THE ACTIVE LEVEL OF THE RESEARCH OF BLOOD RHEOLOGY PRESUMED BY BIBLIOMETRIC EVALUATION / O NÍVEL DA INVESTIGAÇÃO EM REOLOGIA SANGUÍNEA PRESUMÍVEL ATRAVÉS DA AVALIAÇÃO BIBLIOMÉTRICA

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INTRODUCTION

There is a modality of assessment that has the output of the number of research papers as a method of capturing and finding the briskness of the research. This is called bibliometric evaluation. To retrieve the medical literature easily by using the internet Medline today had been changed in many phases. Medline (MEDLARS on Line) by online services was developed in the 1970's. Literature retrieval system PubMed that we are using in daily study is called Internet version Medline.

The purpose of this paper is to estimate the trend and the active level of a recent research in the Clinical Hemorheology field because it is possible to retrieve the document by Medline.

METHOD OF STUDY

The number of pertinent papers was investigated from the aspect of the blood rheology with using Medline about the following key words: ① blood viscosity, ② erythrocyte (red cell) deformability, ③ leukocyte deformability and ④ blood viscoelasticity.

1) The above-mentioned each key word was displayed in bulk as "Blood Viscosity and Related Article".

2) The investigation of the number of papers in line with the various diseases and the blood rheology factors. The retrieval methods were PubMed (Medline 1966-2009 years) and Old Medline (1950-1965). The comparison of the numbers of papers according to the diseases were settled: a) diabetes and other diseas-

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es; b) Hematological disease; c) Cardiovascular disease; d) Cerebrovascular disease; e) Hepatic disease and f) Collagen disease.

3) The object of comparison items was divided into three categories.

I. All "Blood viscosity and related articles": diseases and conditions were assumed to be a retrieval item. It was above-mentioned a) – f) settled not only those diseases but also all other diseases for instance, high blood pressure, shock, the pregnancy, and the effects of the medical drugs were included.

II. "Diabetes and related articles."

III. "Groups of disease and related articles" other than Diabetes: Above-mentioned b)-f) disease groups.

4) The paper retrieval was done in the period from 1950 to March, 2009, subtotaled every four years, and shown by the time series.

RESULTS

The output of research papers were retrieved by Medline from 1950to 2009 every four years and shown by time series. Although there were already appeared in International journal of Biorheology and Clinical Hemorheo1ogy and Microcirculation including blood rheology, but it was behind contents of these journal having come to appear in PubMed from 1965 and 1997 respectively.

The output of research in rheological papers showed the highest number for four years of 1990-1993 shown in Table I. A sudden extension

Table I – Number of papers of hemorheology retrieved by Medline from 1950-2009. Subtotal numbers of papers were taken in every 4 years.

	All"Blood viscosity & releated articles"*	Diabetes : blood viscosity & rerated articles*	Various diseases (excluded DM) & related articles*
1950-1953	31	1	7
1954-1957	33	0	8
1958-1961	36	1	5
1962-1965	243	2	122
1966-1969	629	15	266
1970-1973	769	28	375
1974-1977	972	39	546
1978-1981	1,242	70	683
1982-1985	1,719	128	947
1986-1989	1,904	110	1,093
1990-1993	1,998	110	1,226
1994-1997	1,572	82	875
1998-2001	1,524	89	812
2002-2005	1,681	88	847
2006-2009	1,482	71	595
Total	15,815	834	8,394

* "Blood viscosity & related articles": ① blood viscosity, ② erythrocyte deformability, ③ leukocyte deformability and ④ blood viscoelasticity.
Various diseases [excluded: a) DM; b) Hematological disease; c) Cardiovascular disease; d) Cerebrovascular disease; e) Hepatic disease and f) Collagen disease]
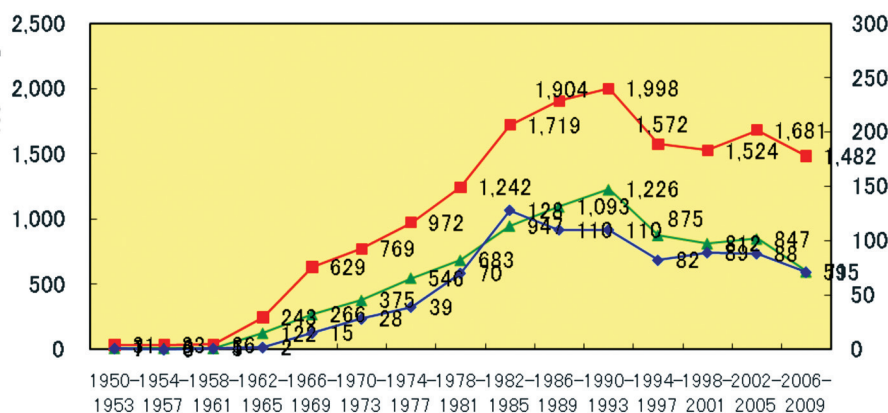
Fig. 1 – Drawn a graph of Table I, the y vertical line was indicated a quantity of papers and horizontal axis indicated years. The number of paper was shown in a right y vertical line showing the diabetes. ■ – All "blood viscosity & related articles": ① blood viscosity, ② red cell deformability, ③ leukocyte deformability and ④ blood viscoelasticity. ▲ – Various diseases excluded including: a) DM; b) Hematological disease; c) Cardiovascular disease; d) Cerebrovascular disease; e) Hepatic disease and f) Collagen disease . ◆ – Diabetes

of the paper had been seen since1978, though till then, an increase of papers comparatively showed the gradual. On the other hand, a decrease was recognized rapidly as for the number of the paper production after 1998.

The output of the papers had been indicated the highest value for four years of 1990-1993 shown in Table I.

In Fig. 1, The upper running solid red square mark connecting line showed all "Blood viscosity & related articles including the various diseases and the pathophysiology, etc.". The solid green triangle mark connecting line showed "Various disease groups [b)-f)]", and the solid blue diamond-shaped mark connected line showed "Diabetes".

As for the age, the computerized search was not able to be used even though it was retrieved by Index Medicus. The results showed to suggest today's trend.

Fig. 2 was a graph of Table II, in which where the change of "Number of papers regarding viscosity of blood (1972-1983, 3.)" was drawn. While

tracing the graph, increasing tendency was seen while repeating the increase and decrease. "ICBR" and "CH" described in the horizontal axis were the abbreviation of "International Congress on Biorheology" and "European Conference on Clinical Hemorheology" respectively. An increase of the number of papers was recognized before and after of those meetings' holding years.

Table III showed the first autour's nationality and the number of paper in blood rheology in publishing jour-
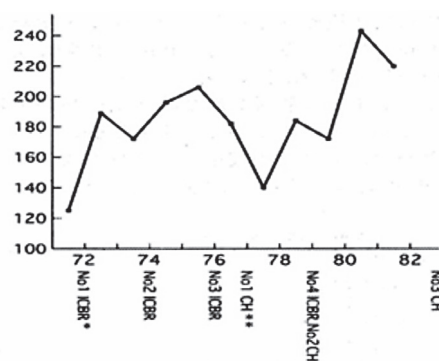
* ICBR: International Congress of Biorheology
** CH: International Conference of Clinical Hemorheology

Fig. 2 – References of "Blood Viscosity" in clinical medicine search by Index Medicus, 1972-1983

Table II – Number of papers related "Blood Viscosity" retrieved by Index Medicus, from 1972 to March 1983. The counting of upper four prizes as following: effects of medical drugs, paraproteinemia, ischemic heart disease and diabetes mellitus.

	'72~74	'75~79	'80~83	Subtotal
Hypertension	22	28	31	81
Ischemic Heart Disease	34	71	55	160
Cerebrovascular Disorder	12	33	38	83
Shock	21	28	21	70
Thrombosis	35	34	22	91
Raynaud's Disease	4	15	18	37
Paraproteinemia	36	81	53	170
Diabetes Mellitus	25	44	56	125
Pregnancy	8	28	25	61
Effect of Medicine	67	143	121	331
Total	264	505	440	1209

nal issue classfication by countries. As for the belonging, First author's unknown nationality was excluded.

Slashing bars meant the country of publishing journals or books, blue bars showed first author's nationality (only described).

Fig. 4 displayed a retrieval of the papers published in the Japanese journals and proceedings[5] about the blood rheology the same as in Table 1, those were viscosity of blood, erythrocyte

deformability, leukocyte deformability and blood viscoelasticity.

DISCUSSION

Brief History of Medline

The starting point of Medline was "Index Medicus: a monthly classified record of the current medical literature in the world (henceforth IM Old Series). This was assumed the start for the purpose of reducing the labor of the document retrieval for present American national library (National Library of Medicine, NLM) since 1879. However, the continuance of publication became difficult because of financial difficulties in 1927, though this IM OLD Series continued in vicinity for 50 years. The other side, American Medical Association had issued "Quarterly Cumulative Index to Current Medical Literature" (QCICML) beside IM OLD. In 1927, IM OLD series and QCICML obtained the help of the Car-

Table III – Blood rheology paper output of classification by countries

	The first author belonged country (author's who describes)	Publishing journal or book issue countries
United State of America	2101	5470
United Kingdom/Scotland	467	2505
Switzerland	118	609
Sweden	144	134
Russia/USSR	77	976
Poland	81	168
Netherlands	180	1117
Japan	612	483
Italy	380	549
Germany	527	1303
France	402	377
China	328	620
Canada	212	88

negie Foundation, and came to be issued a new Quarterly Index Medicus (QIM). And then, the publication of IM NEW Series started in 1960 through the age of a hard-to-find foreign magazine of the Second World War.

Afterward medical document analysis, and search engine (Medical Literature Analysis and Retrieval System, MEDLARS) this led to development, and it became Medline of today repeatedly the upgrade[1].

Bibliometric Evaluation

The activity situation of the blood rheology research was presumed in the output of the research papers that was called Bibliometric Evaluation.

Medline was a literature database in the medical science field, and it was used as information resources that support the document retrieval necessary for the academic activity.

On the other hand, it could be said that the productivity of the research paper was assumed to be an index, and the meaning of the medical research analysis was clarified because it was appreciable as the extension and the evaluation tool in the field of the academic activity.

In addition, the analysis that pays attention to the production of paper was taken up as basic material in advancing the scientific policy of the nation.

"International comparison investigation of the science paper : trends of the paper output of the science, engineering, and medical fields" of 1995-1996 was published by old National Center for Science Information Systems in Japan (Editors-in--Chief: Masamitsu Negishi and Sigeaki Yamazaki) in Japan[2].
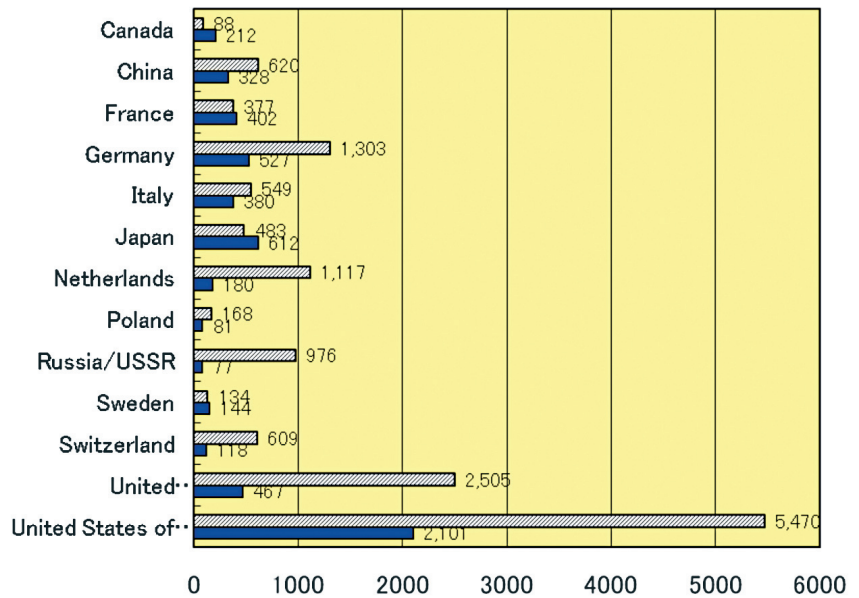

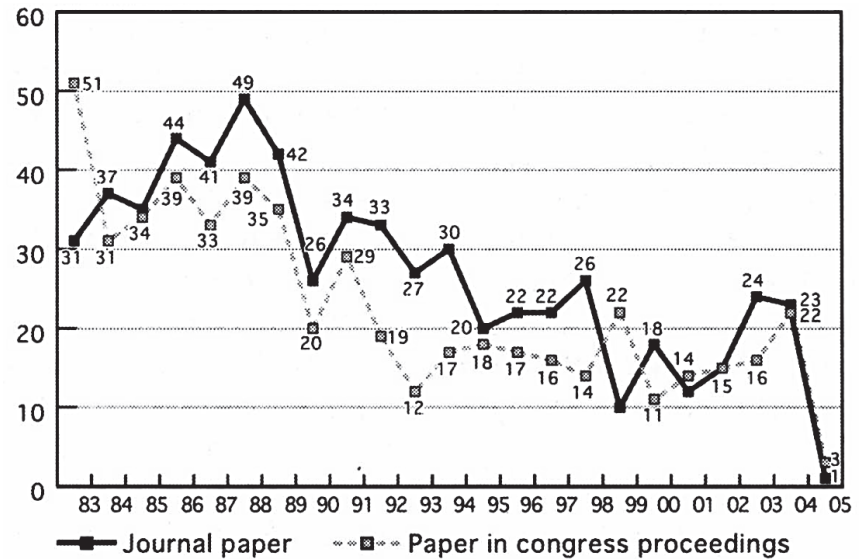Fig. 3 – The graph was showing of Table III in horizontal bar chart

Fig. 4 – Number of hemorheological papers in japanese journals and congress proceedings

As a result, it was a source including the research fund, talent, and the education, etc.

Moreover, the research paper output is useful for the science policy in each country comparative study as the competency of specific laboratories and the factor of the evaluation of research revitalization degree.

Evaluation of Research Revitalization

Anyway, it could be utilized as the ranking evaluation of the material by assuming bibliometric activity to be an important objective criterion of the research revitalization degree : it was about each part of the self-evaluation or the university.

Paper Output of Blood Rheology

Table 1 has shown the change of the time series of the paper output of the blood rheology for 60 years, and was what of the disease and the diabetes connected to an item related to the blood rheology compared according to the categories mentioned above (I, II and III).

In 1958-1961, it was that the papers of "Blood viscosity and the related articles" had showed an increase. It was the age when plastic spouting, manufacturing on a practical side and the process in line with there was an age when the highly developed polymer chemistry, which was close related with the rheology development, and the biorheology faced a prosperous period in its background.

The first international journal of Biorheology volume 1 issued in 1962 was published by the Pergamon Press, in England. The editors-in-chiefs were Alfred L Copley and George Scott Blair.

The 1st International Conference on Hemorheology (ICH) was held in Reykjavik, Iceland in July, 1966. As for the research of the blood rheology, these events caught attention and absorbed interest of researchers, and the research of the field became active.

The above-mentioned international hemorheology conference changed the name on the occasion of holding the 1st International Biorheology Congress in the meeting of the 3rd ICH in Lyon, France in September, 1972, and came to encompass the entire science of Biorheology besides the blood rheology.
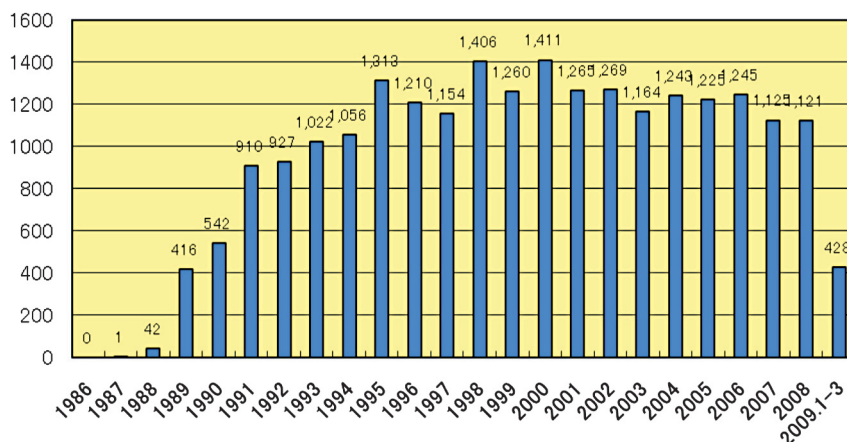
Yrs	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
No	0	1	42	416	542	910	927	1022	1056	1313	1210	1154
Yrs	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
No	1406	1260	1411	1265	1269	1164	1243	1225	1245	1125	1121	428

Fig. 5 – The transition of output on "Endothelin" papers

The 1st European Conference on Clinical Hemorheology was held in Nancy, France in October, 1979[3]. The rise of concern to the clinical blood rheology and related pharmacology were increased.

The first volume 1 issue of the Clinical Hemorheology was published as Biorheology sisters international journal in 1981. The editors-in-chief were Alfred L Copley and Siegfried Witte.

Transition of Paper Output

As for the movement of "Blood viscosity and related articles", the paper production had increased rapidly around 1978-1981. Figure 1 showed the change of time series of the number of papers in the graph. It was thought that the 3 factors of ① the establishment of the clinical blood rheology society (European Clinical Hemorheology Society), ② the regular science meeting, ③ the Clinical Hemorheology (CH) journal publication ,contributed to the research stimulation and the increase of the research paper production. However, it was after 1997 the contents of the CH journal were recorded in Medline.

Therefore, it seemed that the CH papers were published in other journals until that time.

Movement, according to the category (I, II and III), showed the similar abbreviation change, and special movement was not seen in "Papers concerning the diabetes" output in Fig. 1.

Table II was the one that the authors had examined the number of documents of "Viscosity of blood"

related to clinical for 12 years from 1972 to Mar., 1983. We want to pay attention to a lot of numbers of papers regarding the effects of the medical drugs, the paraproteinemia (especially serum hyperviscosity syndrome), the ischemic heart disease, and diabetes.

There were a lot of research papers concerning the effects of the medical drugs for the improvement of microcirculation and red cell deformability. Also it seemed that there were movement of the development of new medical drugs in the view point of blood rheology and of the implications. Moreover, the paraproteinemia came in succession at the time when serum hyperviscosity syndrome became a centering topic of the clinical blood rheology. These were suggested the background in the age, were the stimulation of the paper production on the research topics.

L. Bogar investigated the number of documents by Medline about "Blood and plasma viscosity" of the blood rheology factors and clinical researches until 1966-1997. It was described that a decrease was seen afterwards, and announced the result similar to authors' Figures 1 though the number of papers traced an increase until the latter half of the 1980's[4].

Paper Output in Various Countries

The contributed trend was examined the output of blood rheology papers classified in countries. In Table III, it has been understood that the United States, Britain, Germany, the former Soviet Union, and Russia

were greatly taking part in the paper production. Japan had a lot of numbers which were the first authors after the United States.

Fig. 4 showed the number of clinical blood rheology papers that were able to be put within Japan.

Anyway, an increase until achieving the research target and a decrease after that was assumed as for paper production.

The limit will gradually come into view to the production of papers concerned as long as abundant replenishment support of the sprout or research personnel of a relating modern research topic is not appeared.

In general, the subject of a specific research was formed when the interest of a related area rose if the announcement of the research topic newly paid attention to do and depth came out.

As one example (Fig. 5), the transition of the number of paper of endothelins (ET) (strong vasoconstrictor peptide isolated from the culture supernatant of the culture pig aorta vascular endothelial cell by Mazaki *et al.* 1998) in the vascular biology illustrated in figure and table.

The kind of the endothelin, its precursor and the appearance in cells, and the ET production lived with the cytokine got into the news in recent years, and the paper output seemed the exponential grow at the same time for discovering it.

In similar case, for instance, the paper output has showed an increase in vessel biology including biorheology, the reproduction medicine, and gene therapy, etc.

CONCLUSION

When the research target is subdivided , however, and the result rises, the paper output before long will limit and the expectation by which the acceleration becomes duller. On the other hand, the quality of the paper seems to rise even if the number of paper decreases.

At the end of the paper, authors hope the development of research and increase the paper production as there are unsettled topics a lot in the blood rheology.

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