	2,352	80
10. <b>Vincent Savolainen</b> , Jodrell Lab Royal Bot Gardens Kew Richmond	2,346	39
11. <b>Thomas Boller</b> , Friedrich Miescher Inst. Basel	2,266	74
12. <b>Bernhard Schmid</b> , Environ. Sci. Univ. Zurich	2,231	86
13. <b>Hervé Vaucheret</b> , Nat. Inst. Agronom. Res. (INRA) Versailles	2,215	30
14. <b>Lothar Willmitzer</b> , Max Planck Inst. Mol. Plant Phys. Golm/Potsdam	2,165	82
15. <b>Christine H. Foyer</b> , Crop Res. Inst. Rothamsted Harpenden	2,121	97
16. <b>Klaus Palme</b> , Inst. Biol. II Univ. Freiburg	2,107	42
17. <b>Reinhart Ceulemans</b> , Plant and Veg. Ecol. Univ. Antwerp	2,069	104
18. <b>Göran Sandberg</b> , Forest Gen. and Plant Physiol. Univ. Umea	2,063	52
19. <b>Thomas Mitchell-Olds</b> , MPI Chem. Ecol. Jena ( <i>until 2005</i> )	2,014	60
20. <b>Steve P. McGrath</b> , Crop Res. Inst. Rothamsted Harpenden	1,976	89
21. <b>Yves van de Peer</b> , Plant Syst. Biol. Univ. Ghent	1,963	63
22. <b>Ernst-D. Schulze</b> , Max Planck Inst. Biogeochem. Jena	1,946	87
23. <b>Oliver Voinnet</b> , Inst. Mol. Biol. Plants CNRS Strasbourg	1,908	21
24. <b>Mark Stitt</b> , Max Planck Inst. Mol. Plant Physiol. Golm/Potsdam	1,834	50
25. <b>Michael F. Fay</b> , Jodrell Lab Royal Bot Gardens Kew Richmond	1,826	45
26. <b>William Martin</b> , Bot. Inst. Univ. Düsseldorf	1,795	72
27. <b>Andrew Hamilton</b> , John Innes Ctr Plant Sci Res Norwich	1,784	8
28. <b>George Coupland</b> , Max Planck Inst. Plant Breeding Res. Cologne	1,776	45
29. <b>Jiri Friml</b> , Ctr. Mol. Biol. Plants Univ. Tübingen	1,774	24
30. <b>Heribert Hirt</b> , Max Perutz Lab. Mol. Biol. Univ. Vienna	1,738	42



Citations of articles published between 1999-2005 were recorded until December 2006. The "most cited papers" had corresponding addresses in Europe or Israel.

## ... and Papers

	Citations
1. <b>Hamilton AJ, Baulcombe DC</b> A species of small antisense RNA in posttranscriptional gene silencing in plants. <i>SCIENCE</i> 286 (5441): 950-952 OCT 29 1999	776
2. <b>Emanuelsson O, Nielsen H, Von Heijne G</b> ChloroP, a neural network-based method for predicting chloroplast transit peptides and their cleavage sites. <i>PROTEIN SCIENCE</i> 8 (5): 978-984 MAY 1999	405
3. <b>Hector A, Schmid B, Beierkuhnlein C, ... , Woodward FI, Yachi S, Lawton JH</b> Plant diversity and productivity experiments in European grasslands. <i>SCIENCE</i> 286 (5442): 1123-1127 NOV 5 1999	378
4. <b>Dalmay T, Hamilton A, Rudd S, Angell S, Baulcombe DC</b> An RNA-Dependent RNA polymerase gene in <i>Arabidopsis</i> is required for posttranscriptional gene silencing mediated by a transgene but not by a virus. <i>CELL</i> 101 (5): 543-553 MAY 26 2000	377
5. <b>Ye XD, Al-Babili S, Klott A, Zhang J, Lucca P, Beyer P, Potrykus I</b> Engineering the provitamin A (beta-carotene) biosynthetic pathway into (carotenoid-free) rice endosperm. <i>SCIENCE</i> 287 (5451): 303-305 JAN 14 2000	370