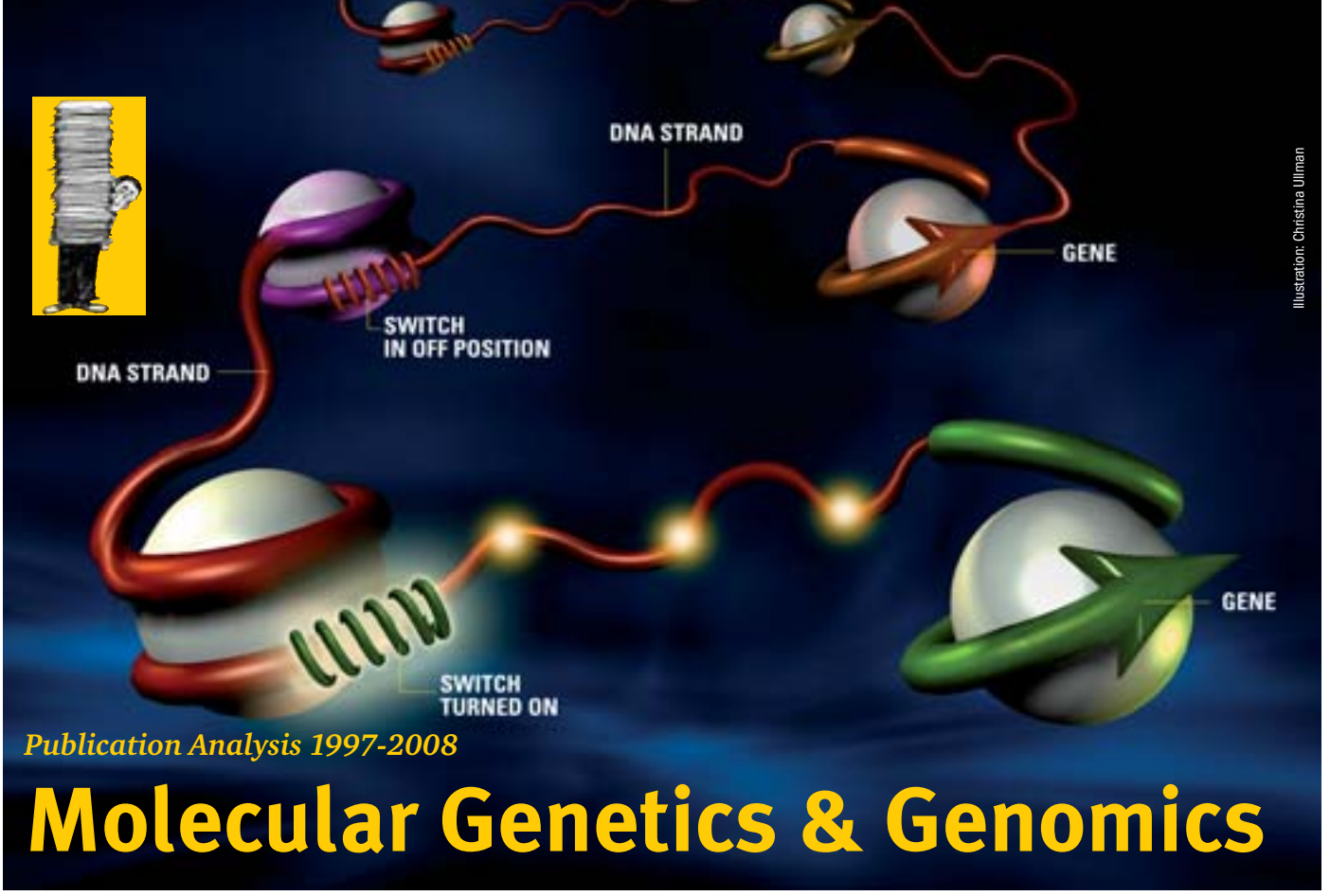

Publication Analysis 1997-2008

Molecular Genetics & Genomics

Under the premise of a "narrow" definition of the field, Germany and England co-dominated European molecular genetics/genomics. The most frequently citated sub-fields were bioinformatical genomics, epigenetics, RNA biology and DNA repair.

First of all, a little science history (you'll soon see why). As is well known, in the 1950s genetics went molecular – and did not just become molecular *genetics* but rather molecular *biology*. In 1963, however, Sydney Brenner wrote in his famous letter to Max Perutz: "[...] I have long felt that the future of molecular biology lies in the extension of research to other fields of biology, notably development and the nervous system." He appeared not to be alone with this view and, as a consequence, along with Brenner many of the leading molecular biologists from the classical period redirected their research agendas, utilising the newly developed molecular techniques to investigate unsolved problems in other fields. This way, in the following years, molecular biology rapidly extended far beyond the borders of genetics and finally became a sort of biological meta-discipline.

In the mid 1980s, molecular biology was taken up by another stream: genomics. And once again, science history repeated itself. As "obtaining genomic information" has since become increasingly easier, the subsequent successes of genomics have encouraged a number of disciplines to also "go genomic". Hence, genomics – as molecular biology before – also transformed into a biological meta-discipline.

Bursting boundaries

However, as more and more fields "have gone genomic", genomics itself has also been supplemented by so-called post-genomics. A general trend has been to focus beyond the mere sequence of As, Cs, Ts, and Gs, concentrating instead on the mechanisms involved in generating such a variety of protein products from a relatively small number of protein-coding regions in the genome. Today, such post-genomics mainly utilise the sequence information provided by genomics but then situates it in a systems-level analysis of all the other entities and activities involved in the classical genetic mechanisms of transcription, regulation and expression. That's where so-called computational biology and systems biology enter research into basic *genetic* problems.

Given that development, it is not easy to answer the question what "molecular genetics & genomics" today actually is – and, in particular, what is it in the context of our publication analysis of the field? It is obvious that, as for example science historian Robert Olby put it, a "wide" definition can be distinguished from a "narrow" definition of the field. The wide definition includes all fields, into which molecular biology has entered as an experimental and theoretical paradigm. The "narrow" definition, on the other hand, still tries to maintain the status as an explicit biological discipline that can be distinguished from other disciplines by distinct key concepts and questions. German science historian Hans Jörg Rheinberger, for example, recently expressed such an "umbrella question" of molecular genetics and genomics as "research into the mechanisms of the flow of genetic information and its molecular details".

In our publication analysis "molecular genetics and genomics", we therefore tried to stick to this "narrow" definition and to distinguish thoroughly, whether genetic questions really are at the core of the respective research or whether the given topics are actually more relevant to other fields as, for example, developmental biology or neuroscience.

In addition, those conceptual difficulties were joined by the methodological ones that are inherent to this kind of publication analysis. Certainly, many "top papers" on "molecular genetics and genomics" from the period 1997-2008 appeared in multidisciplinary science journals like *Nature* or *Science*. Nevertheless, at least for the comparison of the individual countries (see tables, p. 43), we had to restrict the publication analysis to the 116 expert journals selected from the subject categories "Biochemistry & Molecular Biology" and "Genetics & Heredity" of Thomson Reuter's database Web of Science, which was used for this analysis. The rea-

son is a technical one: Web of Science doesn't provide any sufficiently reliable tools to automatically extract relevant "molecular genetics and genomics" articles from the multidisciplinary journals.

Of course, as a result, some of the most prominent papers in the field have been omitted from the "country part" of the analysis. 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 "molecular genetics and genomics" research.

On the contrary, rankings of the most-cited researchers and papers (see tables, p. 48) could be analysed from publications in all journals.

Now, finally, a few words about the results. The top two places in the European nations list are occupied – as usual – by Germany and England. This time, Germany slightly trumped their English colleagues: almost 16,600 vs. 15,200 articles between 1997 and 2008, with at least one co-author listed from the respective country. In terms of citations, however, England practically equalled Germany: both came in with about 630,000 citations of their 1997-2008 articles to-date.

France follows at a considerable distance to the top two. However, an even wider gap exits before Italy (overall articles) and Switzerland (citations) finally show up.

And who achieved the highest citations-per-article-ratio? Small but impressive Ireland. On average, each article with at least one Irish co-author collected more than 61 citations to-date. The next-best countries in this category were Switzerland (44.4) and England (41.1).

The pan-European overall result, however, was clearly topped by the US: 16 percent more articles co-signed by US researchers, which altogether have been cited about 37 percent more frequently to-date. Hence, the US researchers achieved an average citation rate of 36.2 in contrast to 30.6 of their European counterparts.

Becoming an information science

When turning to the lists of the most-cited heads and papers of the years 1997-2008, one thing immediately becomes apparent: genetics/genomics, which in a certain sense deal with information processing in living organisms, have indeed grown into a kind of information science, more recently. Four of the five most-cited papers with European correspondence addresses are about the bioinformatical analysis of genetic/genomic data. Similarly, eleven of the 30 most-cited scientists of the field more or less come from "bioinformatical genomics". To top even that, places one (Peer Bork, Heidelberg) to six (Julie Thompson, Strasbourg) were exclusively occupied by them.

Another striking feature is that quite a number of the top 30 researchers doing basic genetic research work at cancer research centres. Examples are Manel Esteller (Madrid, 10th), Tony Kouzarides (Cambridge, 12th) and Jiri Bartek (Copenhagen, 17th).

Apart from (bioinformatical) genome analysis, what other issues are represented by the most-cited researchers? According to their research topics, the following "top sub-fields" currently appear to have high potential for attracting many citations: epigenetics (7 researchers), DNA repair (4), RNA function (4), transcription control (2) and chromosome structure (2).

And as a last side note, only two of the top 30 (David Baulcombe, 21st; and Detlef Weigel, 23th) mainly work with plants.

Ralf Neumann

Europe...

Country	Citations	Articles	Cit./Art.
1. Germany	633,355	16,560	38.2
2. England	625,162	15,193	41.1
3. France	454,473	12,985	35.0
4. Switzerland	197,710	4,451	44.4
5. Italy	187,440	6,879	27.3
6. Netherlands	181,204	4,795	37.8
7. Scotland	131,613	3,417	38.5
8. Sweden	127,800	3,573	35.8
9. Spain	122,388	5,093	24.0
10. Israel	88,340	2,325	38.0
11. Belgium	81,121	2,167	37.4
12. Denmark	70,234	2,002	35.1
13. Austria	67,289	1,738	38.7
14. Finland	51,573	1,554	33.2
15. Russia	51,203	6,109	8.4
16. Ireland	36,925	601	61.4
17. Norway	31,935	1,071	29.8
18. Poland	24,624	1,533	16.1
19. Czech Rep.	20,510	1,097	18.7
20. Hungary	19,842	762	26.0

Articles appearing between 1997 and 2008 in selected 'Molecular Biology' and 'Genetics' journals as listed by Thomson Reuter's *Web of Science*. The citation numbers are accurate as of July 2010. 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			30.6
USA			36.2
Japan			27.2
Canada			30.6
Australia			30.8
China			14.0
South Kore			14.1

Publication Analysis 1997-2008 – **Molecular Genetics & Genomics**

Most Cited Authors...

		Citations	Articles
1.	**Peer Bork**, European Mol. Biol. Lab. Heidelberg	38,057	243
2.	**Jean Weissenbach**, Genomics Inst. Genoscope Evry/F	26,612	158
3.	**Ewan Birney**, EMBL-European Bioinformatics Inst. (EBI) Hinxton/UK	25,961	90
4.	**Desmond G. Higgins**, Conway Inst. Univ. Coll. Dublin	24,113	42
5.	**Richard Durbin**, Wellcome Trust Sanger Inst. Cambridge	22,346	72
6.	**Julie D. Thompson**, Inst. Genet. and Cell. & Mol. Biol. Illkirch/F	22,294	22
7.	**Hans Lehrach**, Max Planck Inst. Mol. Genet. Berlin	21,025	251
8.	**Pierre Chambon**, Inst. Genet. and Cell. & Mol. Biol. Illkirch/F	19,225	306
9.	**Alex Bateman**, Wellcome Trust Sanger Inst. Cambridge	19,152	60
10.	**Manel Esteller**, Spanish Natl. Canc. Ctr. (CNIO) in Madrid	17,735	188
11.	**Frederic Plewniak**, Inst. Genet. and Cell. & Mol. Biol. Illkirch/F	17,560	12
12.	**Tony Kouzarides**, Gurdon Inst. Univ. Cambridge	15,115	92
13.	**Thomas Jenuwein**, Max Planck-Inst. Immunbiol. Freiburg	14,785	76
14.	**Steve P. Jackson**, Gurdon Inst. Univ. Cambridge	14,729	140
15.	**Michael Ashburner**, Dept. Genet. Univ. Cambridge	13,922	60
16.	**Erwin F. Wagner**, Spanish Natl. Canc. Res. Ctr. (CNIO) Madrid	13,279	165
17.	**Jiri Bartek**, Ctr. Genotoxic Stress Res. Danish Canc. Soc. Copenhagen	13,024	151
18.	**Kim Nasmyth**, Biochem. Univ. Oxford	12,668	95
19.	**Jan H.J. Hoeijmakers**, Genet. Erasmus Univ. Med. Ctr. Rotterdam	11,995	137
20.	**David Baulcombe**, Plant Sci. Univ. Cambridge	11,111	91
21.	**William C. Earnshaw**, Wellcome Trust Ctr. Cell Biol. Univ. Edinburgh	11,009	112
22.	**Detlef Weigel**, Max Planck Inst. Dev. Biol. Tübingen	10,380	123
23.	**Ronald H.A. Plasterk**, Hubrecht Lab. Netherl. Inst. Dev. Biol. Utrecht	9,836	121
24.	**Jiri Lukas**, Ctr. Genotoxic Stress Res. Danish Canc. Soc. Copenhagen	9,604	95
25.	**Adrian Bird**, Wellcome Trust Ctr. Cell Biol. Univ. Edinburgh	9,466	70
26.	**Wolf Reik**, Lab. Dev. Biol. & Imprinting Babraham Inst. Cambridge	9,432	85
27.	**Hans W. Mewes**, Genome Oriented Bioinform. Tech Univ. Munich	9,205	103
28.	**María A. Blasco**, Spanish Natl. Canc. Res. Ctr. (CNIO) Madrid	8,970	118
29.	**Elisa Izaurralde**, Max-Planck-Inst. Dev. Biol. Tübingen	7,842	79
30.	**Bertrand Seraphin**, Inst. Genet. and Cell. & Mol. Biol. Illkirch/F	7,691	74

Citations of articles published between 1997 and 2008 were recorded up until June 2010 using the *Web of Science* database from Thomson Reuters. The "most cited papers" had correspondence addresses in Europe or Israel.

... and Papers

	Citations
1. Thompson, JD; Gibson, TJ; Plewniak, F; Jeanmougin, F; Higgins, DG The CLUSTAL_X windows interface: flexible strategies for multiple sequence alignment aided by quality analysis tools. *NUCLEIC ACIDS RESEARCH, 25 (24): 4876-4882 DEC 15 1997*	16,693
2. Elbashir, SM; Harborth, J; Lendeckel, W; Yalcin, A; Weber, K; Tuschl, T Duplexes of 21-nucleotide RNAs mediate RNA interference in cultured mammalian cells. *NATURE, 411 (6836): 494-498 MAY 24 2001*	4,230
3. Pritchard, JK; Stephens, M; Donnelly, P Inference of population structure using multilocus genotype data. *GENETICS, 155 (2): 945-959 JUN 2000*	3,585
4. Pfaffl, MW A new mathematical model for relative quantification in real-time RT-PCR. *NUCLEIC ACIDS RESEARCH, 29 (9): Art. No. e45 MAY 1 2001*	2,764
5. Chenna, R; Sugawara, H; Koike, T; Lopez, R; Gibson, TJ; Higgins, DG; Thompson, JD Multiple sequence alignment with the Clustal series of programs. *NUCLEIC ACIDS RESEARCH, 31 (13): 3497-3500 JUL 1 2003*	1,759