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A bibliometric analysis of pharmacology and pharmacy journals: Scopus versus Web of Science

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Abstract

Our study aims at examining the suitability of Scopus for bibliometric analyses in comparison with the Web of Science (WOS). In particular we want to explore if the outcome of bibliometric analyses differs between Scopus and WOS and, if yes, in which aspects. In doing so we focus on the following questions: To which extent are high impact JCR (Journal Citation Reports) journals covered by Scopus? Are the impact factor and the immediacy index usually lower for a JCR journal than the corresponding indicators computed in Scopus? Are there high impact journals not covered by the JCR? And, finally, how reliable are the data in these two databases?

Since journal indicators like the impact factor and the immediacy index differ among disciplines, we analysed only journals from the subject pharmacy and pharmaceutical sciences. Focussing on one subject category offers furthermore the possibility to go into more detail when comparing the databases.

The findings of our study can be summarized as follows:

- **Each top-100 JCR pharmacy journal was covered by Scopus.**
- **The impact factor was higher for 82 and the immediacy index greater for 78 journals in Scopus in 2005. Pharmacy journals with a high impact factor in the JCR usually have a high impact factor in Scopus.**
- **Several high but no top-impact journal could be identified in Scopus which were not reported in JCR.**
- **The two databases differed in the number of articles within a tolerable margin of deviation for most journals.**

Keywords: bibliometric analysis; Scopus; Web of Science; Journal Citation Reports; impact factor; immediacy index; comparison of databases; data reliability

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1. Introduction

In 2002, David Adam [1] reported in his article in Nature that the Institute for Scientific Information (ISI) was the undisputed king of the counting houses and the indispensable instrument for scientometric purposes and especially for citation analysis. Adam also foresaw that new software scanning articles, extracting references and automatically generating citation indices may challenge ISI's monopoly shortly after. Late in November 2004 Scopus, a research tool from Elsevier Publishing Company, was commercially launched and claimed to be the "world's largest abstract and indexing database" [2].

The Scopus Web site [3] provides detailed information about the database which has enlisted the collaboration of over 300 researchers world-wide at 21 different institutions for extensive product testing and feedback. In the last two years the product has improved constantly. Scopus has emerged as a dependable research tool providing a user friendly search interface. Furthermore, and even more important, Scopus offers reliable and easy to use citation searching, a feature that until recently has been the exclusive domain of ISI. Actually its new citation tracker has been emulated by its competitor, the Web of Science (WOS), which illustrates the importance and impact this product has gained by now.

There are already several publications which provide more or less extensive evaluations of Scopus with particular emphasis on a comparison with the Web of Science (e. g. Deis & Goodman [4-5], Gorraiz [6]; Jacso [7], LaGuardia [8], Pipp [9], Schneider [10], Wildner [11]). Just recently, a comprehensive study has been conducted at Utrecht University Library comparing Scopus, Web of Science and Google Scholar with regards to coverage and functionality [12]. However there are only a few studies which focused on the suitability of these citation databases for scientometric analyses.

In their study which analysed citation counts of the Journal of the American Society for Information Science and Technology (JASIST), Bauer and Bakkalbasi [13] found that the Web of Science provided more citation counts to 1985 articles, although this could not be tested statistically. For JASIST articles published in 2000, there was no significant difference between Web of Science and Scopus. Similar results are reported by Jacso [14]. In a recent publication, Ball and Tunger [15] compare the two databases with regard to the number of articles covered, the areas of interest, the number of non-cited articles, and the number of citations of a set of articles. The authors conclude that the outcome of bibliometric analyses may be quite different depending on the database chosen. The identification of such differences was also at the core of the article by Klavans and Boyack [16] who investigated if Scopus and Web of Science generate maps representing the structure of science that are structurally equivalent.

2. Research questions and methodology

As already mentioned above, Scopus has emerged as a reliable and easy to use research tool for citation searching. However when it comes up to bibliometric analyses, it seems that Scopus did not yet break the monopoly of its competitor. For this reason, our study aims at examining the suitability of Scopus for bibliometric analyses in comparison with the Web of Science. In particular we want to investigate Scopus and the Web of Science with regard to the following issues:

1. To which extent are high impact JCR (Journal Citation Reports) journals covered by Scopus? Are there journals with a high impact factor which are not included in Scopus?
2. Are the impact factor and the immediacy index usually lower for a JCR journal than the corresponding indicators computed for that journal in the Scopus database?
3. Are there high impact journals not considered by the JCR?
4. How reliable are the data in these two databases? Do the numbers of research and review articles match up in Scopus and JCR?

Since journal indicators like the impact factor and the immediacy index differ among disciplines, we investigated only journals from the subject pharmacy and pharmaceutical sciences. Focussing on one subject

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category offers furthermore the possibility to go into more detail when comparing the databases. Though we analysed only pharma journals, our study has also broader implications. Besides revealing all problems involved when comparing two citation databases, it explores the appropriateness of Scopus for bibliometric analyses.

Our original journal sample was derived from the JCR of the year 2005, subject category "pharmacology & pharmacy". We downloaded the data (impact factor, immediacy index and number of articles published in the year 2005) for the top-100 journals ranked by impact factor and complemented these data with the number of 2003 and 2004 articles (document types article and review) and the number of 2005 citations to 2003, 2004 and 2005 articles.

Since Scopus does not provide any citation statistics comparable to the JCR, we had to retrieve the necessary data from this database manually. But since Scopus has a sophisticated search interface, data collection could be performed with relatively little efforts. When computing the impact factor [for a basic introduction please see 17] and the immediacy index for the Scopus journals, we used the same formulas as in the JCR. Attention has to be paid to the fact that the impact factor (and the immediacy index) only considers research and review articles. As a consequence, we limited our search statements to these document types. In order to determine if there are high impact pharma journals which are not included in the JCR, we used journal lists provided by Science Direct and Subito.

All data were collected in November 2006.

3. Findings

The presentation of the results follows the research questions outlined above.

3.1. Coverage of JCR high impact pharmacology and pharmacy journals in Scopus

A comparison of journals from a certain subject category between the two databases is not without problems for various reasons. Usually different databases use different classification systems. While the relevant subject category is "pharmacology, toxicology and pharmaceutics" in Scopus, the Web of Science uses two categories ("pharmacology & pharmacy" and "toxicology"). Furthermore, the different size of the databases must be considered. While there were 193 journals included in the subject category "pharmacology & pharmacy" (and 75 partly overlapping "toxicology" journals) in the JCR, Scopus covered altogether[2] 266 active titles. (This confirms previous studies [e.g. 2, 7, 12] according to which Scopus has a strong concentration on health and life sciences.) As a consequence, the coverage of JCR journals in Scopus is broader than contrariwise. It was not expected, however, that each of the top-100 JCR pharmacy journals (ranked by impact factor) was included in Scopus.

Finally the indexing procedure is not consistent in different databases. 96 journals were indexed as pharma journals in both citation indices. The remaining four journals were assigned to other categories in Scopus ("medicine" and "biochemistry, genetics and molecular biology").

[2] I.e. also pharma journals in subcategories (e.g. "pharmacology (medical)") of other classes (e.g."medicine (all)") were considered.

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Table 1. Top 100 JCR (2005) journals (subject category "pharmacology & pharmacy"): impact factor and corresponding values computed in Scopus

Rank		Abbrev. journal title	Impact factor			Rank		Abbrev. journal title	Impact factor		
JCR	Scopus		JCR	Scopus	Diff(%)	JCR	Scopus		JCR	Scopus	Diff(%)
1	1	Annu Rev Pharmacol	19.833	20.813	4.9%	51	50	Brit J Clin Pharmaco	2.777	3.083	**11.0%**
2	2	Nat Rev Drug Discov	18.775	17.886	*5.0%*	52	66	Behav Pharmacol	2.773	2.646	4.8%
3	5	Rev Physiol Bioch P	17.053	9.824	***73.6%***	53	48	Prog Neuro-Psychoph	2.769	3.221	**16.3%**
4	3	Pharmacol Rev	15.689	15.958	1.7%	54	52	Pharm Res	2.752	3.014	9.5%
5	4	Trends Pharmacol Sci	10.372	10.507	1.3%	55	47	Int Clin Psychopharm	2.745	3.287	**19.7%**
6	6	Pharmacol Therapeut	8.357	9.086	8.7%	56	49	Ther Drug Monit	2.718	3.105	**14.2%**
7	7	Med Res Rev	7.964	8.636	8.4%	57	57	Pharmacopsychiatry	2.620	2.846	8.6%
8	18	Drug Discov Today	7.755	5.418	***43.1%***	58	62	Toxicology	2.584	2.711	4.9%
9	9	Clin Pharmacol Ther	7.526	7.772	3.3%	59	74	Neurotoxicology	2.576	2.528	1.9%
10	8	Adv Drug Deliver Rev	7.189	8.144	**13.3%**	60	56	Eur J Pharm	2.525	2.876	13.9%
11	10	Drug Resist Update	6.172	7.500	**21.5%**	61	73	Comb Chem High T	2.518	2.557	1.6%
12	11	Pharmacogenetics	5.882	6.480	**10.2%**	62	58	Life Sci	2.512	2.806	**11.7%**
13	15	Curr Drug Metab	5.416	5.805	7.2%	63	61	Eur J Pharmacol	2.477	2.733	**10.3%**
14	17	Neuropsychopharmacol	5.369	5.518	2.8%	64	64	Expert Opin Ther Tar	2.458	2.657	8.1%
15	13	Curr Opin Pharmacol	5.366	5.979	**11.4%**	65	63	Int J Antimicrob Ag	2.428	2.687	**10.7%**
16	32	Antivir Ther	5.286	4.148	***27.4%***	66	100	AAPS Pharmsci	2.417	0.983	***145.8%***
17	12	Clin Pharmacokinet	5.195	6.355	**22.3%**	67	67	Invest New Drug	2.417	2.646	9.5%
18	36	Drug Metab Rev	5.153	3.905	***32.0%***	68	69	Eur J Pharm SCI	2.347	2.593	**10.5%**
19	14	J Clin Psychopharm	5.145	5.812	**13.0%**	69	54	J Child Adol Psychop	2.307	2.925	**26.8%**
20	21	Curr Med Chem	4.904	5.210	6.2%	70	70	Eur J Clin Pharmacol	2.298	2.578	**12.2%**
21	20	Curr Pharm Design	4.829	5.297	9.7%	71	80	J Nat Prod	2.267	2.380	5.0%
22	19	Mol Pharmacol	4.612	5.326	**15.5%**	72	86	Toxicon	2.255	2.272	0.7%
23	16	Drugs	4.466	5.637	**26.2%**	73	85	Control Clin Trials	2.238	2.275	1.7%
24	26	Curr Drug Targets	4.398	4.363	*0.8%*	74	68	J Pharm Sci-US	2.237	2.635	**17.8%**
25	22	Antimicrob Agents Ch	4.379	5.008	**14.4%**	75	84	Cancer Chemoth	2.235	2.278	1.9%
26	27	J Pharmacol Exp Ther	4.098	4.345	6.0%	76	81	Peptides	2.231	2.348	5.2%
27	31	Drug Metab Dispos	4.015	4.157	3.5%	77	65	Pharmacoeconomics	2.198	2.651	**20.6%**
28	24	Psychopharmacology	3.994	4.438	**11.1%**	78	99	Drug News Perspect	2.159	1.677	***28.7%***
29	34	Pharmacogenomics J	3.989	4.010	0.5%	79	77	Int J Pharm	2.156	2.461	**14.1%**
30	42	Int J Neuropsychoph	3.981	3.570	***11.5%***	80	92	Cardiovasc Drug Rev	2.122	2.082	*1.9%*
31	25	J Antimicrob Chemoth	3.886	4.402	**13.3%**	81	89	N-S Arch Pharmacol	2.098	2.178	3.8%
32	33	Curr Opin Drug Disc	3.778	4.093	8.3%	82	71	Pharmacol Res	2.096	2.574	**22.8%**
33	29	Crit Rev Ther Drug	3.696	4.280	**15.8%**	83	94	Chirality	2.072	2.018	*2.7%*
34	30	J Control Release	3.696	4.217	**14.1%**	84	55	Drug Aging	2.072	2.923	**41.1%**
35	28	CNS Drugs	3.671	4.318	**17.6%**	85	72	Microb Drug Resist	2.072	2.559	**23.5%**
36	35	Neuropharmacology	3.637	3.958	8.8%	86	79	Biomed Pharmacother	2.069	2.386	**15.3%**
37	59	Pharmacogenomics	3.623	2.794	***29.7%***	87	87	Assay Drug Dev	2.060	2.198	6.7%
38	38	Biochem Pharmacol	3.617	3.829	5.9%	88	82	J Pharm Pharm Sci	2.042	2.324	**13.8%**
39	60	Eur Neuropsychopharm	3.510	2.760	***27.2%***	89	88	Int Immunopharmacol	2.008	2.183	8.7%
40	23	Aliment Pharm Therap	3.434	4.891	**42.4%**	90	91	Pharmacol Biochem	1.970	2.102	6.7%
41	40	Int J Immunopath Ph	3.418	3.769	**10.3%**	91	90	Chem-Biol Interact	1.968	2.141	8.8%
42	43	Brit J Pharmacol	3.410	3.546	4.0%	92	97	Exp Clin	1.952	1.882	*3.7%*
43	41	Antivir Res	3.406	3.703	8.7%	93	75	Pharmacotherapy	1.920	2.486	**29.5%**
44	53	CNS Drug Rev	3.353	2.953	***13.5%***	94	96	Anti-Cancer Drug	1.907	1.977	3.6%
45	45	Expert Opin Inv Drug	3.267	3.479	6.5%	95	76	Clin Neuropharmacol	1.890	2.466	**30.5%**
46	37	Drug Safety	3.211	3.885	**21.0%**	96	93	Hum Psychopharm	1.890	2.025	7.2%
47	51	J Psychopharmacol	3.178	3.037	*4.6%*	97	95	J Pharmaceut Biomed	1.889	1.984	5.0%
48	46	Toxicol Appl Pharm	3.148	3.340	6.1%	98	78	Ann Pharmacother	1.837	2.420	**31.8%**
49	39	Clin Ther	3.030	3.776	**24.6%**	99	98	Qsar Comb Sci	1.826	1.850	1.3%
50	44	J Clin Pharmacol	2.889	3.514	**21.6%**	100	83	Expert Opin	1.823	2.300	**26.2%**

Italics: higher values in JCR; **bold**: impact factor differs more than 10%

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3.2. Differences in impact factor and immediacy index

Since there are more journals included in Scopus than in WOS, a journal in Scopus has a higher chance to get cited in general. Therefore the values for the impact factor and the immediacy index should also be higher in Scopus. This assumption turned out to be true for most journals in our journal sample. The impact factor was higher for 82 journals in Scopus, 18 journals had a higher impact factor in the JCR. Similarly the immediacy index of 78 journals had higher values in Scopus. As can be seen in Table 1, a journal with a high impact factor in the JCR usually has a high impact factor in Scopus, and vice versa. This goes along with the correlation (Pearson's r=0.96) of the impact factors of the top-100 pharma journals in the JCR and those computed for them in Scopus.

The size of the differences (in %) between the impact factor values follows a skewed distribution (see Table 2). For most journals, the difference is relatively small (median = 10.3%). Yet two journals ("Reviews of Physiology Biochemistry and Pharmacology" and "AAPS Pharmsci") attracted our attention because of their remarkable discrepancies of 74 and 146 percent. A first analysis shows that these big differences are not only caused by different citation frequencies but also by high deviations in the numbers of articles. In order to identify the reasons for these differences, we will go into deeper analysis in the following sub-section (reliability of data).

Table 2. Distribution of the % differences between Scopus and JCR in the impact factor, immediacy index, number of articles in 2003, 2004 and 2005, and the number of 2005 citations to articles from those years (basis for comparison: top-100 JCR pharma journals ranked by impact factor)

	Impact factor	2003 articles	2004 articles	2005 citations to			2005 articles	Immediacy index
				03'art.	04'art.	05'art.		
Differences between Scopus and JCR								
0-5%	25	71	68	21	15	6	66	7
5-10%	23	10	11	28	20	7	10	8
10-20%	28	7	11	32	35	20	10	24
20-30%	16	7	5	13	18	25	2	25
30-50%	6	2	2	5	11	24	5	19
>=50%	2	3	3	1	1	16	4	14
Total	100	100	100	100	100	98	97	97
Median (of % differences)	10.3%	2.1%	2.1%	10.5%	14.4%	24.5%	1.6%	23.4%
No. of journals with greater values in Scopus	82	65	65	86	94	86	66	78
No. of journals with greater values in JCR	18	14	17	13	6	10	11	18

Table 2 also confirms the original assumption that higher citations in Scopus, which are generated by more (pharma) journals in this database, are the main cause for the higher impact factor values. The median of the percentage differences between Scopus and the JCR in the impact factor (10.3 %) is similar to those in the 2005 citations to articles published in 2003 (10.5 %) and 2004 (14.4 %). (Hence, it would be worth considering to normalize the impact factor values in order to allow a "fair" comparison.)

The higher differences in the immediacy index (median = 23.4 %) are also mainly due to greater deviations in the number of citations which articles published in 2005 have received in the same year (median = 24.5 %). However, it must be taken into account that, because the number of citations in the year in which these articles were published is low in general, already small deviations in the absolute numbers can show high percentage effects. As was pointed out by one of the referees, "Molecular Pharmacology" is an extreme example. The reason

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for the huge difference in the immediacy index for this journal (nearly 8800% - see Table 3) is due to an error in the JCR. While a search in WOS showed 413 citations in the year 2005 to articles published in the same year, the JCR lists only 6 citations. As a consequence, the immediacy index ought to be corrected to 0.93 in the JCR resulting in a much smaller difference in comparison with the corresponding value computed in Scopus.

Table 3. Top 50 JCR (2005) journals (subject category "pharmacology & pharmacy") ranked by impact factor: immediacy index and corresponding values computed in Scopus

Rank JCR	Abbrev. journal title	Immediacy index			Rank JCR	Abbrev. journal title	Immediacy index		
		JCR	Scopus	Diff(%)			JCR	Scopus	Diff(%)
1	Annu Rev Pharmacol	5.793	7.172	23.8%	26	J Pharmacol Exp Ther	0.891	1.072	20.3%
2	Nat Rev Drug Discov	3.364	2.574	***30.7%***	27	Drug Metab Dispos	0.733	0.787	7.4%
3	Rev Physiol Bioch P	0.214	0.600	**180.4%**	28	Psychopharmacology	0.4	0.768	**92.0%**
4	Pharmacol Rev	1.586	1.724	8.7%	29	Pharmacogenomics J	1.136	1.277	12.4%
5	Trends Pharmacol Sci	1.951	2.054	5.3%	30	Int J Neuropsychoph	0.912	1.103	21.0%
6	Pharmacol Therapeut	1	1.193	19.3%	31	J Antimicrob Chemoth	0.749	0.888	18.5%
7	Med Res Rev	1.552	1.862	20.0%	32	Curr Opin Drug Disc	0.662	0.848	28.2%
8	Drug Discov Today	1.125	1.287	14.4%	33	Crit Rev Ther Drug	0.333	0.545	**63.8%**
9	Clin Pharmacol Ther	1.689	1.243	***35.9%***	34	J Control Release	0.429	0.479	11.7%
10	Adv Drug Deliver Rev	1.176	1.520	29.3%	35	CNS Drugs	0.736	1.000	**35.9%**
11	Drug Resist Update	0.227	0.556	**144.7%**	36	Neuropharmacology	0.552	0.692	25.4%
12	Pharmacogenetics	-	-	-	37	Pharmacogenomics	0.444	0.380	*16.9%*
13	Curr Drug Metab	0.425	0.500	17.6%	38	Biochem Pharmacol	0.489	0.556	13.7%
14	Neuropsychopharmac	1.181	1.421	20.3%	39	Eur Neuropsychopharm	1.215	1.488	22.5%
15	Curr Opin Pharmacol	0.854	1.178	**37.9%**	40	Aliment Pharm Therap	0.578	0.732	26.6%
16	Antivir Ther	0.642	0.626	*2.6%*	41	Int J Immunopath Ph	0.341	0.358	5.0%
17	Clin Pharmacokinet	0.723	1.096	**51.6%**	42	Brit J Pharmacol	0.541	0.646	19.5%
18	Drug Metab Rev	0.55	0.476	*15.5%*	43	Antivir Res	0.473	0.627	**32.5%**
19	J Clin Psychopharm	0.824	1.022	24.0%	44	CNS Drug Rev	0.235	0.222	*5.8%*
20	Curr Med Chem	0.542	0.605	11.5%	45	Expert Opin Inv Drug	0.354	0.504	**42.3%**
21	Curr Pharm Design	1.194	1.418	18.7%	46	Drug Safety	0.646	0.938	**45.2%**
22	Mol Pharmacol	0.014	1.245	**8796%**	47	J Psychopharmacol	0.434	0.500	15.2%
23	Drugs	0.677	0.952	**40.6%**	48	Toxicol Appl Pharm	0.506	0.487	*3.9%*
24	Curr Drug Targets	0.305	0.463	**51.9%**	49	Clin Ther	0.241	0.325	**35.0%**
25	Antimicrob Agents Ch	0.82	0.984	20.0%	50	J Clin Pharmacol	0.578	0.711	23.1%

Italics: higher values in JCR; **bold**: immediacy index differs more than 30%

3.3. Reliability of data

Contrary to the citations received, there should be only small differences in the number of articles between the two databases. Since Pipp [9, p. 13] reported differences in the provision of document types between the two databases which may strongly affect the number of retrieved records, we considered only articles and review articles. As can be seen in Table 2, the values for the median of the percentage differences are between 1.6 and 2.1% in the three years. The difference in the number of research and review articles is below 5% for two thirds of all journals in each year. Nevertheless, we computed a wider difference of at least 10 percent for one fifth of all journals. There were even a few journals in each year, in which the article counts differed more than 50% (2003: "Reviews of Physiology Biochemistry and Pharmacology", "Pharmacogenomics", "Drug Discovery Today", 2004: "Reviews of Physiology, Biochemistry and Pharmacology", "Drug News & Perspectives", "AAPS Pharmsci", 2005: "Nature Reviews Drug Discovery", "CNS Drug Reviews", "European Journal of Pharmaceutical Sciences", "Drug News & Perspectives"). This raises severe questions with regard to data quality.

Table 4: "Reviews of Physiology, Biochemistry and Pharmacology": number of review articles according to journal, JCR, WOS, and Scopus

	2003	*2004*	*2005*
No. of articles (data collected from journal volumes)	20	14	10
No. of articles indexed in			
JCR	8	11	14
Web of Science	8	11	21
Scopus	20	14	10

In the following, we go into more details about the discrepancies of the two journals identified in the previous section. As is revealed by Table 4, the article counts in Scopus are accordant with the real values we collected for "Reviews of Physiology, Biochemistry and Pharmacology". However, there are big deviations in the article numbers for this hybrid serial in comparison with the Web of Science. The main reason for this mismatch might be the irregular publication of this serial. Accordingly, a few volumes were not indexed in the proper publication year in WOS. As can also be seen in Table 4, there are again data inconsistencies between JCR and WOS for the year 2005.

Table 5: "AAPS Pharmsci" and "AAPS Journal": number of articles and review articles according to journal homepage, JCR, WOS, and Scopus

	2003	*2004*		*2005*
	AAPS PharmSCI	AAPS PharmSCI	AAPS J	AAPS J
No. of articles (data collected from journal homepage)	32	14	19	83
No. of articles indexed in				
JCR	22	14	20	83
Web of Science	31	14	20	83
Scopus	33	19	18	76 (1)

For the electronic journal "AAPS PharmSCI" (see Table 5) the JCR article data of the year 2003, which are used for the calculation of the impact factor, are again erroneous (22 instead of 32 articles) and not consistent with the WOS figures (31 articles). However, the indexing in JCR and WOS is nearly correct in the following years. Contrary to WOS, the title change (from "AAPS PharmSCI" to "AAPS J") affected Scopus more negatively. In particular it is not very clear which articles refer to which journal title. For instance, a search for the former title ("AAPS PharmSCI") in 2005 shows 76 articles and review articles assigned to "AAPS J". However, a search for "AAPS J" in the same year lists only one article for this title (but 48 items for "AAPS Journal Electronic Resource").

For most other journals, the mismatch in the article counts was due to the different assignment to document types. For instance, various conference papers in "Drug Discovery Today", "Drug News & Perspectives" and "CNS Drug Reviews" were categorized as articles in Scopus; in WOS they were nonexistent. For two other journals ("Nature Reviews Drug Discovery" and "Pharmacogenomics") opinion papers were attributed to articles in Scopus but to editorial comments in WOS. And in the "European Journal of Pharmaceutical Sciences" meeting abstracts were wrongly assigned to articles in Scopus. As this short analysis reveals, both Scopus and WOS have problems with regard to the accuracy of data. Unlike Deis and Goodman [4, 5], our analysis suggests that Scopus is not worse than the Web of Science with regard to the completeness of (research and review) articles in journals. It must be considered, however, that our analysis was based on a small, more specialized and more present journal sample.

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3.4. Pharmaceutical journals covered by Scopus but not included in the JCR

In order to identify other high impact pharmaceutical journals not covered by the JCR, it would be easiest to compare the highest impact journals in Scopus with their counterparts in JCR. Though Scopus offers sophisticated tools for citation analysis, there are no citation statistics and rankings comparable with the JCR in this database as of now. As a consequence, the compilation of the high impact journals in this database can be rather laborious and time-consuming. For this reason we contacted Elsevier which provided us with the citation counts and number of articles for journals from the subject category "pharmacology, toxicology and pharmaceutical science" in Science Direct. After having checked the reliability of data for these 81 journals in Scopus (in case of data inconsistencies we used the Scopus data), we calculated the impact factor and the immediacy index and compared them with the results in JCR.

Table 6. Presence and absence of Science Direct journals (subject category "pharmacology, toxicology and pharmaceutical science") in JCR

	No. of journals	Particular top impact journal in Science Direct	Impact factor	
			Scopus	JCR
Not included in the JCR	10	NeuroRX	2.261	-
Included in JCR:				
Subject pharmacology and pharmacy	40	Trends in Pharmacological Sciences	10.504	10.372
Subject toxicology	10	Critical Reviews in Toxicology	5.233	5.000
Other subject categories	21	Pain	5.129	4.309
Total no. of Science Direct journals	81			

As can be seen in Table 6, 10 out of 81 titles were not covered by JCR in the year 2005. For each of these journals, we computed a relatively low impact factor. Only one Science Direct journal ("NeuroRX"), with an impact factor amounting to 2.261, would place in the JCR top 100 ranking. For four titles ("Acute Pain", "The American Journal of Geriatric Pharmacotherapy", "Journal of Clinical Forensic Medicine" and "Legal Medicine") an impact factor was calculated which would rank these journals better than the worst ranked (193rd) JCR pharma journal. The impact factor of the other five journals could not be computed because of publication or indexing irregularities.

From the remaining 71 journals, 40 were covered under the subject categories "pharmacology and pharmacy", 10 under "toxicology" and 21 under other categories such as "medicine" in JCR. 31 of the 40 titles were among the JCR top 100 pharma journals, i.e. almost one third of the JCR top 100 pharmaceutical journals are currently published by Elsevier and are available in full text via Science Direct. Four of these journals are in the top 10, with "Trends in Pharmacological Sciences" ranked best in fifth position. Comparing the impact factors between Scopus and JCR revealed again that most journals have a higher value for this indicator in the Scopus database. Also the distribution of the differences (in percent) is similar.

In order to determine further "candidates" for important journals, we tied up to the results of a study by Schloegl and Gorraiz [18] which showed a low to moderate correlation between the journal requests at a document delivery service and the citation frequencies of those journals in the JCR. Accordingly, we used data from Subito [19], one of the largest European document delivery services, and examined highly demanded journals for inclusion in JCR and Scopus. Our comparison revealed that from the top 100 JCR journals (subject category "pharmacology and pharmacy") 60 titles were among the 1000 most requested journals in Subito. Furthermore, we identified three Subito journals ("Current Pharmaceutical Biotechnology", "Pediatric Drugs", and "Expert Opinion on Drug Safety") which were included in Scopus but not in JCR. The computed impact factors in Scopus amounted to 2.578, 2.188 and 1.798. This would place them 59th, 78th and 103rd in the JCR ranking.

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4. Conclusions

The most relevant implications of our study can be resumed as follows:

Coverage:

Our analysis showed that both WOS and Scopus have a good coverage of high impact journals in the field of pharmacology and pharmacy. We could identify a few pharmaceutical journals with a significant but not top impact factor which were not included in the JCR. We computed higher values for both impact factor and immediacy index for most journals in Scopus. This is mainly due to the fact that there are more sources in Scopus which generate higher citations in this database and confirms that Scopus is the world's largest multidisciplinary database in terms of more recent scholarly literature (the back files of the Web of Science go back much further to the past).

Subject categories:

The subject categorisation is not very extensive in either database. Furthermore, the assignment of subject categories to journals is not always transparent and differs between Scopus and WOS. This can lead to more or less considerable differences when comparing the two databases. Obviously, a more detailed subject categorisation and a better journal classification would improve the quality of the two databases.

Document types:

Another implication of our study is that Scopus and the Web of Science provide different document types and that they do not assign them always consistently. As our analysis has shown, a different assignment to document types was one of the main reasons for mismatches in the number of (research) articles.

Reliability of data:

The differences in the number of research and review articles were tolerable for the majority of the investigated journals. Nevertheless, we calculated greater differences for several journals which were caused by both Scopus and WOS. Furthermore, data consistency between WOS and JCR cannot be taken for granted. In cases where data accuracy is crucial, it is advisable to verify the data.

Appropriateness for bibliometric analyses:

In our study, Scopus turned out to be suitable for bibliometric analyses. However, the practicability of such studies could be much increased if Scopus were to add an own bibliometric “infrastructure” comparable to the Journal Citation Reports to its citation database. Since such an add-on could be implemented from scratch, critical issues concerning the JCR could be avoided from the beginning. Among other issues [see e.g. 20], this applies to field-normalized journal impact indicators [e.g. 21, p. 1993f.]. Furthermore, it could be avoided to mix different document types when relating the citation frequencies to the article counts [e.g. 22,23]. Concerning conference articles, Scopus is more transparent than the Web of Knowledge. For the latter it is not always clear in which cases proceedings, which are recorded in ISI Proceedings in general, are included.

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