

## **INTELLECTUAL PROPERTY IMPORTANCE IN EXAMPLE OF RECENT PATENTS IN THE FIELD OF BIOMATERIALS**

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### **ABSTRACT**

*The number of patents has been increasing steadily nowadays, forcing companies to consider intellectual property as a part of their strategy. Patent analysis and patent mapping are used as effective tools to quickly view a portfolio of patents.*

*The analysis of patents, as important significations of intellectual property in the field of biomaterials, was done using specific database - the International Patent Classification and Patent Scope - for the period 2003 to 2013 and obtained results are presented in this paper.*

**Keywords:** Biomaterials, Patent analysis, Patent databases.

### **1. INTRODUCTION**

With the evolution of human civilization, the field of biomaterials evolved involving different materials at multiple length scales from macro to micro and to nano level with a simple focus to extend human life and improve the quality of life [1].

A biomaterial can be defined as any material used to make devices to replace a part or a function of the body in a safe, reliable, economic, and physiologically acceptable manner [2].

Materials can be classified into different groups based on crystal structure, bonding, and macrostructures, showing somewhat similar properties. The most common classes of materials used as biomaterials are metals, polymers, ceramics, and composites [1, 3]. Specific metallic biomaterials can be made from stainless steels, alloys of cobalt, titanium and magnesium, as well as shape memory alloys of nickel–titanium, silver, tantalum and zirconium [4].

Interest in biomaterials research has been growing in the last decade, as a life-saving and life-improving option for countless patients, so biomaterials have been paid more and more attention. They has been developed as a science with various forms of implants/medical devices, widely used to replace and/or restore the function of traumatized or degenerated tissues or organs [5].

Current research interest focuses principally on tissue engineering, prostheses, bone regeneration, biological materials, drug delivery/nanoparticles, implants / surgery tools, methods and processes / sensors / diagnosis tools, surface modification / coatings, artificial tissues / organs, bio adhesives [6, 7].

When considering a biomaterial for implantation or medical use, the first most important requirement is non-toxic, non-immunogenic, chemically inert/active, and acceptable by the human body. Biocompatible in most cases means that the biomaterials must not form thrombi in the blood system, result in tumors in the surround tissues, or rejected by the body [5]. Critical issues in their clinical applications are systemic toxicity of released metal ions due to corrosion, fatigue failure of structural components due to movement [4].

## 2. METHODOLOGY

Although a large number of patents are technically significant, only a few patents actually develop into something of commercial value [8]. In order to gain an insight to an overall technology forecasting model, it is important to understand the growth in an area of technology and to measure using keywords or phrases [9]. Both scientific journals and patent databases record a high increase in publications in biomaterials area [5, 10]. Patent analysis represents a “valuable approach that uses patent data to derive information about a particular industry or technology used in forecasting” [9]. The objective of this work was to give an overview of current situation of biomaterials based on patent analysis for the period from the year 2003 to 2013. The analysis was done using the International Patent Classification and Patent Scope [10]. This database provides a lot of information about patents which helped to complete this analysis successfully. Information found in this database was about number of patents, patent classification by country, patent applicators, main inventors and pub date.

## 3. RESULTS AND DISCUSSION

According to the results obtained using the International Patent Classification and Patent Scope, there were 42.661 patents within the field of biomaterials (Figure 1.) in period from the year 2003 to 2013. Following pictures demonstrate lists of countries where patents were registered, applicators, inventors and the year of registration.

United States	23267	A61K	15959	THE REGENTS OF THE UNIVERSITY OF CALIFORNIA	244	BEVEC, Dorian	146	2003	2239
PCT	13425	A61L	9434	MASSACHUSETTS INSTITUTE OF TECHNOLOGY	204	Hunter William L.	123	2004	2327
European Patent Office	4320	A61F	8689	Massachusetts Institute of Technology	171	Sung Hsing-Wen	90	2005	2705
China	433	C12N	6329	The Regents of the University of California	149	VANANGAMUDI, Sulur, Subramaniam	67	2006	2946
Japan	314	A61P	4861	NOVARTIS AG	142	Brister Mark	53	2007	3203
South Africa	228	A61B	4217	Medtronic, Inc.	134	Bevec Dorian	48	2008	3639
Republic of Korea	218	C07K	4131	MONDOBIOTECH LABORATORIES AG	131	Mirkin Chad A.	47	2009	3807
Russian Federation	178	G01N	3994	BOSTON SCIENTIFIC SCIMED, INC.	120	Hubbell Jeffrey A.	42	2010	4056
Israel	163	C08G	2177	DexCom, Inc.	111	Reiley Mark A.	41	2011	3969
Mexico	58	C12Q	2146	ALLERGAN, INC.	97	Kohn Joachim B.	38	2012	3432
Russian Federation (USSR data)	26							2013	2534
Spain	12								
Singapore	12								
Brazil	5								

Figure 1. Summary data of biomaterials patents, Source: International Patent Classification (Patent Scope)

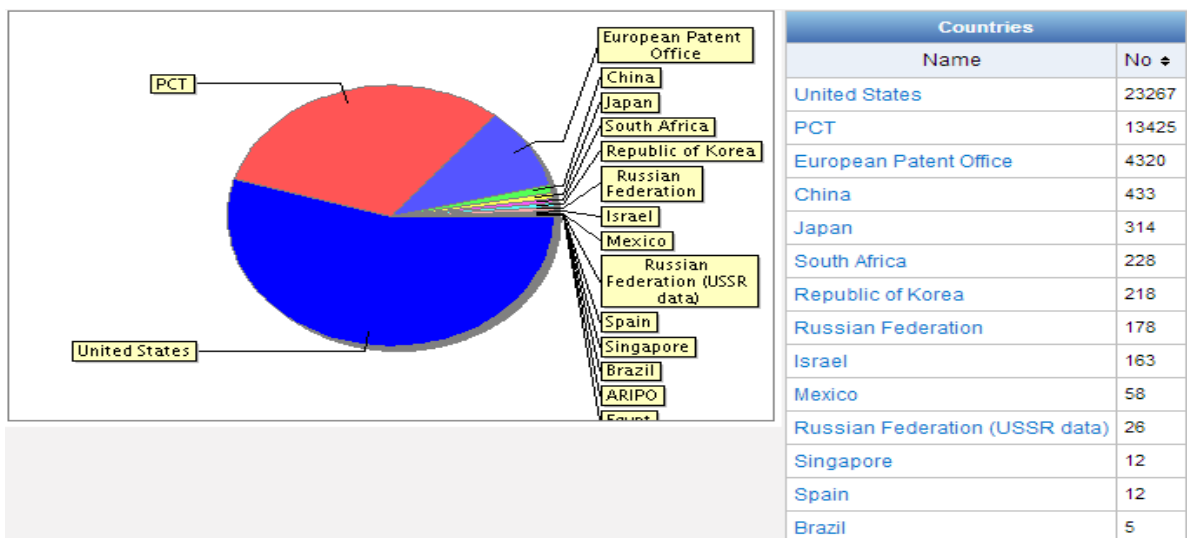


Figure 2. Review of biomaterials patents per countries, Source: International Patent Classification (Patent Scope)

As presented in Figure 2. United States has considerable advantage over countries which have most registered patents - from a total of 42.661 registered patents even 23.267 patents (about 55% of total). In analysed period from the year 2003 to 2013, main applicators for biomaterials patents (Figure 3.) were the Regents of the University of California (244 applications). According to Figure 4, Bevec Dorian (143 patents) and Hunter William (123 patents) were the inventors with most registered patents, whereas most of biomaterials patents (Fig. 5.) were registered in the years 2010 (4056 patents) and 2011 (3969 patents).

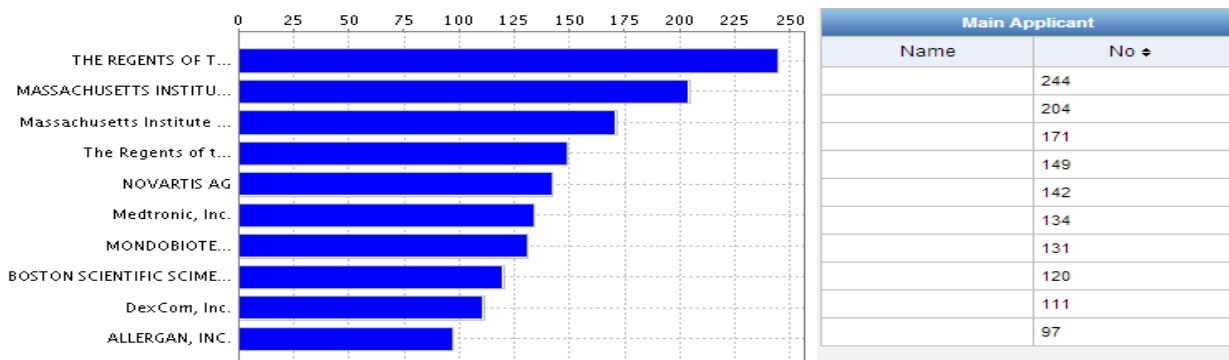


Figure 3. Review of main applicants for biomaterials patents, Source: International Patent Classification (Patent Scope)

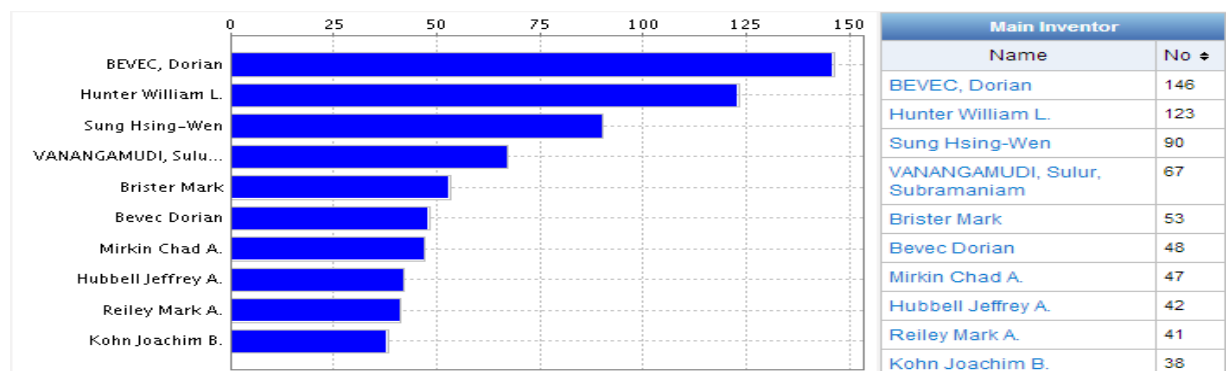


Figure 4. Review of main inventors for biomaterials patents, Source: International Patent Classification (Patent Scope)

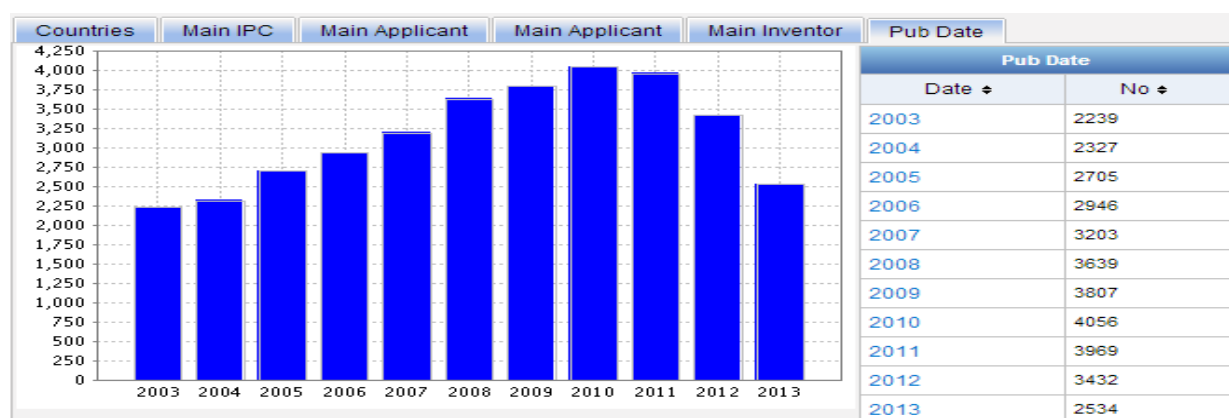


Figure 5. Review of pub date for biomaterials patents, Source: International Patent Classification (Patent Scope)

„Materials intended for biomedical purposes have evolved through three different generations, namely first generation (bioinert materials), second generation (bioactive and biodegradable materials) and third generation (materials designed to stimulate specific responses at the molecular level)” [11].

More than ten years of research and development of new biomaterials resulted in extending number of patents such as medical devices, implants and prostheses. Therefore, the presented results show that there is a growth of registered patents in general. This can be explained with the fact that biomaterials can be used for medical purposes and their acceptability by the human body [3]. The development and use of biomaterials is expected to dramatically increase over the coming decades as a result of ageing populations in Europe, China, Japan and the USA [12]. In the United States, the country with most registered patents, there are more than 13 million implant/medical devices implanted annually [5]. From 1997 until 2007 the European Union (EU) has funded biomaterials research projects (RTD) under its Fifth and Sixth Framework Programmes - 38 biomaterials projects were funded, with a total granted amount of € 66.6 million and research interest focused principally on tissue engineering, bone repair, diagnostic tools and medical adhesives [7]. Even though the Global Financial Crises in 2010 brought to a slight fall in registration of biomaterials patents, biomaterials for health will become a major focus of European research efforts in the coming years and as part of the Horizon 2020 Framework Programme for Research and Innovation [13].

#### 4. CONCLUSION

The analysis of patents, as important significations of intellectual property in the field of biomaterials, was done with specific database, using the International Patent Classification and Patent Scope for the period 2003 to 2013 and presented in this paper. It has been showed that the number of registered patents in the field of biomaterials was growing from year to year, and that United States is the country with the most registered patents. This drastic increase in number of announced patents can be explained by the fact that there was a significant investment in biomaterials research and development in the past ten years with the exception of Global Financial Crises in 2010. In accordance with previous facts, presented patent analysis in the field of biomaterials may be useful for trend monitoring in this scientific and technological field, being of interest for further technological forecasting and management.

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