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A Biliometric Survey of Volumes 1–48 (1999) 1–17
BIOELECTROCHEMISTRY AND BIOENERGETICS
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Bioelectrochemistry and Bioenergetics A Bibliometric Survey of Volumes 1–48

1. Introduction

Statistics on publications, references, citations and other bibliographical items - whether called scientometrics, bibliometrics or by any other name - has lately become a standard basis of classifying, mapping, assessing journals. A milestone paper on this topics has been published almost 25 years ago [1]; skepticism regarding the reliability of such kind of a mirror is almost of the same age [2]. Nevertheless, there is still a devoted group, who believe that some non-trivial and yet relevant conclusions might sometimes be drawn from such statistical reasoning, and that the mirror of bibliometrics is worth a glance even if not for a privileged but just for a different view.

In the present study, bibliometric techniques have been used to survey the career of the journal *Bioelectrochemistry and Bioenergetics* (hencetoforth occasionally abbreviated as *B&B*) from its very first volume in 1974 up to the present (1999).

The main data sources of the analysis were the volumes of the journal itself, as well as the *Scientometric Indicators Datafiles* of the ISSRU (Budapest, Hungary) [3] derived from the *Science Citation Index* (SCI) database of the Institute for Scientific Information (ISI, Philadelphia, PA, USA).

2. Analysis of publications

A total number of 2044 papers published in Volumes 1 (1974) through 48 (1999) of *Bioelectrochemistry and Bioenergetics* were taken into account. About 89% of them were Articles (Original Papers, Regular Papers), 10% Notes (Preliminary Notes, Short Communications) and 1% Reviews. All other publication types (such as biographical items, editorials, corrections, book reviews) were discarded.

2.1 Authors, authorships

The 2044 papers contained 6035 authorship entries - an average of nearly 3 authors per paper. About 3350 authors contributed to the journal; the exact number is not quite certain because of several variants of some names and the possible homonyms. A quite large percentage (70%) of the authors contributed only once; on the other hand, a small group of most productive scientists (1.5% of the authors - see Table 1) were among the authors of 30% of the papers.

Figure 1 shows the annual changes in the number of papers, authors and authorships. The most striking characteristics of this diagram is the opening of the "scissors" between authorship and publication numbers, i.e., the increase in the number of authors per paper. This phenomenon worth a separate diagram (Fig. 2), where - beside the annual values - a moving-average curve helps to see clearly the trendline.

Table 1
The most productive authors of *Bioelectrochemistry and Bioenergetics*

Name	*B&B* papers	Name	*B&B* papers
Berg, H.	49	Hianik, T.	13
Blank, M.	34	Núñez-Vergara, L.J.	13
Tien, H.T.	30	Senda, M.	13
Miller, I.R.	22	Soo, L.	13
Kell, D.	21	Squella, J.A.	13
Martirosov, S.	21	Wang, J.	13
Palecek, E.	19	Tarasevich, M.R.	12
Santhanam, K.S.V.	19	Teissié, J.	12
Kulys, J.	18	Yao, S.J.	12
Goodman, R.	17	Yaropolov, A.I.	12
Pastushenko, V.	17	Chiabrera, A.	11
Chizmadzhev, Yu.A.	16	Czochralska, B.	11
Trchounian, A.	16	Goyal, R.N.	11
Dong, S.J.	15	Valenta, P.	11
Kwee, S.	15	Wolfson, S.K. (Jr.)	11
Volkov, A.G.	15	Abidor, I.G.	10
Weaver, J.C.	15	Bara, M.	10
Glaser, R.	14	Boguslavsky, L.I.	10
Kamal, M.M.	14	Donath, E.	10
Pilla, A.A.	14	Miklavcic, D.	10
Scheller, F.	14	Neumann, E.	10
Studnicková, M.	14	Nürnberg, H.W.	10
Temerk, Y.M.	14	Razumas, V.	10
Dryhurst, G.	13	Wiggins, P.M.	10
Elving, P.J.	13		

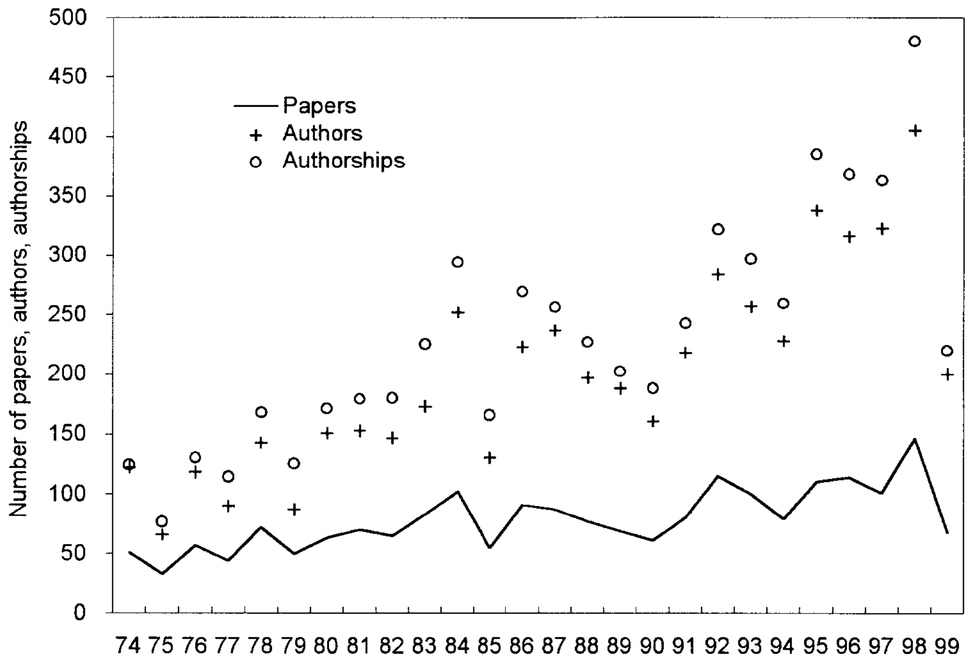

Fig. 1. Annual number of papers, authors and authorships

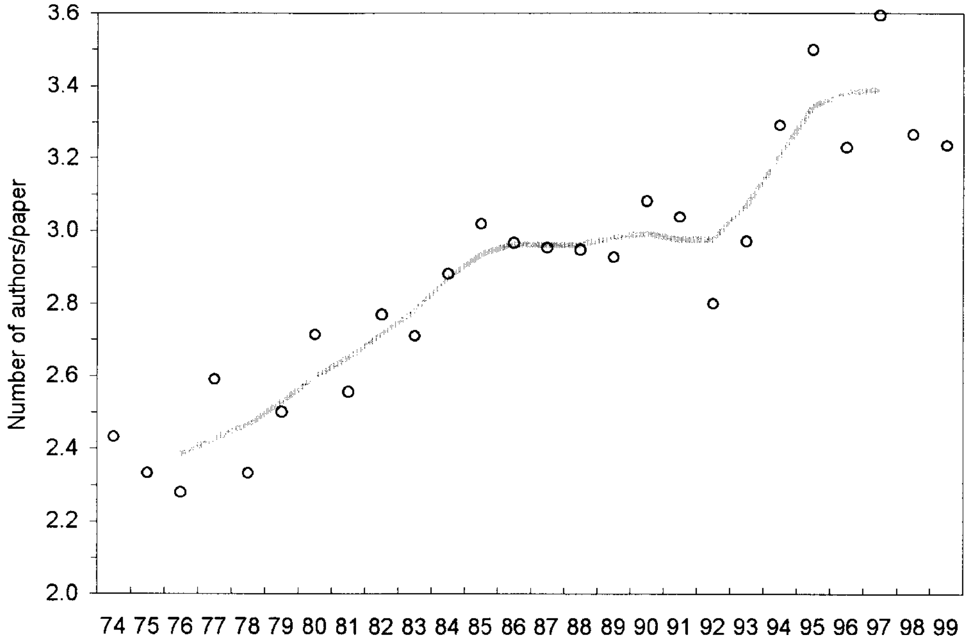

Fig. 2. Number of authors per paper. Annual values (circles) and moving-average trendline

An even deeper insight can be gained by considering the evolution of the distribution of the papers by the number of authors. For the sake of lucidity, the overall time span 1974-1999 is divided into five periods (Period 1: 1974-1979, Period 2: 1980-1984, Period 3: 1985-1989, Period 4: 1990-1994, Period 5: 1995-1999). Figure 3 shows that the proportion of one-, two- and even three-authored papers is decreasing, while the proportion of papers with four and more authors is increasing. By Period 4, the modus of the distribution changed from 2 to 3.

Unlike the number of authors per paper, the number of papers per author (i.e., the authors' publication productivity) does not show any definite tendency. Not only the average productivity fluctuates more or less randomly around the overall mean, but also the underlying productivity distribution exhibits a remarkable stability. A double logarithmic plot of the productivity distribution of authors in the five periods is shown in Fig. 4. The five distributions are very close to each other, and all obey an inverse power law (cf. [4]) with a common exponent of about 2.5.

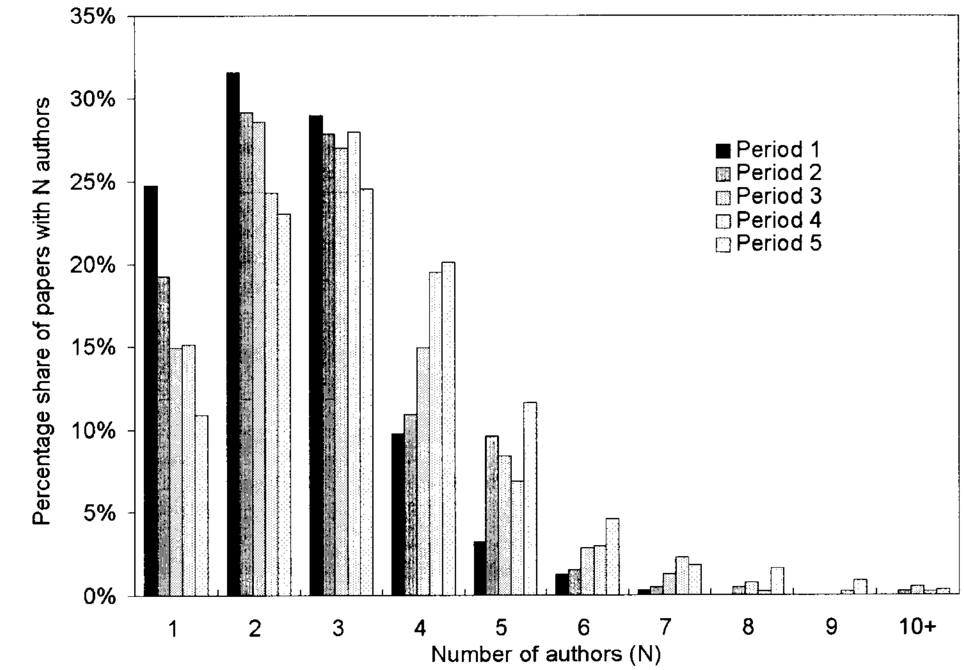

Fig. 3. Distribution of papers by the number of authors
Period 1: 1974-1979, Period 2: 1980-1984, Period 3: 1985-1989, Period 4: 1990-1994, Period 5: 1995-1999

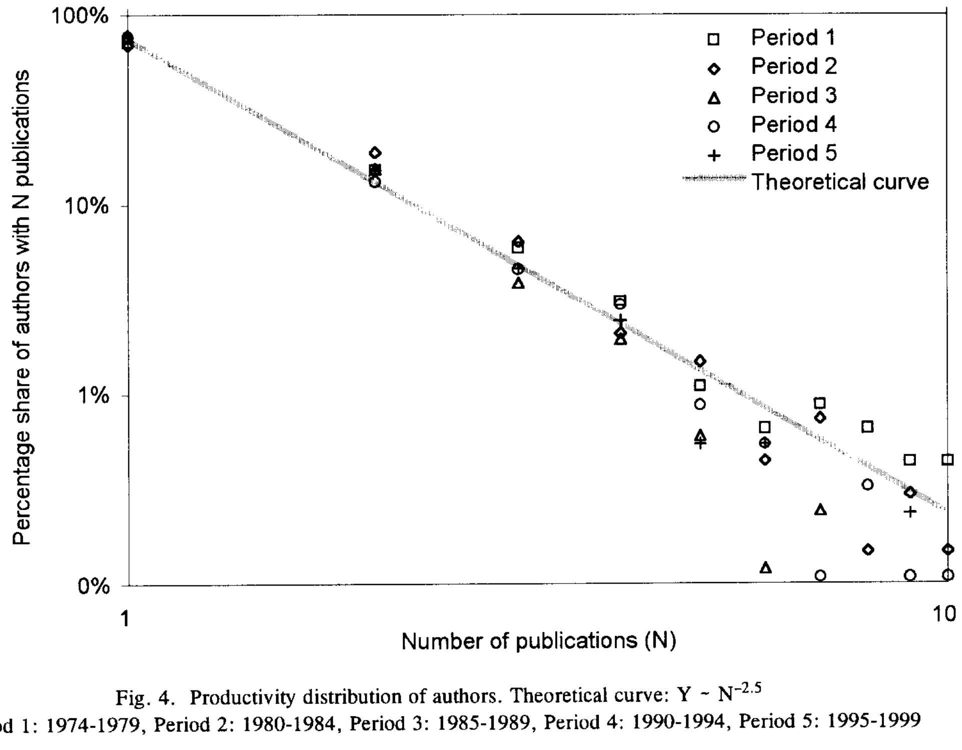

Fig. 4. Productivity distribution of authors. Theoretical curve: $Y \sim N^{-2.5}$
Period 1: 1974-1979, Period 2: 1980-1984, Period 3: 1985-1989, Period 4: 1990-1994, Period 5: 1995-1999

The statistical stability of the high productivity end of the distributions can be seen in Table 2, where both the length and the weight of the "tail" of the distributions prove to be similar. At the same time it also becomes obvious that the statistically stable behaviour is realized in a varying population. In fact, there are only two scientists (Professors H. Berg and M. Blank) among the most productive authors in all five periods.

Table 2
The most productive authors of *Bioelectrochemistry and Bioenergetics* in the five periods

Period 1 (1974-1979)		Period 2 (1980-1984)		Period 3 (1985-1989)		Period 4 (1990-1994)		Period 5 (1995-1999)	
Name	No. of papers	Name	No. of papers	Name	No. of papers	Name	No. of papers	Name	No. of papers
Chizmadzhev, Yu. A.	10	Martirosov, S.M.	10	Tien, H.T.	14	Goodman, R.	10	Berg, H.	24
Pastushenko, V. Ph.	10	Dryhurst, G.	9	Limaye, N.M.	7	Senda, M.	9	Blank, M.	9
Elving, P.J.	9	Kulys, J.	9	Santhanam, K.S.V	7	Blank, M.	8	Hianik, T.	9
Tarasevich, M.R.	9	Palecek, E.	8	Martirosov, S.M.	6	Dong, S.J.	8	Tien, H.T.	9
Allen, M.J.	8	Abidor, I.G.	7	Blank, M.	5	Kell, D.	8	Pokorny, J.	8
Miller, I.R.	8	Berg, H.	7	Brunori, M.	5	Berg, H.	7	Kramer, K.-D.	7
Nürnberg, H.W.	8	Blank, M.	7	Cadossi, R.	5	Henderson, A.S.	6	Ci, Y.X.	6
Arakelyan, V.B.	7	Studnicková, M.	7	Kell, D.	5	Kakutani, T.	6	Feng, J.	6
Berg, H.	7	Trchounian, A.A.	7	Wiggins, P.M.	5	Kamal, M.M.	6	Gheorghiu, E.	6
Flemming, J.	7	Brabec, V.	6	Berg, H.	4	Markin, V.S.	6	Kell, D.	6
Valenta, P.	7	Temerk, Y.M.	6	D'Alba, F.	4	Santhanam, K.S.V.	6	Miklavcic, D.	6
Jensen, M.A.	6	Volkov, A.G.	6	Dimitrov, D.S.	4	Dinzeo, G.	5	Velizarov, S.	6
Wolfson, S.K. (Jr.)	6	Boguslavsky, L.I.	5	Di Lorenzo, S.	4	Ide, Y.	5	Weaver, J.C.	6
Yao, S.J.	6	Chernomordik, L.V.	5	Glaser, R.	4	Matsue, T.	5	Dong, S.J.	5
Blank, M.	5	Chizmadzhev, Yu.A.	5	Kotowski, J.	4	Miller, I.R.	5	Goyal, R.N.	5
Britten, J.S.	5	Jelen, F.	5	Kulys, J.J.	4	Pilla, A.A.	5	Litovitz, T.A.	5
Malfoy, B.	5	Kamal, M.M.	5	Miller, I.R.	4	Soo, L.	5	Ottova, A.L.	5
Scheller, F.	5	Kovár, J.	5	Núnez-Vergara, L.J.	4	Takehara, K.	5	Snejdarkova, M.	5
Wiggins, P.M.	5	Singh, R.P.	5	Razumas, V.J.	4	Uchida, I.	5	Soo, L.	5
		Sélégny, E.	5	Squella, J.A.	4			Trkal, V.	5
		Takamura, K.	5	Studnicková, M.	4				
		Wrona, M.Z.	5	Teissié, J.	4				
				Trchounian, A.A.	4				
				Wang, J.	4				
				Weaver, J.C.	4				

2.2 Publication geography

Countries of origin can be assigned to papers according to the corporate addresses indicated in the by-line of the papers or given as a footnote. All addresses of all contributing authors were considered, and each contributing country was counted exactly once. What counted was, thus, the number of papers to which (any number of) authors from the given country contributed.

A total of 64 countries contributed to *Bioelectrochemistry and Bioenergetics*. 41 of them are shown in Fig. 1, where the number of publications is given in the form of a *proportional map*, i.e., a map, where the relative position of the countries is attempted to remind their "natural" (geographical) order, whereas their area represents the number of papers published in *Bioelectrochemistry and Bioenergetics*.

To facilitate the assessment of their relative proportions, countries publishing at least 30 papers are ranked in Table 3 by their *Relative Preference Index* (RPI) . This indicator is the ratio of the country's share in papers published in *Bioelectrochemistry and Bioenergetics* to the country's share in world total electrochemistry publications, as taken from a recent survey [5]. Countries with an indicator value above 1 are, in this sense, overrepresented in the journal, while those below one are underrepresented.

Table 3
Relative Preference Index

Country	RPI
Czech/Slovakia	3.0
Bulgaria	2.7
Italy	2.2
Israel	2.0
Germany	1.4
Belgium	1.3
USSR/Russia	1.2
Poland	1.1
France	0.9
P.R. China	0.9
Spain	0.7
India	0.6
USA	0.5
UK	0.5
Japan	0.4

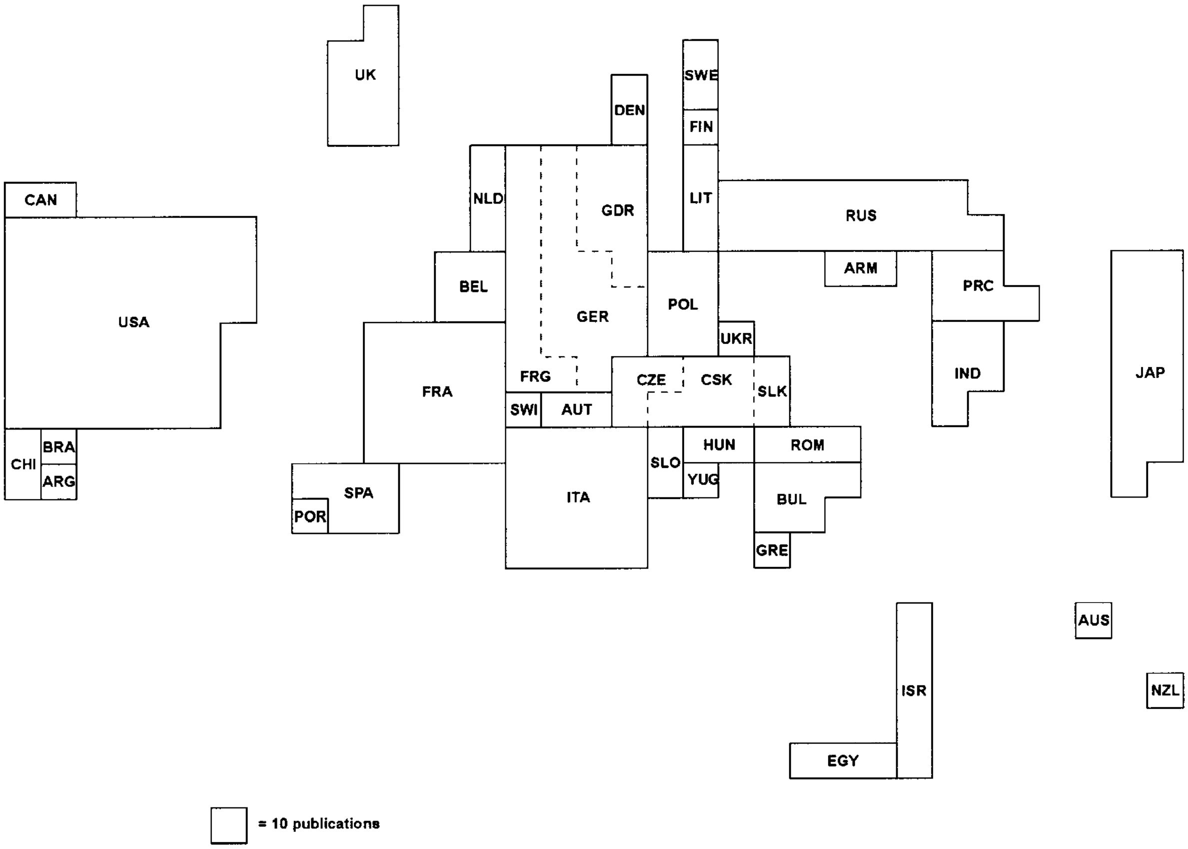

Fig. 5. Proportional map of countries by the number of publications in *Bioelectrochemistry & Bioenergetics*

Country codes and full country names (explanation for Figs 5 and 8)

ARG - Argentina	DEN - Denmark	ITA - Italy	SLO - Slovenia
ARM - Armenia	EGY - Egypt	JAP - Japan	SPA - Spain
AUS - Australia	FIN - Finland	LIT - Lithuania	SWE - Sweden
AUT - Austria	FRA - France	NLD - Netherlands	SWI - Switzerland
BEL - Belgium	FRG - Fed. Rep. Germany	NZL - New-Zealand	UK - United Kingdom
BRA - Brazil	GDR - German Dem. Rep.	POL - Poland	UKR - Ukraine
BUL - Bulgaria	GER - Germany	POR - Portugal	USA - USA
CAN - Canada	GRE - Greece	PRC - P.R. China	YUG - Yugoslavia
CHI - Chile	HUN - Hungary	ROM - Romania	
CSK - Czechoslovakia	IND - India	RUS - Russia	
CZE - Czech Republic	ISR - Israel	SLK - Slovakia	

Figures 6a and 6b illustrate the publication dynamics of the 12 most productive countries. The USA, which appeared to be underrepresented anyway, is still moves downwards; Germany seems to regain its earlier position; Italy, on the contrary, is losing its outstanding position in the second half of the 80's; the Czech/Slovak peaks are clearly connected with certain local conference materials; the most dynamic increase is shown by China and Spain (for China the political changes on the turn of the decade, for Spain the EU membership meant a lot).

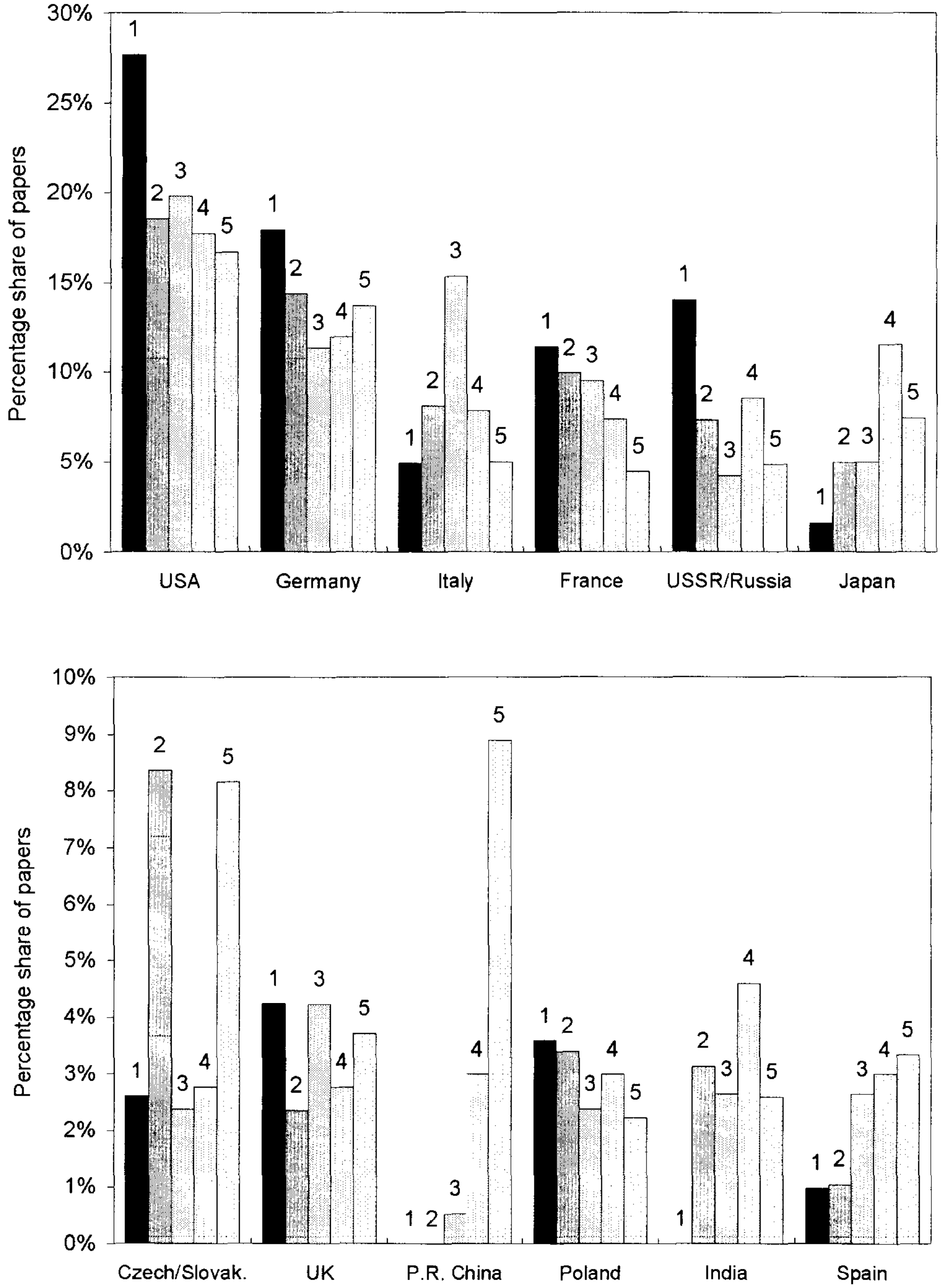

Fig. 6. The most productive countries' percentage share of publications in *Bioelectrochemistry & Bioenergetics* as compared to the world total
Period 1: 1974-1979, Period 2: 1980-1984, Period 3: 1985-1989, Period 4: 1990-1994, Period 5: 1995-1999

2.3 International coauthorship patterns

A commonplace topic nowadays to speak about the globalization, the increasing internationality of scientific research. It is no surprise, therefore, that the proportion of internationally coauthored papers has been constantly growing in *Bioelectrochemistry and Bioenergetics*, as well (see Fig. 7).

Maybe even more interesting than the mere extent of internationality, is the structure of international cooperations. Figure 8 presents graphically the main coauthorship links between the countries. The position of the countries was attempted to remind their natural geographical order; two countries were connected if at least three joint papers were published.

The graph shows an interesting "trinodal" character, with the USA, Germany and Russia/USSR being the three nodes. As compared to other similar maps (e.g., [6]), the lack of a stronger European cooperation is particularly striking.

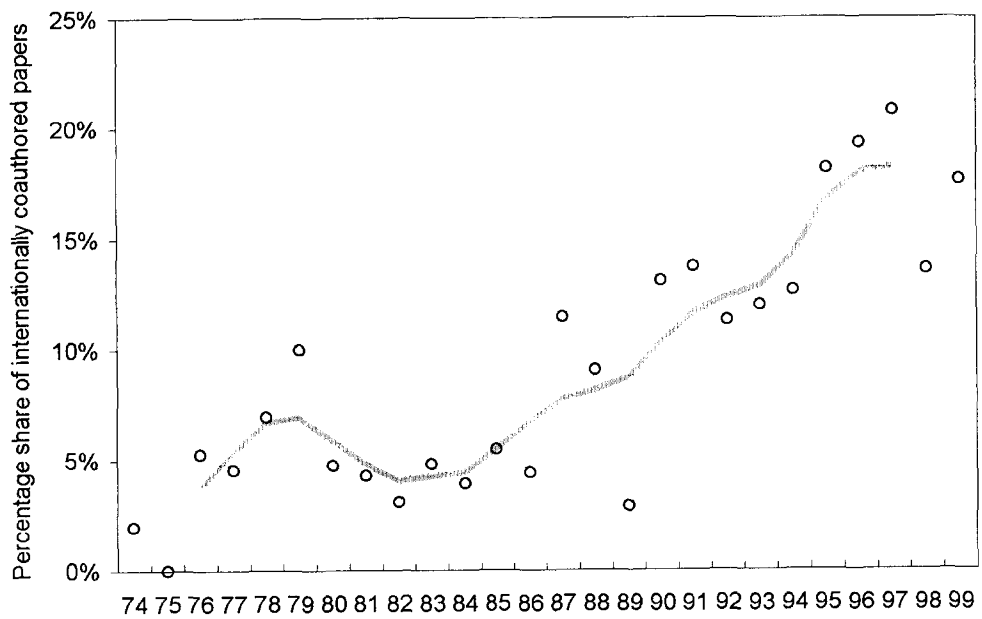

Fig. 7. Percentage share of internationally coauthored papers in total *Bioelectrochemistry & Bioenergetics* publications. Annual values (circles) and moving-average trendline

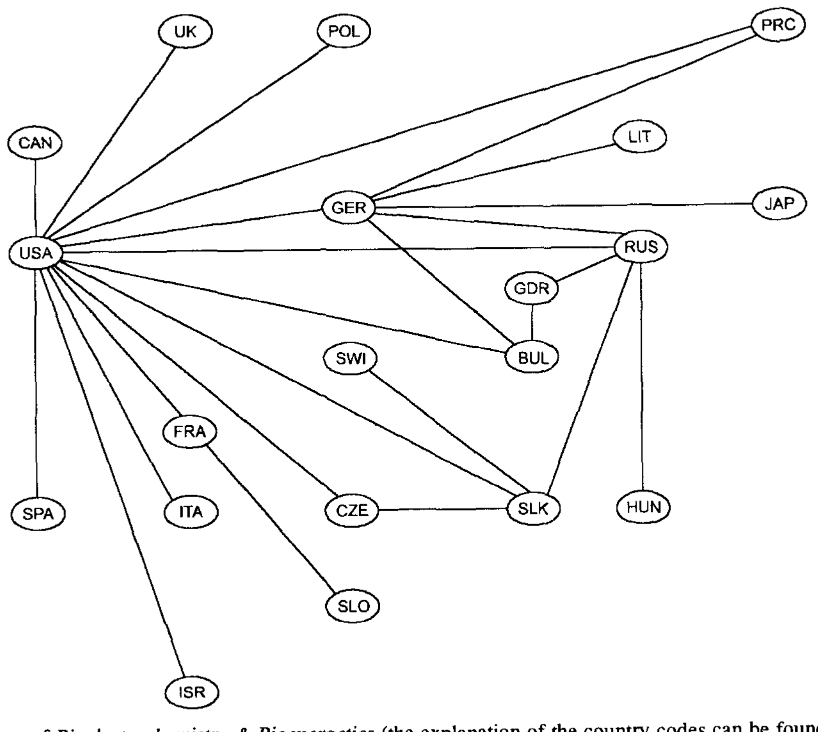

Fig. 8. Coauthorship map of *Bioelectrochemistry & Bioenergetics* (the explanation of the country codes can be found after Fig. 5)

2.4 Institutional activity

About one third of the papers published in *Bioelectrochemistry and Bioenergetics* came from a handful of institutions listed in Table 4. It should, however, be noted that the Academies of the former Soviet-bloc countries as well as the French CNRS and the Italian CNR, dominating the top of the list, are, in fact, multi-institutional research networks (even if only a few of their institutes might be active in bioelectrochemical research). Nevertheless, the contribution of several European and US universities is also impressive.

Table 4
Institutions with the greatest number of publications in the journal

Institute (Country)	Percentage share in total papers
Russian Academy of Sciences (formerly USSR Academy of Sciences) (Russia)	5.90%
[Frumkin Institute of Electrochemistry, Moscow]	[2.25%]
CNRS (France)	4.55%
Columbia University, New York, NY (USA)	2.65%
Czech Academy of Sciences (formerly Czechoslovak Academy of Sciences) (Czech Republic)	2.35%
[Institute of Biophysics, Brno]	[1.55%]
Bulgarian Academy of Sciences (Bulgaria)	2.00%
GDR Academy of Sciences (Germany)	2.00%
University of Rome, La Sapienza (Italy)	1.75%
Michigan State University, East-Lansing, MI (USA)	1.65%
CNR (Italy)	1.60%
Humboldt University, Berlin (Germany)	1.30%
Weizmann Institute of Science, Rehovoth (Israel)	1.30%
Univerity of Assiut (Egypt)	1.25%
Free University Brussels/Université Libre Bruxelles (Belgium)	1.25%
University of Chile, Santiago (Chile)	1.25%
MIT, Cambridge, MA (USA)	1.25%
University of Ljubljana (Slovenia)	1.20%
Univesity of Warsaw (Poland)	1.20%
Chinese Academy of Sciences (P.R. China)	1.15%
City University of New York, New York, NY (USA)	1.15%
Kyoto University (Japan)	1.10%
University of Modena (Italy)	1.05%
Tata Institute of Fundamental Research, Bombay (India)	1.05%
University of Paris 06 (France)	1.05%

2.5 Cognitive analysis

The cognitive analysis of the papers published in *Bioelectrochemistry and Bioenergetics* was performed on a twofold basis. One was a thematic classification of the papers, the other was the selection and tallying of relevant words from the titles.

For thematic classification, the papers were divided into one or more of five categories.

Category A (for **A**nalysis): Electroanalytical tools in studying substances of biological significance; sensors, biosensors.

Category B (for **B**iosystems): Interaction of electromagnetic field with biological systems; their passive electric behavior, dielectric properties.

Category C (for **C**hemistry): Electrochemical synthesis and reactions of substances of biological significance; redox reacions; catalysis, electrocatalysis; enzymes.

Category D (for **D**ouble layer): Surface and interface phenomena; double layers, bilayers, membranes.

Category E (for **E**nergetics): Bioenergetics; bioelectronics; light-driven processes.

The distribution of papers among the five categories in the five periods defined earlier in this survey is presented in Fig. 9. It seems that the most definite tendency of the last decade (Periods 4 and 5) is the advent of Category B, mainly at the expense of Categories C and E.

Although the five categories A through E apparently completely cover the scope of the journal, there are several research areas or topics which are largely self-contained, yet they either overlap with two or more major categories, or form a subcategory of them. Three such particular topics are chosen and their trends are presented in Fig. 10. "Theoretical" means all kind of purely theoretical studies (computer simulations, quantum-chemical calculations, kinetic models, etc.) in practically all five categories, and represents a fairly constant share of the publications; "Electroporation" together with electrofusion and related phenomena appeared to be the most dynamically advancing area of research in Category D, or maybe in the whole field, although a kind of saturation can be observed in the last years; "Transport", including ionic and molecular transport phenomena both in solutions and through membranes and interfaces, after its peak in the early 80's declines sharply and looks forward to a dire future.

Rather similar conclusions can be drawn from the lists of most frequently occurring relevant title words (Table 5). B-category terms *electric*, *magnetic* and *electromagnetic field* became the dominating keywords of the last decade, completely ousting C-category terms *oxidation* and *reduction*; a substantial restructuring of Category D can be experienced by the advent of *electroporation* followed by *electrofusion* and *electropermeability* instead of *adsorption* or *mercury* and *gold electrodes*. The word *theory* is permanently present on the top lists, even if usually at a rear position.

A general overview of the five thematic categories together with their characteristic title words is given in a form of a "cognitive map" in Fig. 11.

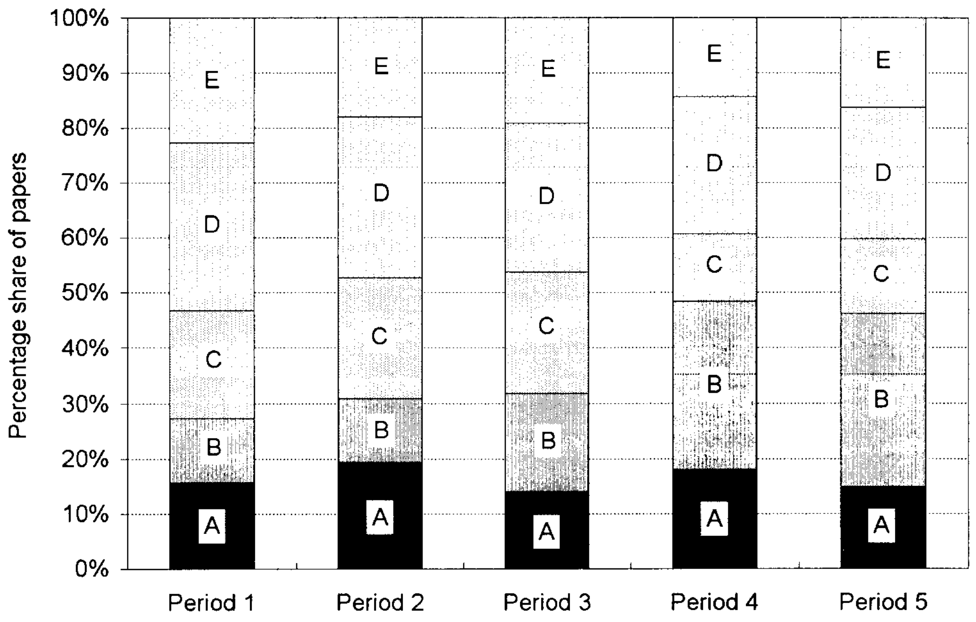

Fig. 9. Thematic distribution of papers published in *Bioelectrochemistry & Bioenergetics*
Period 1: 1974-1979, Period 2: 1980-1984, Period 3: 1985-1989, Period 4: 1990-1994, Period 5: 1995-1999

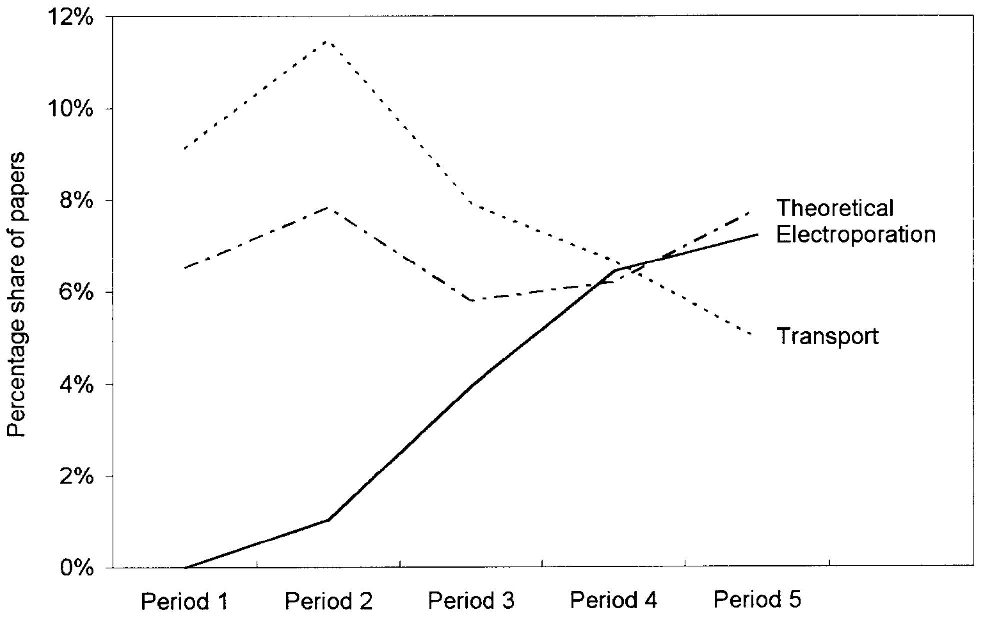

Fig. 10. Percentage share of three particular topics among the papers published in *Bioelectrochemistry & Bioenergetics*
Period 1: 1974-1979, Period 2: 1980-1984, Period 3: 1985-1989, Period 4: 1990-1994, Period 5: 1995-1999

Table 5
The most frequently used relevant title words in the five periods

Period 1 (1974-1979) Title word	No. of papers	Period 2 (1980-1984) Title word	No. of papers	Period 3 (1985-1989) Title word	No. of papers	Period 4 (1990-1994) Title word	No. of papers	Period 5 (1995-1999) Title word	No. of papers
DNA	17	Polarography	28	Electromagnetic-Field	14	Electromagnetic-Field	32	Magnetic-Field	41
Mechanism	15	Electrochemical-		Electric-Field	13	Magnetic-Field	28	Electromagnetic-Field	32
Adsorption	13	-Oxidation	13	Voltammetry	13	Voltammetry	25	Electric-Field	23
Cytochrome	13	Interaction	13	Experiment	11	Electric-Field	24	Voltammetry	23
Polarography	12	Voltammetry	13	Interaction	10	Interaction	16	Bilayer-Lipid-Membrane	18
Mercury-Electrode	10	Adsorption	10	Magnetic-Field	10	Electroporation	15	Model	18
Protein	10	Mechanism	10	Membrane-Potential	10	Kinetics	13	Electroporation	16
Bilayer-Lipid-Membrane	9	Oxidation	10	Protein	10	Model	12	Interaction	16
Kinetics	9	Escherichia-Coli	9	Treatment	10	Mechanism	11	Electron-Transfer	14
Model	9	Cytochrome	8	Bilayer-Lipid-Membrane	9	Erythrocyte	10	Electrofusion	12
Reduction	9	DNA	8	Mechanism	9	Theory	10	Escherichia-Coli	12
Biomembrane	8	Energy-Dependent	8	Cytochrome	8	Experiment	9	In-Vitro	11
Electric-Breakdown	8	Model	8	Electrofusion	7	Adsorption	8	Measurement	11
Membrane	8	Bilayer-Lipid-Membrane	7	Mercury-Electrode	7	Cytochrome	8	Cytochrome	9
Adenine	7	Electric-Field	7	Polarography	7	Escherichia-Coli	8	Superoxide-Dismutase	9
Electrochemical-Property	7	Gold-Electrode	7	Reaction	7	Gold-Electrode	8	Carbon-Paste-Electrode	8
Measurement	7	Measurement	7	Reduction	7	Polarography	8	Enhancement	8
Aqueous-Solution	6	Mercury-Electrode	7	Adsorption	6	Cell	7	Kinetics	8
Interaction	6	Reduction	7	Aqueous-Solution	6	In-Vitro	7	DNA	7
Polynucleotide	6	Solution	7	Cytochrome-Oxidase	6	Membrane	7	Dielectric-Spectroscopy	7
Theory	6	Surface-Compartment-		DNA	6	Protein	7	Electropermeabilization	7
...		-Model	7	Erythrocyte	6	...		Lipid-Bilayer	7
...		Theory	7	Mitochondrium	6	...		Ornithine-Decarboxylase	7
...		...		Model	6	...		S.-Cerevisiae	7
...		...		Theory	6	...		Theory	7

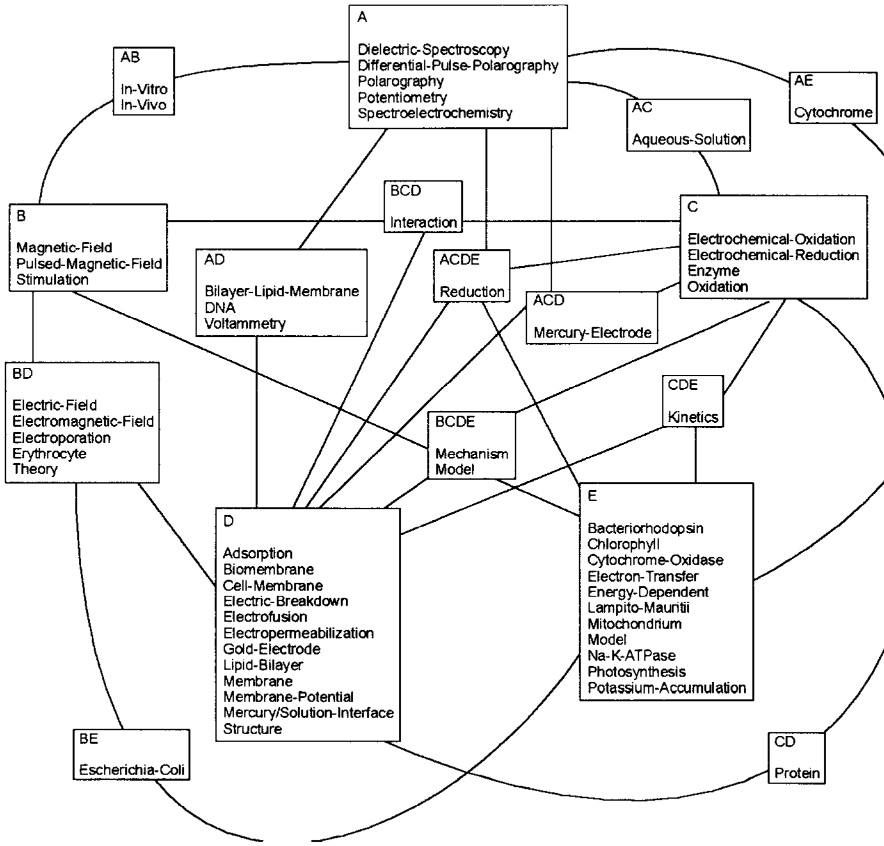

Fig. 11. "Cognitive map" of the thematic categories through their characteristic title words

3. Analysis of references

By analyzing the references, the "intellectual sources" of a journal can be tracked.

A typical *Bioelectrochemistry and Bioenergetics* paper has about 20-25 items in its list of references. For technical reasons, the analysis of references was restricted to the period 1980-1998 (practically, to Periods 2-5). In this period 1617 papers contained 39103 references (an average of about 24 references/paper) to about 28000 items.

The distribution of papers by the number of references is given in Fig. 12. The stability of the distribution from the 80's (Periods 2+3) to the 90's (Periods 4+5) is remarkable.

Authors most cited in the reference lists of *Bioelectrochemistry and Bioenergetics* are listed in Table 6 (only first authors were considered in this case). Authors marked with an asterisk (*) were also authors in *Bioelectrochemistry and Bioenergetics* itself; those marked with a double asterisk (**) were in the most productive authors' list (Table 1).

About 85% of the cited items were journal articles. The list of journals most cited in *Bioelectrochemistry and Bioenergetics* is given in Table 6. The stabilization of the journal itself at the first position with a healthy self-reference rate of about 8% should be seen as a sign of maturity. The slipping back of *J. Am. Chem. Soc.* parallels the losing ground of thematic category C (electrochemical reactions, catalysis, etc.).

Table 6
Authors most cited in *B&B* papers (first authors only)

Author	Number of references	Author	Number of references
** Palecek E.	303	* Hong F.T.	74
** Berg H.	232	* Kinosita K.	73
** Blank M.	193	* Adey W.R.	69
** Tien H.T.	189	* Eddowes M.J.	68
* Brabec V.	152	* Liboff A.R.	59
** Kell D.B.	133	** Kulys J.J.	58
* Tsong T.Y.	121	** Pastushenko V.	58
** Temerk Y.M.	105	Bard A.J.	57
** Martirosov S.M.	103	** Neumann E.	55
** Chiabrera A.	90	** Abidor I.G.	54
** Pilla A.A.	82	Pethig R.	54
** Wang J.	82	* Sowers A.E.	54
Schwan H.P.	80	* Janik B.	53
** Teissie J.	80	** Volkov A.G.	52
* Benz R.	78	** Weaver J.C.	52
Bassett C.A.L.	75	** Goyal R.N.	50
* Blackman C.F.	75		

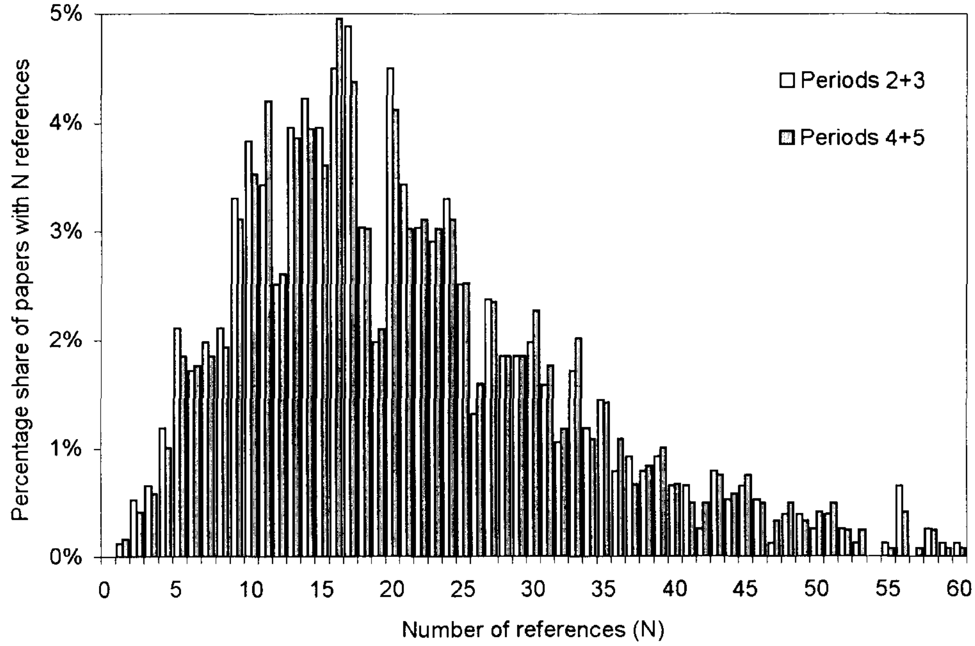

Fig. 12. Distribution of papers by the number of references
Periods 2+3: 1980-1989, Periods 4+5: 1990-1999

Table 7
Journals most cited in *Bioelectrochemistry and Bioenergetics*

Journal title Period 2 (1980-1984)	Times cited in *B&B*	Journal title Period 3 (1985-1989)	Times cited in *B&B*
Biochim. Biophys. Acta	496	Biochim. Biophys. Acta	569
Bioelectrochem. Bioen	489	Bioelectrochem. Bioen.	532
J. Electroanal. Chem	488	J. Electroanal. Chem.	337
J. Am. Chem. Soc	331	J. Biol. Chem.	262
J. Biol. Chem.	157	J. Am. Chem. Soc.	257
Anal. Chem	153	P. Natl. Acad. Sci. USA	186
Biochemistry US	138	FEBS Lett.	166
P. Natl. Acad. Sci. USA	133	Nature	150
Nature	127	Biochemistry US	148
J. Membrane. Biol	112	Anal. Chem.	138
FEBS Lett	107	J. Membrane Biol	129
Biophys. J	92	Biochem. Bioph. Res. Co.	109
Stud. Biophys.	85	Biophys. J.	106
J. Gen. Physiol	82	Stud. Biophys.	106
Collect. Czech. Chem. C.	80	Science	101
Biochem. Bioph. Res. Co.	75	Biochem. J	97
Science	75	Eur. J. Biochem	91
J. Phys. Chem. US	72	Arch. Biochem. Biophys	85
J. Electrochem. Soc	69	J. Phys. Chem. US	74
J. Colloid. Interf. Sci.	63	Electrochim. Acta	65
Photochem. Photobiol.	63	Photochem. Photobiol.	61
Anal. Chim. Acta	60	J. Electrochem. Soc.	55
J. Physiol. London	60	J. Bacteriol.	52
Electrochim. Acta	58	J. Gen. Physiol.	51
Arch. Biochem. Biophys.	56	Anal. Chim. Acta	50
Dokl. Akad. Nauk SSSR	56		

Period 4 (1990-1994)		Period 5 (1995-1999)	
Bioelectrochem. Bioen	675	Bioelectrochem. Bioen.	852
Biochim. Biophys. Acta	614	Biochim. Biophys. Acta	506
J. Electroanal. Chem	368	J. Electroanal. Chem.	326
Biophys. J	238	Biophys. J	309
Bioelectromagnetics	211	Bioelectromagnetics	264
J. Am. Chem. Soc	209	Anal. Chem.	215
Anal. Chem	208	Biochemistry US	213
Biochemistry US	181	J. Am. Chem. Soc.	207
J. Biol. Chem.	180	J. Biol. Chem.	197
P. Natl. Acad. Sci. USA	165	Nature	191
Nature	155	P. Natl. Acad. Sci. USA	177
FEBS Lett.	143	Science	168
J. Membrane. Biol.	134	FEBS Lett.	153
Stud. Biophys.	104	J. Phys. Chem. US	112
Science	96	Biochem. Bioph. Res. Co.	104
Eur. J. Biochem.	88	J. Membrane Biol.	103
Anal. Chim. Acta	79	Anal. Chim. Acta	98
J. Phys. Chem. US	76	Langmuir	95
Biochem. Bioph. Res. Co	73	Method Enzymol.	84
Method Enzymol.	71	Electroanal	83
Photochem. Photobiol.	68	Eur. J. Biochem	83
Biochem. J	61	J. Gen. Physiol.	62
Anal. Biochem.	60	Photochem. Photobiol.	58
J. Bioelectricity	59	Arch. Biochem. Biophys	57
J. Electrochem. Soc	58	Anal. Biochem.	55

Table 8
Most cited references in *Bioelectrochemistry and Bioenergetics*

Reference	Times cited in *B&B*
Bard, A.J., Faulkner, L.L.: *Electrochemical Methods - Fundamentals and Applications*, Wiley, New York, 1980	50
Zimmermann, U.: Electric Field Mediated Fusion and Related Electrical Phenomena (Review), *Biochim. Biophys. Acta* 694 (1982) 227-277	42
Neumann, E., Sowers, A.E., Jordan, C.A.: *Electroporation and Electrofusion in Cell Biology*, Plenum, New York, 1989	40
Tien, H.T.: *Bilayer Lipid Membranes*, Dekker, New York, 1974	39
Nicholson, R.S., Shain, I.: Theory of Stationary Electrode Polarography - Single Scan and Cyclic Methods Applied to Irreversible and Kinetic Systems, *Anal. Chem.* 36 (1964) 706	38
Abidor, I.G., Arakelyan, V.B., Chenomordik, L.V., Chizmadzhev, Yu.A., Pastushenko, V.F., Tarasevich, M.R.: Electric Breakdown of Bilayer Lipid Membranes. I. The Main Experimental Facts and Their Qualitative Discussion, *Bioelectrochemistry and Bioenergetics* 6 (1979) 37-52	36
Lowry, O.H., Rosebrough, N.J., Farr, A.L., Randall, R.J.: Protein Measurement with the Folin Phenol Reagent, *J. Biol. Chem.* 193 (1951) 265-275	30
Neumann, E., Hofschneider, P.H., Schaefer-Ridder, M., Wang. Y.: Gene Transfer into Mouse Lyoma Cells by Electroporation in High Electric Fields, *EMBO J.* 1 (1982) 841-845	26
Pethig, R.: *Dielectric and Electric Properties of Biological Materials*, Wiley, Chichester, 1979	25
Goodman, R., Shirley-Henderson, A.: Transcription and Translation in Cells Exposed to Extremely Low-Frequency Electromagnetic Fields (Review), *Bioelectrochemistry and Bioenergetics* 25 (1991) 335-355	24
Schwan, H.P.: Electrical Properties of Tissue and Cell Suspension, *Adv. Biol. Med. Phys.* 5 (1957) 147-209	24
Berg, H.: Polarographic Possibilities in Protein and Nucleic Acid Research, *Topics in Bioelectrochemistry and Bioenergetics* 1 (1976) 39-104	22
Goodman, R., Henderson, A.S.: Exposure of Salivary Gland Cells to Low-Frequency Electromagnetic Fields Alters Polypeptide Synthesis, *P. NAS USA* 85 (1988) 3928-3932	22
Palecek, E.: Modern Polarographic (Voltammetric) Techniques in Biochemistry and Molecular Biology, Part 2. Analysis of Macromolecules, *Topics in Bioelectrochemistry and Bioenergetics* 5 (1983) 65-155	22
Vetterl, V.: Alternating Current Polarography of Nucleosides, *J. Electroanal. Chem.* 19 (1968) 169	21
Krznaric, D., Valenta, P., Nürnberg, H.W., Branica, M.: Electrochemical Behaviour of Mononucleotides and Oligonucleotides. I. Effects of Charge and Configuration of Adenine Mononucleotides on Their Absorption at Mercury-Solution Interface, *J. Elec. Chem.* 65 (1975) 863-881	21
Eddowes, M.J., Hill, H.A.O.: Electrochemistry of Horse Heart Cytochrome c, *J. Am. Chem. Soc.* 101 (1979) 4461-4464	21
Adey, W.R.: Tissue Interactions with Nonionizing Electromagnetic Fields (Review), *Physiol. Rev.* 61 (1981) 435-514	21
Luben, R.A., Adey W.R., Cain, C.D., Chen, M.C.Y., Rosen, D.M.: Effects of Electromagnetic Stimuli on Bone and Bone Cells In Vitro - Inhibition of Responses to Parathyroid Hormone by Low-Energy Low-Frequency Fields, *P. Natl. Acad. Sci. USA* 79 (1982) 4180-4184	21
Tsong, T.Y., Astumian, R.D.: Absorption and Conversion of Electric Field Energy by Membrane Bound ATPases, *Bioelectrochemistry and Bioenergetics* 15 (1986) 457-476	20
Pethig, R., Kell, D.B.: The Passive Electrical Properties of Biological Systems - Their Significance in Physiology, Biophysics and Biotechnology (Review), *Phys. Med. Biol.* 32 (1987) 933-970	20

The list of journal and non-journal items most cited in *Bioelectrochemistry and Bioenergetics* during the 1980-1998 period is given in Table 8. A few non-journal items attracted significantly higher number of references than most journal articles.

Bard & Faulkner's classic proved to be the most cited work in electrochemistry both in 1990 and 1995 [5].

A reference item worth of particular attention is Lowry's *J. Biol Chem.* article, which is the highest cited scientific article of all times: in 1998, 47 years after its publication it still received a total of more than 5000 citations!

It is somewhat surprising that the 90's are represented in this most-cited list with a single paper, that of Goodman & Shirley-Henderson from 1991.

The age distribution of the references is shown in Fig. 13. Again, the 80's (Periods 2+3) and the 90's (Periods 4+5) are presented separately. The maximum (modus) of both distributions is at 2 years, the median ("reference half-life") changed from 6 to 7. This latter value indicates that *Bioelectrochemistry and Bioenergetics* papers largely rely upon more "mature" literature, but the value is far not unusual in this field. Another indicator characteristic to the age of the references is the *Price-index*: the percentage share of references not older than five years. The Price-index of *Bioelectrochemistry and Bioenergetics* changed from 45% to 41% during the period under study - certainly far from the 80% of the hottest particle physics or molecular biology journals, but fitting well into its own subject field.

Some of the references are worth attention just because of their extreme age. References to papers more than a century old at the time of citation are collected in Table 9 in the order of their age.

It is worth noting that these "citation Methuselahs" were mentioned not in some special historical studies but in 18 research articles.

Table 9
Century old references found in *Bioelectrochemistry and Bioenergetics*

Van Helmont J.B., *A Ternary of Paradoxes*, 1620
Boyle R., *Sceptical Chymist*, 1661
De Lorraine P., *Physique Occulte*, 1693
Galvani L., *De Viribus Electricitatis*, 1791
Dubois-Reymond E., *Untersuch. Tierische Elektrizität*, 1849
Bernstein J., *Arch. Ges. Physiol.*, 1 (1868) 173
Wolff J., *Arch. Anat. Phys.*, 50, (1870)
Burdon-Sanderson J., *P. R. Soc. London*, 21 (1873) 491
Lippmann G., *Poggendorf Ann.*, 149 (1873) 547
Gibbs J.W., *T. Connecticut Acad.*, 3 (1875) 106
Lippmann G., *Ann. Chim. Phys.*, 5 (1875) 494
Lippmann G., *Ann. Chim. Phys.*, 12 (1877) 265
Gibbs J.W., *T. Connecticut Acad.*, 3 (1878) 343
Helmholtz H., *Ann. Phys. Chem.*, 7 (1879) 337
Lippmann G., *Wiedemanns Ann.*, 11 (1880) 316
Hertz H., *J. Reine Angewandte. M.*, 92 (1881) 156
Hertz H., *Ann. Phys. Chem.*, 13 (1881) 266
Maxwell J.C., *Treatise of Electricity*, 1881
Plochl J., *Ber. Dtsch. Chem. Ges.*, 21 (1888) 2117
Nernst W., *Z. Phys. Chem.*, 4 (1889) 129
Maxwell J.C., *Electricity and Magnetism*, 1892
Edwardes D., *Q. J. Pure Appl. Math.*, 26 (1893) 70

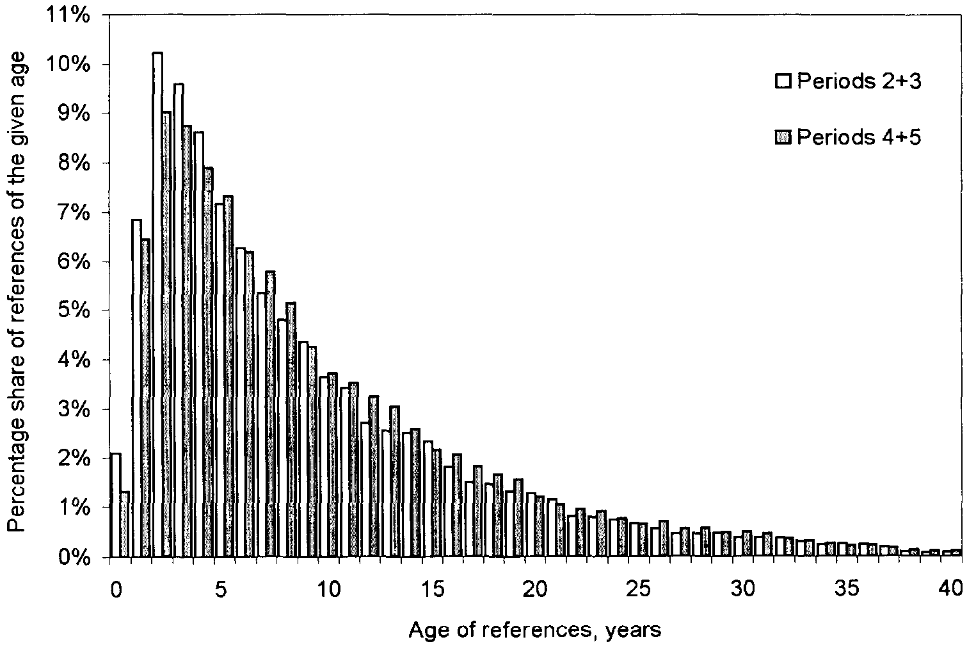

Fig. 13. Distribution of references by age
Periods 2+3: 1980-1989, Periods 4+5: 1990-1999

4. Analysis of citations

First some summary statistics. During the years 1975-1998, 1522 *Bioelectrochemistry and Bioenergetics* papers (out of the total 2044) received 13512 citations from 8314 citing papers (including 1023 papers from *Bioelectrochemistry and Bioenergetics* itself). Taking into account that according to certain estimates [7] 25% of the scientific literature would never be cited, and that about 2/3 of the uncited *Bioelectrochemistry and Bioenergetics* papers were published after 1995, having thus good chances to get still cited, the overall visibility of the journal is definitely above average.

Bioelectrochemistry and Bioenergetics papers were cited in the 1975-1998 period in more than 1000 journals. Almost half of the citing items (and 56% of the citations) were concentrated in 25 journals (see Table 10)

Table 10
Journals citing *Bioelectrochemistry and Bioenergetics*

Journal	No. of citing items	No. of citations
Bioelectrochem. Bioenerg.	1023	2491
J. Electroanalytical Chem.	544	992
Biochim. & Biophys. Acta	266	429
Analyt. Chim. Acta	235	373
Analyt. Chem.	201	319
Electroanalysis	193	366
Biophys. Journal	157	270
Stud. Biophys.	138	208
Electrochim. Acta	106	218
Biochemistry	103	122
J. Am. Chem. Soc.	101	142
Bioelectromagnetics	96	156
Biofizika	96	202
Biologicheskie Membrany	83	146
Biosensors & Bioelectronics	77	109
Langmuir	72	100
Russian J. Electrochem.	71	98
Analyst	67	91
J. Membrane Biol.	67	84
J. Colloid & Interface Sci.	66	76
Analyt. Lett.	65	94
J. Phys. Chem.	63	72
Electro- & Magnetobiol.	56	126
Talanta	54	77
Inorg. Chem.	53	62

The set of citing and cited journals (cf. Table 7) is obviously largely overlap. It is interesting to compare the relative weight of journals as cited and citing journals. An indicator, the *Cited/Citing Ratio* was created as the ratio of the share of a given journal in all *Bioelectrochemistry and Bioenergetics* references to its share in all items citing *Bioelectrochemistry and Bioenergetics*. Values greater than 1 indicate that the journal in question is mainly an information provider to rather than an information user of *Bioelectrochemistry and Bioenergetics*, for values smaller than 1, the situation is just the opposite. The Cited/Citing Ratio of a selected set of journals relative to *Bioelectrochemistry and Bioenergetics* is given in Table 11.

Table 11
Cited/Citing Ratio of a selected set of journals (relative to *B&B*)

Journal	Cited/Citing Ratio	Journal	Cited/Citing Ratio
Nature	11.5	Bioelectromagnetics	1.1
J. Biol. Chem.	8.2	Biophys. Journal	1.0
Science	7.6	J. Electrochem. Soc.	0.9
Proc. Natl. Acad. Sci. USA	7.4	Analyt. Chem.	0.8
FEBS Lett.	2.8	Stud. Biophys.	0.5
J. Am. Chem. Soc.	2.5	J. Electroanalytical Chem.	0.5
J. Membrane Biol.	2.0	Langmuir	0.4
Biochemistry	1.9	Electrochim. Acta	0.4
Biochim. & Biophys. Acta	1.8	Analyt. Chim. Acta	0.3
Photochem. & Photobiol.	1.5	Electroanalysis	0.1

3.1 The sources of the citations

The statistics of this section are based on the 7291 papers citing *Bioelectrochemistry and Bioenergetics* and published in other journals.

The country distribution of the authors of the citing items is compared in Fig. 14 with that of the *B&B* publications for 20 countries responsible for more than 95% of the papers in the journal.

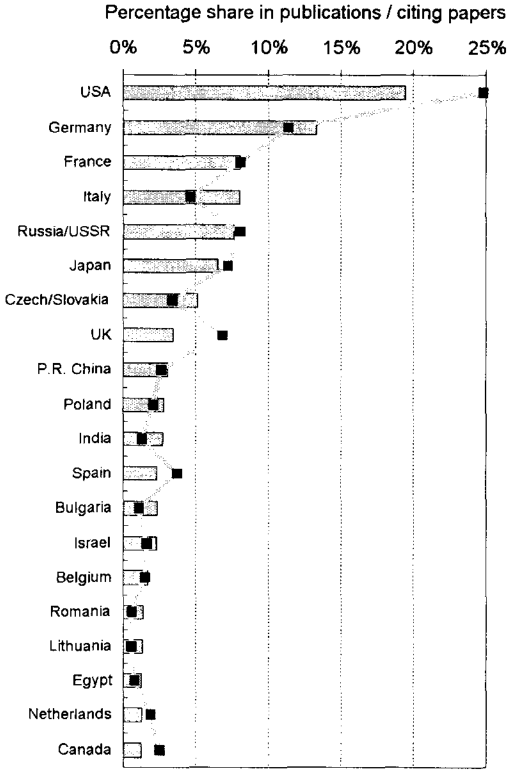

Fig. 14. Percentage share of 20 countries in *B&B* publications (bars) and in citing items (solid squares + line)

The two distributions apparently resemble, a closer look, however, reveals interesting differences.

Table 12 lists the countries in the decreasing order of an indicator named *Citation/Publication Preference Index*. This indicator is the ratio of the country's share in papers citing *Bioelectrochemistry and Bioenergetics* to its share in papers published in the journal. The value of this indicator can be interpreted in two ways: from the side of the numerator or of the denominator. Thus a high value may either mean that authors from the country have a special preference for citing *Bioelectrochemistry and Bioenergetics* or that they are negatively biassed as publishing in the journal is concerned; similarly, a low value may equally be interpreted as a negative bias in citation or as a positive bias in publication behavior. To put it a bit aphoristically: those at the top of the list are readers rather than writers, those at the bottom, writers rather than readers.

Table 12
Countries ranked by their Citation/Publication Preference Index

Country	Citation/Publication Preference Index	Country	Citation/Publication Preference Index
Ireland	15.42	Belgium	0.87
Turkey	8.13	Germany	0.85
Taiwan	6.45	P.R. China	0.84
Mexico	3.08	Poland	0.73
Greece	2.62	Brazil	0.69
Finland	2.29	Israel	0.69
Switzerland	2.24	Chile	0.69
Canada	2.03	Czech/Slovakia	0.66
UK	1.99	Egypt	0.60
Sweden	1.91	Denmark	0.59
Australia	1.72	Austria	0.59
Spain	1.58	Italy	0.57
Netherlands	1.48	Portugal	0.54
USA	1.27	India	0.46
Japan	1.11	Bulgaria	0.44
Yugoslavia	1.09	Romania	0.40
Russia/USSR	1.05	Lithuania	0.39
France	1.00	New Zealand	0.39
Argentina	0.97	Slovenia	0.35
Hungary	0.90	Armenia	0.35

In Table 13, those authors are listed who cited *Bioelectrochemistry and Bioenergetics* papers most frequently in other journals. Authors marked with an asterisk (*) were also authors in *Bioelectrochemistry and Bioenergetics* itself; those marked with a double asterisk (**) were in the most productive authors' list (Table 1). Comparing the three lists of Tables 1, 6 and 13, it is rather apparent that a very coherent set of scientists dominate the lists whether publishing, citing or cited authors are concerned.

Table 13
Authors citing *B&B* papers most frequently in other journals

Author	No. of citing items	No. of citations	Author	No. of citing items	No. of citations
* Zimmermann, U.	66	120	* Deng, J.Q.	27	43
** Palecek, E.	57	140	* Kadish, K.M.	25	37
* Gorton, L.	56	125	* Brabec, V.	24	46
** Wang, J.	52	101	* Cosnier, S.	24	40
** Dong, S.J.	51	104	* Nir, S.	24	24
** Teissie, J.	46	85	* Willner, I.	24	45
** Kell, D.B.	43	79	* Heineman, W.R.	23	41
** Scheller, F.	37	61	* Kano, K.	23	40
* Tsong, T.Y.	37	67	* Kauffmann, J.M.	23	56
* Markin, V.S.	36	49	* Markó-Varga, G.	23	59
** Tien, H.T.	36	143	** Neumann, E.	23	43
** Blank, M.	35	109	* Salamon, Z.	23	56
* Haladjian, J.	35	92	** Berg, H.	22	73
* Hill, H.A.O.	35	60	* Schmidt, H.L.	22	36
** Volkov, A.G.	35	73	** Senda, M.	22	29
* Astumian, R.D.	34	55	* Sokolov, V.S.	22	26
* Bianco, P.	34	91	** Tarasevich, M.R.	22	36
* Katz, E.Y.	34	64	* Chen, H.Y.	21	32
* Chernomordik,L.V.	33	93	* Dominguez, M.	21	38
** Abidor, I.G.	32	90	** Goyal, R.N.	21	33
** Kulys, J.J.	32	56	* Krull, U.J.	21	40
** Glaser, R.	31	54	* Niki, K.	21	46
** Donath, E.	30	55	** Pastushenko, V.F.	21	50
* Ikeda, T.	30	49	* Berthon, G.	20	20
** Weaver, J.C.	30	110	* Hawkridge, F.M.	20	56
* Tollin, G.	29	49	* Kovacic, P.	20	34
** Trchounian, A.A.	29	131	* Liu, H.Y.	20	26
** Martirosov, S.M.	28	94	* Mobius, D.	20	25
** Nunez-Vergara,L.J.	28	42	O'Neill, R.D.	20	35
** Squella, J.A.	28	42	** Temerk, Y.M.	20	71
* Blazquez, M.	27	46	* Wang, E.	20	36
** Chizmadzhev, Y.A.	27	82			

3.2 The targets of citations

The most cited papers published in *Bioelectrochemistry and Bioenergetics* are collected in Table 14.

Table 14
The most cited papers published in *Bioelectrochemistry and Bioenergetics*

Bibliographic data	Number of citations
Vol. 6 No. 1 (1979) 37–52 **Abidor, I.G.** & al., Electric breakdown of bilayer lipid membranes. I. The main experimental facts...	207
Vol. 5 No. 1 (1978) 116–133 **Nir, S.** & al., Binding of cations to phosphatidylserine vesicles	114
Vol. 15 No. 3 (1986) 457–476 **Tsong, T.Y., Astumian, R.D.**, Absorption and conversion of electric field energy by membrane bound ATPases	98
Vol. 5 No. 3 (1978) 504–525 **Lane, R.F.** & al., Brain dopaminergic neurons. In vivo electrochemical information concerning storage...	87
Vol. 8 No. 1 (1981) 103–113 **Cénas, N.K., Kulys, J.J.**, Biocatalytic oxidation of glucose on the conductive charge transfer complexes	85
Vol. 7 No. 3 (1980) 553–574 **Zimmermann, U.** & al., Development of drug carrier systems. Electrical field induced effects in cell membranes	84
Vol. 7 No. 3 (1980) 527–537 **Eddowes, M.J.** & al., The electrochemistry of cytochrome c. Investigation of the mechanism...	81
Vol. 22 No. 3 (1989) 211–218 **Tien, H.T., Salamon, Z.**, Formation of self-assembled lipid bilayers on solid substrates	81
Vol. 4 No. 4 (1977) 512–521 **Kuznetsov, B.A.** & al., The reduction mechanism of cytochrome c and methemoglobin on the mercury electrode	64
Vol. 25 No. 3 (1991) 335–355 **Goodman, R., Shirley-Henderson, A.**, Transcription and translation in cells exposed to extremely low-frequency electromagnetic fields	64
Vol. 7 No. 3 (1980) 503–511 **Kittler, L.** & al., Redox processes during photodynamic damage of DNA. III. Redox mechanism of photosensitization...	63
Vol. 24 No. 3 (1990) 305–311 **Kulys, J., Schmid, R.D.**, Mediatorless peroxidase electrode and preparation of bienzyme sensors	63
Vol. 15 No. 2 (1986) 275–295 **Palecek, E.**, Electrochemical behavior of biological macromolecules	62
Vol. 4 No. 4 (1977) 490–499 **Scheller, F.**, Functional properties of adsorbed hemoproteins	61
Vol. 8 No. 1 (1981) 81–88 **Kulys, J.J.** & al., The development of bienzyme glucose electrodes	60
Vol. 12 No. 3-4 (1984) 297–322 **Razumas, V.J.** & al., Electrocatalysis on enzyme-modified carbon materials	60
Vol. 6 No. 1 (1979) 53–62 **Pastushenko, V.Ph.** & al., Electric breakdown of bilayer lipid membranes. II. Calculation of the membrane lifetime...	59
Vol. 9 No. 3 (1982) 365–378 **Elving, P.J.** & al., NAD/NADH as a model redox system. Mechanism, mediation, modification by the environment	59
Vol. 7 No. 4 (1980) 723–739 **Benz, R., Zimmermann, U.**, Relaxation studies on cell membranes and lipid bilayers in the high electric field range	58
Vol. 5 No. 1 (1978) 67–76 **Bawin, S.M.** & al., Possible mechanisms of weak electromagnetic field coupling in brain tissue	56
Vol. 26 No. 2 (1991) 287–296 **Wollenberger, U.** & al., Bulk modified enzyme electrodes for reagentless detection of peroxides	56
Vol. 4 No. 1 (1977) 1–17 **Kuznetsov, B.A.** & al., Electrochemical behaviour of proteins containing coenzyme groups and metals	54
Vol. 8 No. 3 (1981) 355–370 **Jaegfeldt, H.**, A study of the products formed in the electrochemical reduction of nicotinamide-adenine dinucleotide	54
Vol. 6 No. 2 (1979) 117–122 **Scheller, F.** & al., Polarographic reduction of the prosthetic group in flavoproteins	52
Vol. 8 No. 6 (1981) 621–631 **Palecek, E.** & al., Reaction of the purine and pyrimidine derivatives with the electrode mercury	51

About 75% of the citations were received by papers with at least one author from the 12 most productive countries. The relative contributions of authors from these countries to the citedness of the journal can be assessed by the relative citation rate (RCR). This indicator gauges the actual number of citations received by each paper to the expected number of citations, i.e., to the average citation rate of the journal. To put it very simply, countries with RCR values higher then 1 contribute to the citedness above par, while those with RCR < 1 contribute under par. The 12 most productive countries of each period (Periods 1–5) are ranked by their relative citation rate in Table 15. The most striking feature of these lists is the constant high Relative Citation Rate of Russian/USSR papers. In most journals (except for the domestic ones) the citation rate of Russian papers seriously lags behind the journal average (see, e.g. [8]). Surprising as it is, the high RCR value of USA is also unusual, since - due to a kind of "large number effect" - the typical USA RCR value is around 1. It seems that what has been lost in quantity (cf. Table 3), is gained in quality. On the other hand, Italy pays the price of a rather mediocre Relative Citation Rate indicator for its overrepresentation in the journal. India's rear position is symptomatic; UK is extremely fluctuating; the dynamic development of Spain and China (cf. Fig. 6) is not limited to publication numbers but is also reflected in the RCR indicator.

Table 15
Relative Citation Rate (RCR) of countries

Period 1 (1974-1979)		Period 2 (1980-1984)		Period 3 (1985-1989)		Period 4 (1990-1994)		Period 5 (1995-1999)	
Country	RCR	Country	RCR	Country	RCR	Country	RCR	Country	RCR
USSR/Russia	1.82	UK	1.98	USA	1.78	USA	1.70	USA	2.03
Germany	1.31	Armenia	1.45	Canada	1.47	UK	1.40	USSR/Russia	1.67
Poland	1.05	Germany	1.34	USSR/Russia	1.15	Germany	1.31	Germany	1.30
USA	1.00	USSR/Russia	1.33	Bulgaria	0.97	Japan	1.02	Czech Rep.+Slovakia	1.26
Japan	0.99	Japan	0.99	Germany	0.87	France	0.97	Spain	1.23
Czechoslovakia	0.88	Czechoslovakia	0.95	Spain	0.86	USSR/Russia	0.90	P.R. China	1.01
France	0.70	USA	0.91	UK	0.83	Italy	0.76	France	0.95
Italy	0.63	France	0.82	France	0.76	P.R. China	0.58	Japan	0.85
UK	0.51	Israel	0.60	Japan	0.76	Poland	0.54	Romania	0.69
Belgium	0.46	Italy	0.58	Belgium	0.76	Spain	0.54	Italy	0.69
Israel	0.39	Poland	0.43	India	0.57	India	0.29	UK	0.52
New Zealand	0.24	India	0.31	Italy	0.52	Bulgaria	0.24	India	0.44

Similarly to the countries, thematic categories can also be compared using the Relative Citation Rate indicator. The actual citation rate of papers classified into a given category can be measured to the journal's average. A period-by-period comparison of RCR values of the five thematic categories A though E is given in Table 16.

Conspicuously, neither of the categories maintained an indicator value either above or below 1 in all five periods.

Table 16
Relative Citation Rate of *Bioelectrochemistry and Bioenergetics* publications classified into the five thematic categories

	Period 1	Period 2	Period 3	Period 4	Period 5
Category A	1.06	0.98	1.14	1.32	1.03
Category B	0.88	0.92	0.71	1.02	0.93
Category C	0.93	1.10	1.09	1.06	0.75
Category D	1.18	1.12	1.01	0.93	1.58
Category E	0.98	1.01	1.17	0.95	0.56

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