

# TECHNOLOGY WATCH REPORT



## Sensors in healthcare

# hub**b**30.

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### Sensors in healthcare

#### Authors

Carlos Raga Camilleri, UAB Office of Patent Valuation  
Roser Salvat Jofresa, UAB Research Park

#### Edition and design

Communication and Promotion Area  
UAB Research Park



UAB Research Park  
Av. de Can Domènech s/n - Eureka Building - UAB Campus  
08193 Bellaterra (Cerdanyola del Vallès) Barcelona · Spain  
[www.hubb30.cat/en](http://www.hubb30.cat/en)

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# 1

## Overview of innovation and tendencies in Health Sensors

The impressive advances in medical science over the last few years are associated with **technological breakthroughs in other fields** of research. This is particularly evident in the innovations taking place in the area of **sensors**.

A recent report by Frost & Sullivan on emerging sensor technologies for medical diagnostics points out that, in the field of research, the main breakthroughs are taking place in the fields of nanotechnology, microelectronics and advanced materials.

**“Innovations in the field of health sensors, typically using nanotechnology, robotics, and three-dimensional (3D) printing, ICT, smart devices and virtual reality”**

- The **Nanotechnologies** are propelling the development of active **implantable healthcare devices** comprising smart sensors, such as pacemakers, retinal implants and hearing aids. Nanotech-based applications have demonstrated significant success in developing more effective devices that can play a leading role in medical diagnostics as surgical tools, smart textiles and dressing monitoring.
- The **Microelectronics and robotic science**, in second place, comprise surgical robots and other **computer-assisted electromechanical devices** that can be designed to be used in robotically-assisted procedures overcoming the limitations of conventional diagnostics equipment.
- The **Advanced materials** have become a remarkable and promising field combining the principles of sensor technology and material engineering: combining small molecules and biologics onto material lattices to sense and act over human tissues and organs to help restore their functions.

In this context, health sensor tendencies involve nanotechnology, robotics, and three-dimensional (3D) printing, ICT, smart devices and virtual reality. The current outlook also shows an interesting **confluence and synergy between research approaches**:

- The discovery of new biological molecules or **biomarkers** for biosensing applications, which can potentially be used as a target for medical diagnostics applications.
- The immobilisation and stabilisation of particular molecules on the surface of the sensor, including nano-patterned surfaces, nanomaterials, biomolecules such as nucleic acids, engineered proteins or whole cells which, once integrated with silicon components at the micron and nano-scale can act as a novel biosensing technology. This is what is known as **surface engineering**.
- **Detection technology** covers a vast spectrum of transduction technologies inclu-

ding optical, electrochemical, piezoelectric or magnetic measurements, as well as novel sensors for bioimaging applications and micro- and nano-manufacturing technologies.

This means that in this field it is absolutely necessary to resort to **integrated systems**, or the combination of technologies in the development of completely new functional systems, including microfluidics, advanced materials, flexible electronics, instrumentation signal and image processing, data analysis and communications, among many more.

In short, innovation in health sensors covers a broad spectrum of **emerging technologies and adjacent applications** ranging from implantable technologies (such as nanotech-based implants for monitoring physiological signals or 3D bioprinted sensors over smart devices integrated into clothes) wearable technologies, robotically-assisted diagnostics or smart home technologies for home support or point-of-care applications.

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robotically-assisted diagnostics or smart home technologies for home support or point-of-care applications.

Finally, it is important to stress the impact of **digital innovations** which, by providing precise data unthinkable to date, play a central role in this field of knowledge. This data can be analysed, displayed and shared in real time, thus improving clinical results. This also contributes to better **relationships and collaboration** between patients, doctors, managers, insurers and healthcare organisations, opening up the possibility of cost savings and working in real time. These communications

open up the possibility of **training individuals and communities** in the use of the tools and knowledge required to make better informed decisions. These innovations related with the digitalisation are therefore related to the possible defence of more universal approaches to diagnostics, the monitoring, conservation and promotion of health associated with new **models for the empowerment** of patients, families, doctors, carers and social healthcare centres.

# 2

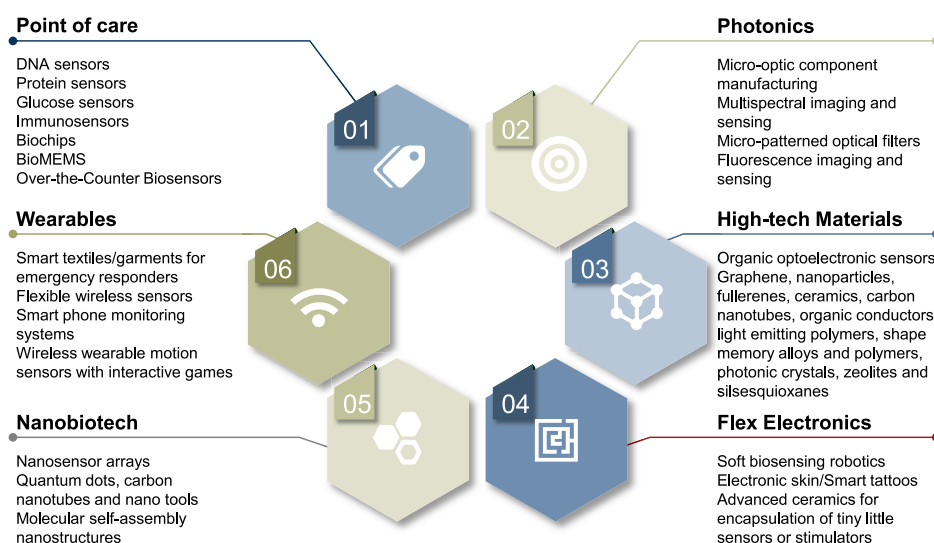
## Sensor technology for diagnostics: Key infographics on a dynamic market

2.1. A look towards the future: What is the field of medical sensors going to be like on a technological level?



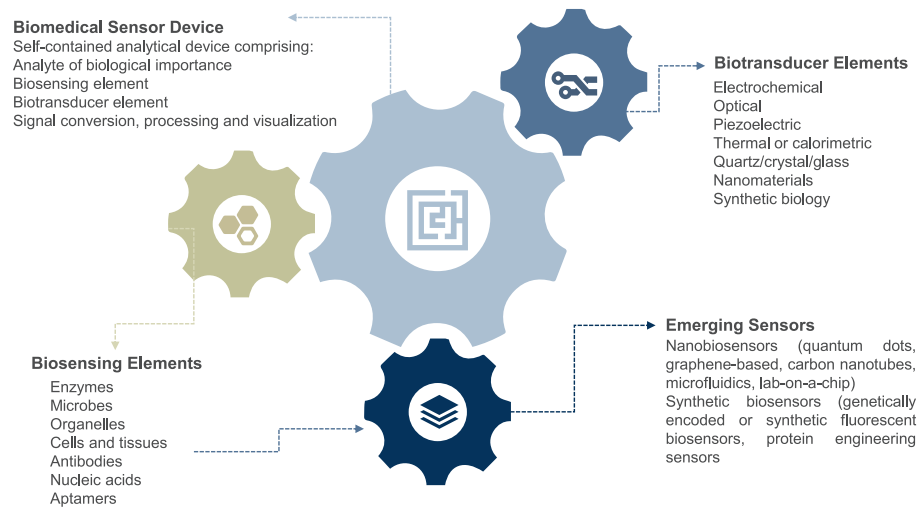
Source: Frost & Sullivan (2017). Emerging Sensor Technologies Transforming Medical Diagnostics.

2.2. Objective: Creation of novel solutions through R+D+I. Main players



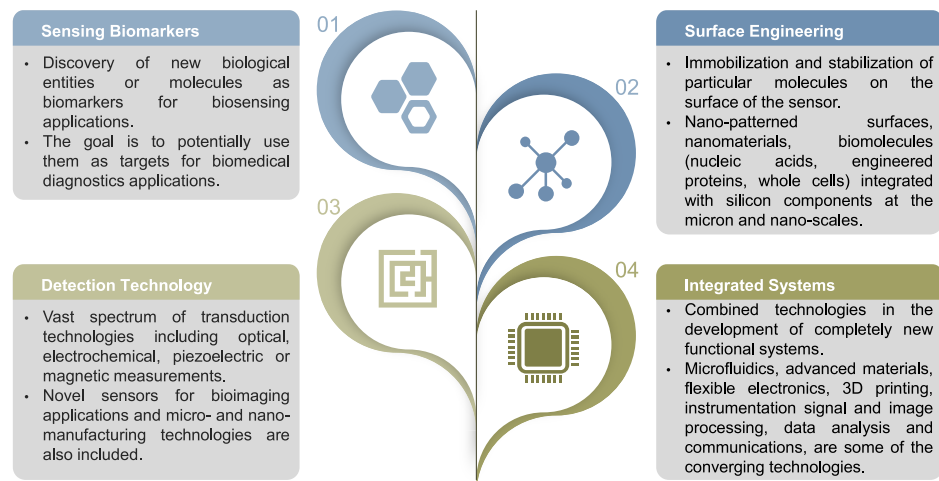
Source: Frost & Sullivan (2017). Emerging Sensor Technologies Transforming Medical Diagnostics.

### 2.3. Type and classification of emerging sensors and their relationship to developing technology



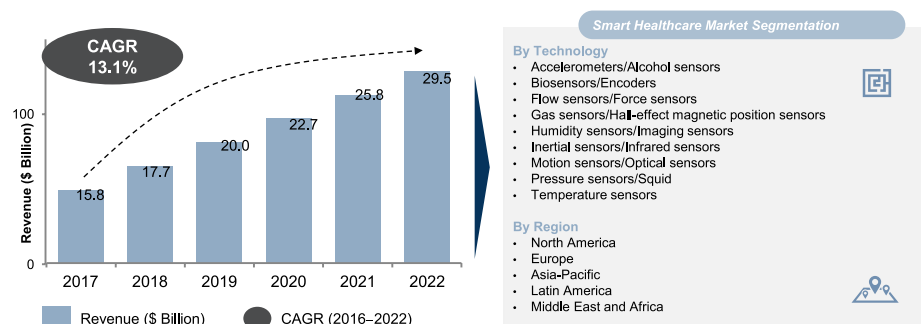
Source: Frost & Sullivan (2017). Emerging Sensor Technologies Transforming Medical Diagnostics.

### 2.4. key sector technologies for advancement



Source: Frost & Sullivan (2017). Emerging Sensor Technologies Transforming Medical Diagnostics.

### 2.5. Market forecast: Income over the next few years



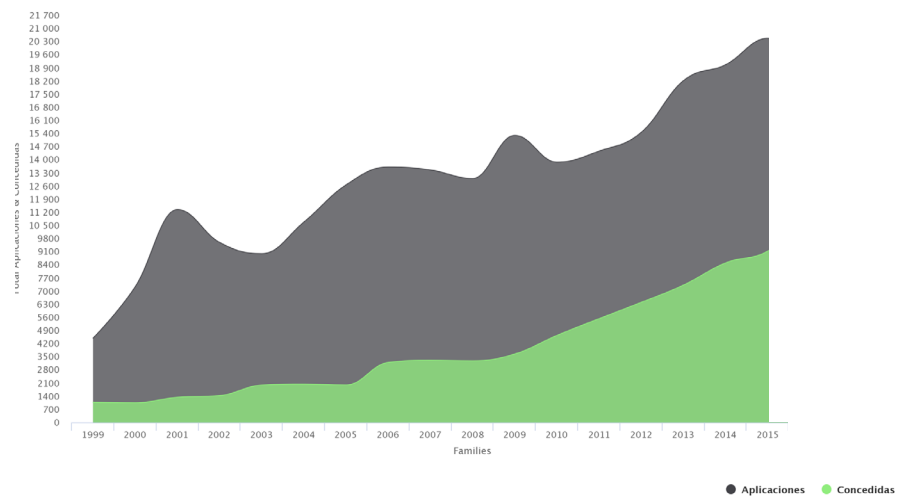
Source: Frost & Sullivan (2017). Emerging Sensor Technologies Transforming Medical Diagnostics.

# 3

## Patent analysis

### 3.1. Evolution of patents applied for and granted

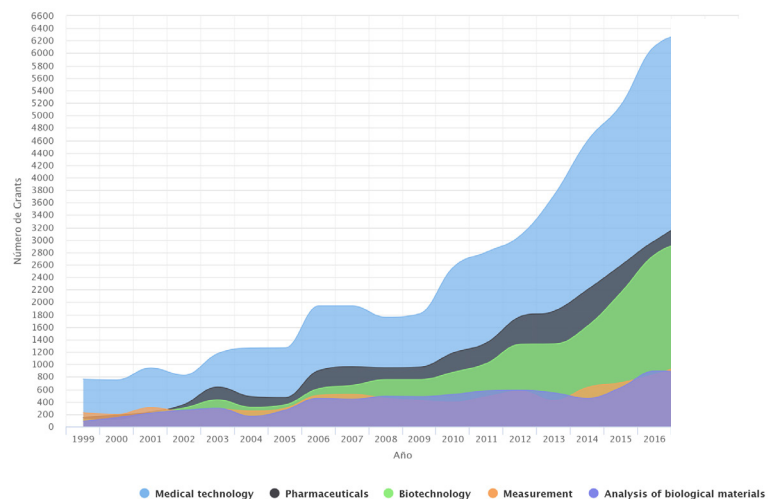
Analysis of data on patent applications provides a vision of sector tendencies, it is obviously growing:



Source: PatBase. Search: April 2018.

### 3.2. Technological sector of the patents analysed

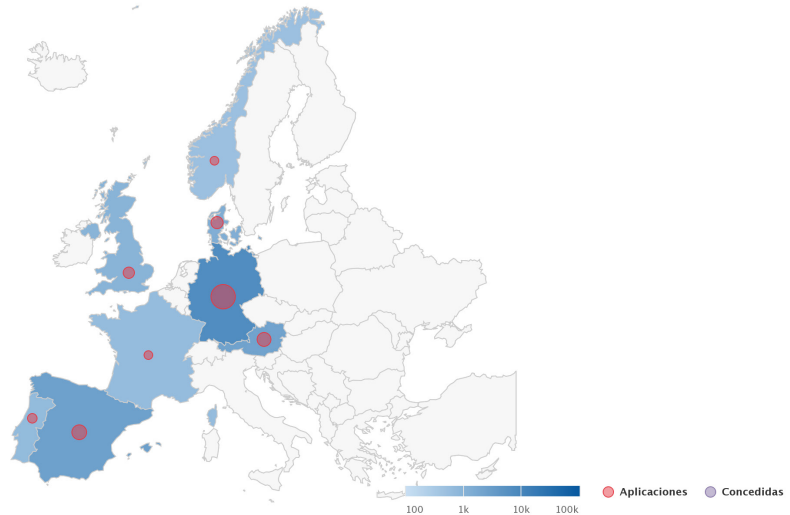
This enables identifying which sector the patents analysed belong to, thus enabling the display of applications, working subsectors that could be of interest for technology development:



Source: PatBase. Search: April 2018.

### 3.3. Territorial location of patents: Europe in the top-30 jurisdictions

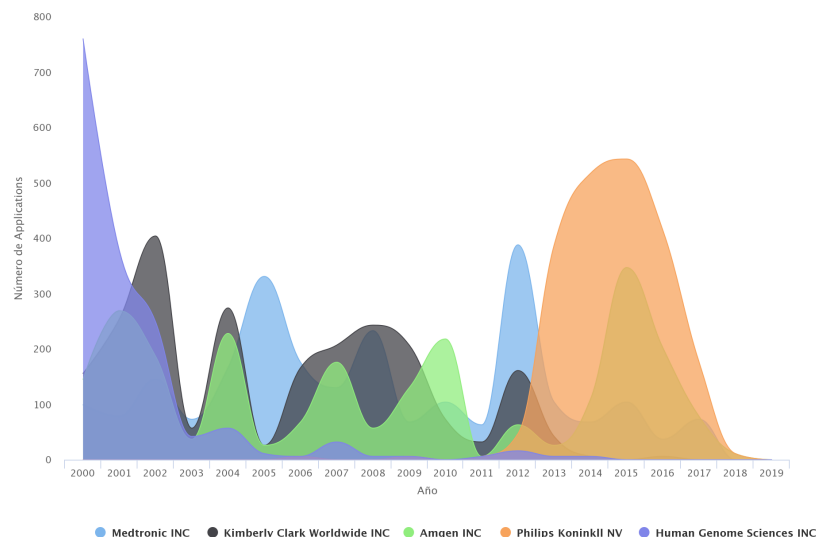
Analysis of the countries with most applications indicates where the sector analysed should be protected. Specific considerations of the various applications of technology are usually in addition to considerations related to the Gross National Product or the presence of clusters.



Source: PatBase. Search: April 2018.

### 3.4. Most active patent applicants over the last 20 years

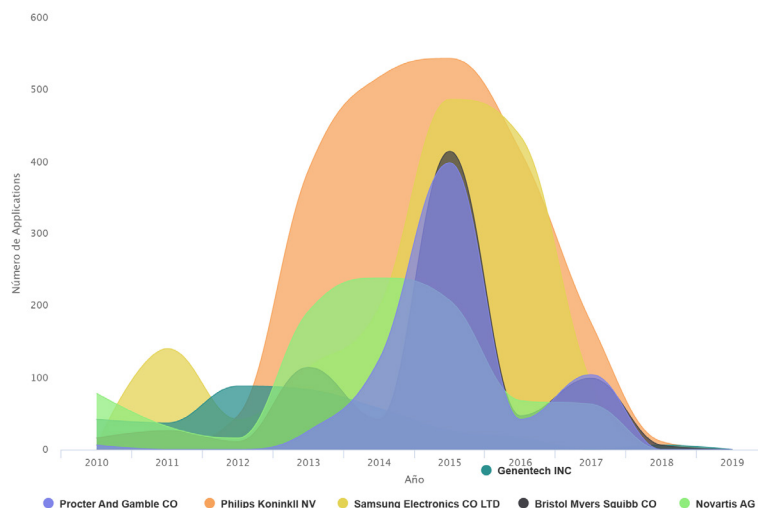
Medtronic is one of the main applicants in medical technology. Over the last years however it seems to have made a change of strategy and abandoned the field of sensitive devices:



Source: PatBase. Search: April 2018.

### 3.5. Who are among the most committed? Most active applicants over the last 10 years

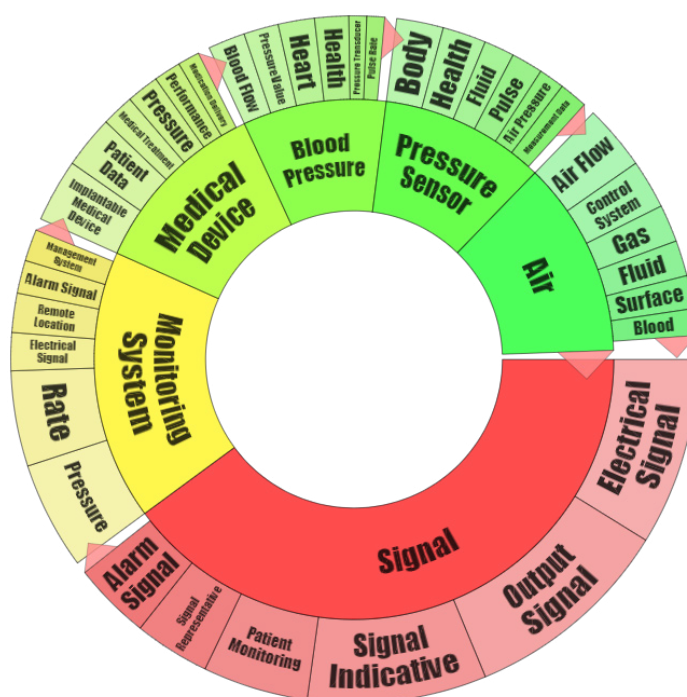
It is important to note the strong tendency to increased patent applications by Philips, Samsung, Bristol Myers Squibb CO and Novartis, related to their possible relevance as players in the field of health sensors over upcoming years.



Source: PatBase. Search: April 2018.

### 3.6. Keywords attributed to patents in this field

The terms “Signal”, “Monitoring system” and “Medical device”, together with their associated terms, provide us with information about possible applications of the technology being watched.



Source: PatBase. Search: April 2018.

### 3.7. ANNEX: Mostra de l'estudi de patents realitzat

The information provided in this section refers to a statistical study of 264,861 patent applications.

|                                                 |                                                                             |                               |                                 |
|-------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------|---------------------------------|
| <b>44,251</b>                                   | <b>24,663</b>                                                               | <b>264,861</b>                | <b>367,069</b>                  |
| Patent family                                   | Family of patents granted                                                   | Applications                  | Publications                    |
| Total number of families in this set of results | Total number of families with publications granted with this set of results | Applications with this result | Publications within this result |

Source: PatBase. Search: April 2018.

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