JRC 142609

European Commission

SCIENCE FOR POLICY BRIEF

Trends in Patents in Life Sciences: focus on Pharmaceuticals and Medical Technologies

HIGHLIGHTS

→ Pharmaceuticals and Medical Technologies (PMTs) patents represent 12.6% of the total IP5 patent families[1] filed worldwide in the period 2010-2020.

→ The US are the biggest player in the field, filing 25.1% of all PMTs IP5 patent families 2010-2020. The EU is second with 17.2%, followed by Japan (8.5%), South Korea (4.4%) and China (3.2%).

→ The US have a clear specialisation in PMTs, while the EU is more or less in line with the world average in the time period considered.

→ Among EU Member States, Germany has by far the highest number of PMTs IP5 patent families filed in the observed period, accounting for 36% of all the patents filed by the EU 2010-2020.

INTRODUCTION

Patent data are commonly used to map technological activities (e.g. Archibugi and Pianta, 1996). Notwithstanding their known limitations (e.g. Griliches, 1998), patent data are considered a good proxy of the innovation output for a company, sector or country.

In a recent JRC report, Grassano et al. (2024) have used patent data to get a snapshot of the evolution of innovation in biotechnology across the world, finding that biotechnology patents represent around 5% of all the IP5 patents filed in the period 2001-2020 and almost all of them (96%) relate to industrial and medical applications.

This brief note presents a similar analysis on another subfield of Life Sciences, namely Pharmaceuticals and Medical Technologies (PMTs). PMTs patent families are defined as families where at least one application presents at least one of the technological codes (International Patent Classification (IPC) codes) related to PMTs and reported in the Annex section[2]. Each family defined accordingly counts as one PMTs

[1] International patents filed at multiple offices, at least one of which belonging to the IP5 consortium, composed by the European Patent Office (EPO), the United States Patent and Trademark Office (USPTO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), and China National Intellectual Property Administration (CNIPA). Unless explicitly specified, every time this note refers to patents, it always refers to IP5 patent families.

[2] Albeit the analysis on PMTs patents is conducted as the one on biotechnology patents in Grassano et al. (2024), the numbers from the two exercises cannot be directly combined. This is because the list of technological codes used in this note and the one used in Grassano et al. (2024) are both not mutually exclusive and present different levels of aggregation. This means that there are technological codes that are included in both lists (e.g. code A61K48), hence creating double counting. It also means that codes included in the PMTs technology list are on average more aggregated than those included in the biotechnology list, so that a direct comparison of the numbers included in the two documents is not recommended.

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patent family, with technologies or applicant countries included in each family fractionally counted.

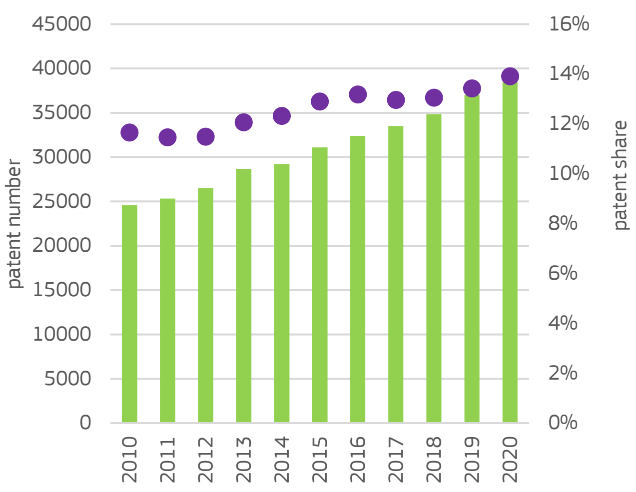
Following Grassano et al. (2024)[3], the dataset is built using the EPO's PATSTAT database[4]. We attribute a patent to the country where the applicant is located, fractionally counting for multiple applicants and countries. This information is not always available in PATSTAT. This is particularly true for applications filed at the CNIPA and JPO.

WORLDWIDE TRENDS IN PMTS PATENTS

Figure 1 shows the trends in number of IP5 patent families in Pharmaceuticals and Medical Technologies (PMTs), both as absolute number and as share of the total IP5 patent families. PMTs IP5 patent families represent 12.6% of the total IP5 patent families in the period 2010-2020.

The number of PMTs patents has increased over the observed period 2010-2020 with a compound annual growth rate of 4.6%, which is almost double the one of IP5 patent families in other technologies (2.5%).

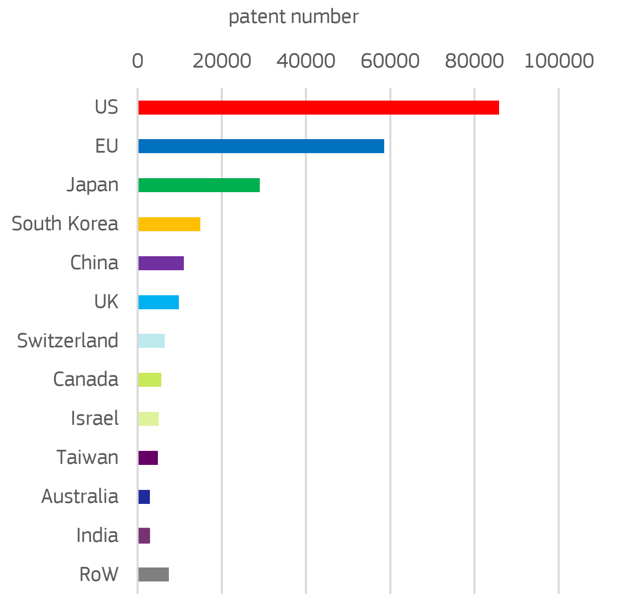
Figure 1 – PMTs Patent trends



Source: JRC computation based on PATSTAT 2024 Spring Edition

Figure 2 disaggregates the bulk of PMTs IP5 patent families 2010-2020 by the country of applicant, showing the US being the biggest player in the field with 25.1% of the total PMTs IP5 patent families filed by US based applicants. The EU is second with 17.2% of PMTs IP5 patents, followed by Japan (8.5%), South Korea (4.4%) and China (3.2%)[5].

Figure 2 – PMTs Patents by country/region



Note: only regions/countries representing at least 0.5% of the total PMTs IP5 patent families are presented separately, the remaining countries are aggregated in the Rest of the World (RoW). Only data, where the applicant country information is present, are included in the chart.
Source: JRC computation based on PATSTAT 2024 Spring Edition.

Figure 3 shows the trends by region in PMTs IP5 patent families (focussing only on the top 5 regions). China has the highest growth rate of PMTs IP5 patent families in the time period considered, overcoming South Korea in terms of annual PMTs patent filing in 2018 and getting very close to Japan in 2020.

The EU PMTs patent filing has slightly grown between 2010 and 2020, while the US has experienced a sustained growth in the same time period. Consequently,

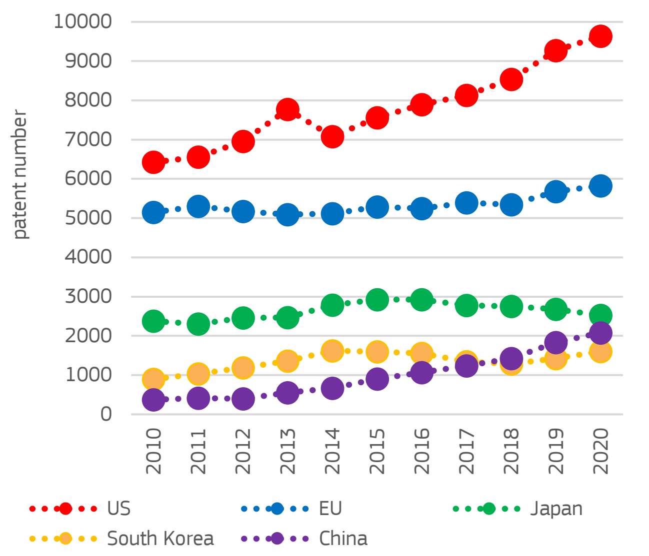
[3] We use a most recent version of PATSTAT, namely the SPING2024a edition, while in Grassano et al. (2024) the AUTUMN2023b edition was used. Detailed information about the latest editions of the database is available at https://www.epo.org/en/searching-for-patents/business/patstat.

[4] EPO updates the PATSTAT database every two years, a practice that has been ongoing since 2007. The database is a massive collection of over 100 million patent documents. It offers a comprehensive set of information about each document, featuring the receiving office, filing date, and technological innovations, which are encoded using standard technology codes. The database also includes data on the residence of applicants and inventors at the time of filing, provided that this information is available. The nature of the data collection process generates an intrinsic lag of at least 12-18 months between the time an application reaches a patent office and when the corresponding record appears in PATSTAT. This lag increases further due to contingencies specific to individual offices. Therefore, patent counts extracted from an edition of PATSTAT published in a year y are not fully reliable beyond (y-3) or (y-4).

[5] As already explained, applicant country is an information not always present in PATSTAT. In our PMTs data, it is missing in 28.6% of the cases. This can influence the results especially for some specific countries, given the vast majority of patents filed at the CNIPA and JPO lack this information.

the EU-US gap in PMTs patents has widened considerably. The EU PMTs IP5 patent families as a share of the total PMTs US IP5 patent families has decreased from 80.1% in 2010 to 60.4% in 2020.

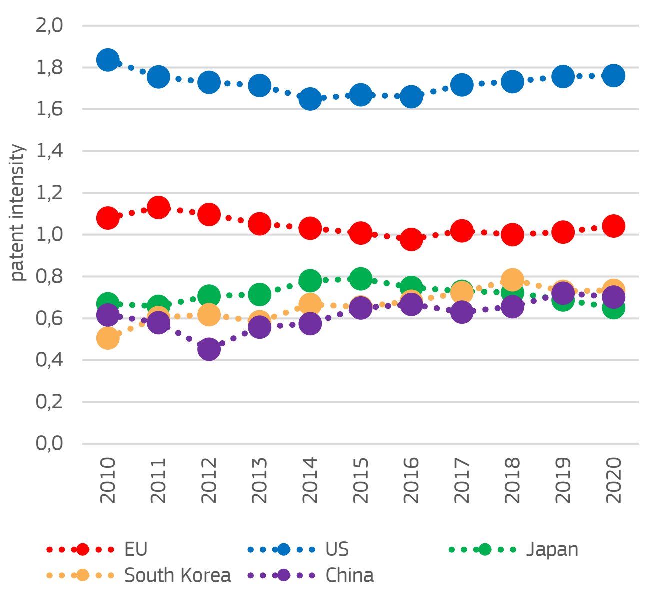
Figure 3 – PMTs Patent trends by country/region



Source: JRC computation based on PATSTAT 2024 Spring Edition.

Figure 4 reports the PMTs patent intensities (defined as the share of PMTs IP5 patent families in the region over the share of PMTs IP5 patent families in the world) for the top five regions in terms of absolute number of PMTs IP5 patent families. A value above 1 signals a relative specialisation in Pharmaceuticals and Medical Technologies.

Figure 4 – PMTs patent intensity trends

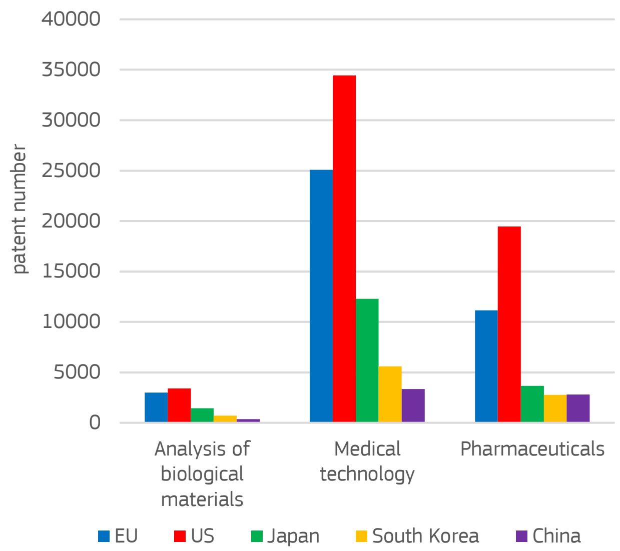


Source: JRC computation based on PATSTAT 2024 Spring Edition.

Of the top five regions, only the US have a clear specialisation in PMTs, while the EU is more or less in line with the world average (slightly above if we consider the period average), especially from 2015 onwards. This means there is also a PMTs patent intensity EU-US gap, which has increased during the time period considered. China, South Korea and Japan show similar intensities among them in the most recent years, all considerably below 1.

Figure 5 shows the breakdown of PMTs patents into the three main technological fields (“Analysis of biological materials technologies”, “Medical technologies“, and “Pharmaceutical technologies“)[6] focussing on the five main regions. “Medical technologies” IP5 patent families are double the number of “Pharmaceutical technologies” IP5 patent families, which in turn are five times the number of “Analysis of biological materials technologies” IP5 patent families.

Figure 5 – PMTs Patent by technological group and country/region



Source: JRC computation based on PATSTAT 2024 Spring Edition.

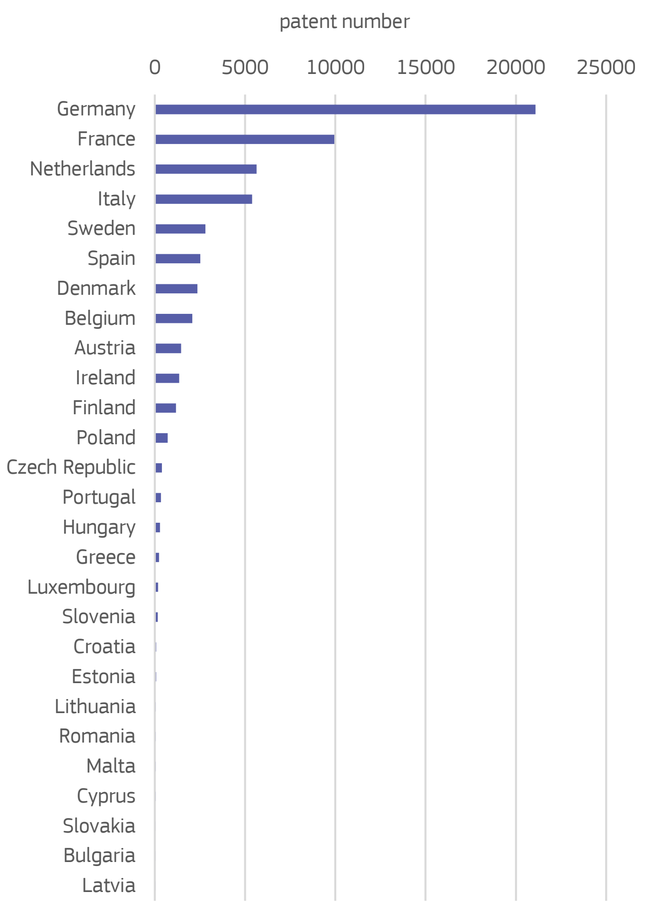
Looking at a more detailed level of technological aggregation (i.e. technologies report the Annex), the top three patented technologies worldwide are A61B (technologies related to diagnosis, surgery, and identification in medical and veterinary contexts); A61M (devices that introduce media into or onto the human body); A61K 31 (medicinal preparations that contain organic active ingredients), which respectively represent 18.3%, 6.1% and 5.8% of all technological codes in IP5 PMTs patent families.

[6] See the Annex for the detailed list of which technologies follow in the different fields.

A CLOSER LOOK AT THE EU

Figure 6 reports the data of PMTs IP5 patent families by Member State. Germany is by far the Member State with the highest number of PMTs patent, accounting for 36% of all the PMTs patent filed by the EU in the observed period. If taken alone, Germany would be the third country in the world in terms of total PMTs patents (2010-2020), only behind US and Japan. The top five Member States in terms of PMTs patents (Germany, France, Netherlands, Italy and Sweden) are responsible for 76.6% of all the PMTs patents in the EU.

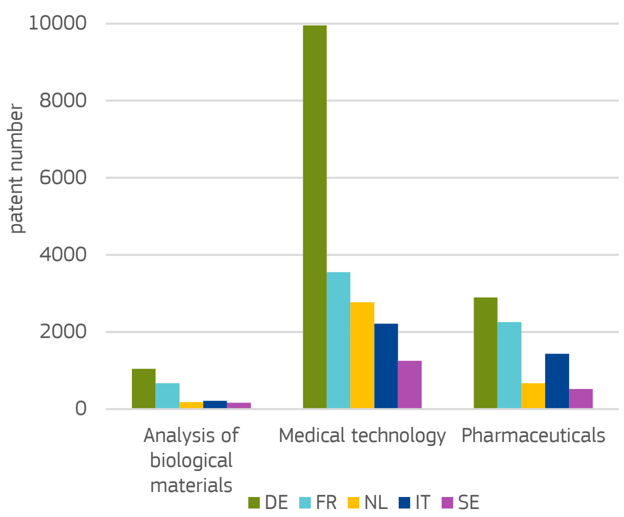
Figure 6 –PMTs patent by Member State



Source: JRC computation based on PATSTAT 2024 Spring Edition

Figure 7 reports the same breakdown of PMTs patents into the three main technological fields reported in Figure 5, but focussing on the top 5 countries in the EU in terms of overall PMTs IP5 patent families. The technological split for the EU is similar to what Figure 6 shows for the entire sample of PMTs IP5 patent families worldwide, with "Medical technologies" almost double the number of "Pharmaceutical technologies", which in turn are more than five times the number of "Analysis of biological materials technologies". It is interesting to notice that in the EU, while Germany and France are respectively number one and number two patenting countries in all three technological groups, Italy is ahead of the Netherlands in terms of number of patents in both "Analysis of biological materials technologies" and "Pharmaceutical technologies".

Figure 7 – PMTs Patent by technological group and MS



Source: JRC computation based on PATSTAT 2024 Spring Edition.

Going deeper in the technological disaggregation[7], the top three technologies in the EU are A61B (technologies related to diagnosis, surgery, and identification in medical and veterinary contexts); A61M (devices that introduce media into or onto the human body); and A61F (filters implantable into blood vessels, prostheses, and devices providing patency to, or preventing collapsing of, tubular structures of the body, as well as bandages, dressings, absorbent pads, and first-aid kits.). These technologies represent respectively 15.8%, 7.6% and 6.1% of all technological codes in IP5 PMTs patent families in the EU.

CONCLUSION

This brief provides a snapshot of the trends in Pharmaceutical and Medical technologies worldwide using patent data. The US (25.1%) have a leading role in this field, followed by the EU (17.2%). Further refinement of the analysis could help in the future to shed light on the reasons for the US-EU gap in patents and possible ways to address it.

[7] See footnote 6.

ANNEX

LIST OF MEDICAL TECHNOLOGIES CODES

A61B (Diagnosis; Surgery; Identification); **A61C** (Dentistry; Apparatus Or Methods For Oral Or Dental Hygiene); **A61D** (Veterinary Instruments, Implements, Tools, Or Methods); **A61F** (Filters Implantable Into Blood Vessels; Prostheses; Devices Providing Patency To, Or Preventing Collapsing Of, Tubular Structures Of The Body, […]; Fomentation; Treatment Or Protection Of Eyes Or Ears; Bandages, Dressings Or Absorbent Pads; First-Aid Kits); **A61G** (Transport, Personal Conveyances, Or Accommodation Specially Adapted For Patients Or Disabled Persons […] ; Operating Tables Or Chairs; Chairs For Dentistry; Funeral Devices); **A61H** (Physical Therapy Apparatus […]; Artificial Respiration; Massage; Bathing Devices For Special Therapeutic Or Hygienic Purposes Or Specific Parts Of The Body); **A61J** (Containers Specially Adapted For Medical Or Pharmaceutical Purposes; Devices Or Methods Specially Adapted For Bringing Pharmaceutical Products Into Particular Physical Or Administering Forms; Devices For Administering Food Or Medicines Orally; Baby Comforters; Devices For Receiving Spittle); **A61K40** (Cellular Immunotherapy); **A61L** (Methods Or Apparatus For Sterilising Materials Or Objects In General; Disinfection, Sterilisation Or Deodorisation Of Air; Chemical Aspects Of Bandages, Dressings, Absorbent Pads Or Surgical Articles; Materials For Bandages, Dressings, Absorbent Pads Or Surgical Articles); **A61M** (Devices For Introducing Media Into, Or Onto, The Body; Devices For Transducing Body Media Or For Taking Media From The Body; Devices For Producing Or Ending Sleep Or Stupor); **A61N** (Electrotherapy; Magnetotherapy; Radiation Therapy; Ultrasound Therapy); **G16H** (Healthcare Informatics […]); **H05G** (X-Ray Technique).

LIST OF PHARMACEUTICAL TECHNOLOGIES CODES

A61K6 (Preparations For Dentistry); **A61K9** (Medicinal Preparations Characterised By Special Physical Form); **A61K31** (Medicinal Preparations Containing Organic Active Ingredients); **A61K33** (Medicinal Preparations Containing Inorganic Active Ingredients); **A61K35** (Medicinal Preparations Containing Materials Or Reaction Products Thereof With Undetermined Constitution); **A61K36** (Medicinal Preparations Of Undetermined Constitution Containing Material From Algae, Lichens, Fungi Or Plants, Or Derivatives Thereof, […]); **A61K38** (Medicinal Preparations Containing Peptides); **A61K39** (Medicinal Preparations Containing Antigens Or Antibodies); **A61K41** (Medicinal Preparations Obtained By Treating Materials With Wave Energy Or Particle Radiation); **A61K45** (Medicinal Preparations Containing Active Ingredients […]); **A61K47** (Medicinal Preparations Characterised By The Non-Active Ingredients Used […]; Targeting Or Modifying Agents Chemically Bound To The Active Ingredient); **A61K48** (Medicinal Preparations Containing Genetic Material Which Is Inserted Into Cells Of The Living Body To Treat Genetic Diseases; Gene Therapy); **A61K49** (Preparations For Testing In Vivo); **A61K50** (Electrically Conductive Preparations For Use In Therapy Or Testing In Vivo […]); **A61K51** (Preparations Containing Radioactive Substances For Use In Therapy Or Testing In Vivo); **A61K101** (Preparations Containing Radioactive Substances For Use In Therapy Or Testing In Vivo - Radioactive Non-Metals); **A61K103** (Preparations Containing Radioactive Substances For Use In Therapy Or Testing In Vivo - Radioactive Metals); **A61K125** (Preparations Containing Radioactive Substances For Use In Therapy Or Testing In Vivo - Containing Or Obtained From Roots, Bulbs, Tubers, Corms Or Rhizomes); **A61K127** (Preparations Containing Radioactive Substances For Use In Therapy Or Testing In Vivo - Containing Or Obtained From Leaves); **A61K129** (Preparations Containing Radioactive Substances For Use In Therapy Or Testing In Vivo - Containing Or Obtained From Bark); **A61K131** (Preparations Containing Radioactive Substances For Use In Therapy Or Testing In Vivo - Containing Or Obtained From Seeds, Nuts, Fruits Or Grains); **A61K133** (Preparations Containing Radioactive Substances For Use In Therapy Or Testing In Vivo - Containing Or Obtained From Flowers Or Blossoms); **A61K135** (Preparations Containing Radioactive Substances For Use In Therapy Or Testing In Vivo - Containing Or Obtained From Stems, Stalks, Branches, Twigs Or Shoots); **A61P** (Specific Therapeutic Activity Of Chemical Compounds Or Medicinal Preparations).

LIST OF ANALYSIS OF BIOLOGICAL MATERIALS TECHNOLOGIES CODES

G01N33 (Investigating or analysing materials by specific methods not covered by groups G01N 1/00-G01N 31/00).

REFERENCES

[1] Archibugi, D., & Planta, M. (1996). Measuring technological change through patents and innovation surveys. Technovation, 16(9), 451-519.

[2] Grassano, N., Napolitano, L., M'barek, R., Rodriguez Cerezo, E. and Lasarte Lopez, J., Exploring the global landscape of biotech Innovation: preliminary insights from patent analysis, Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/567451, JRC137266.

[3] Griliches, Z. (1998). Patent statistics as economic indicators: a survey. In R&D and productivity: the econometric evidence (pp. 287-343). University of Chicago Press.

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