Clinical and Biomedical Engineering in Europe

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CONTENTS

Biomedical engineering

- Biomedical engineers are working at the interface of engineering, life sciences and healthcare.
- Biomedical engineers use principles of:
  - applied sciences (including engineering, electronics, chemical and computer engineering) and
  - basic sciences (physics, chemistry and mathematics) for applications in biology and medicine

  http://www.embs.org/about-biomedical-engineering

Bioengineering

The profession named Bioengineering and/or Biological Engineering is younger then biomedical engineering and emerged with the realization of the possibility of manipulation of living cells

Biological engineering is based on

- molecular biology and on
- engineering principles used in the design, synthesis and analysis
- at the cellular and molecular level

as opposed to biomedical engineering, which uses traditional engineering principles in order to analyze and solve problems in medicine and that solutions need not be based the use of living cells

http://web.mit.edu/be/programs/be_faq.shtml

Clinical engineering

Clinical engineers are professionals who support and enhance patient care by applying engineering and managerial skills to healthcare technology

- trained to solve problems when working with complex human and technological systems of the kind found in health care facilities
- function of technological systems manager for medical equipment including very often, and information systems in health care facilities
- provide valuable feedback on the operation of medical equipment and
- contribute to the research and development from their direct experience

http://www.accenet.org/default.asp?page=about&section=definition

Biomedical engineering

Unit Group 2149

Engineering Professionals Not Elsewhere Classified

This unit group covers engineering professionals not classified elsewhere in Minor Group 214: Engineering Professionals (excluding Electrotechnology) or in Minor Group 215: Electrotechnology Engineers. For instance, the group includes those who conduct research and advise on or develop engineering procedures and solutions concerning workplace safety, biomedical engineering, optics, materials, nuclear power generation and explosives.

In such cases tasks would include –

(a) applying knowledge of engineering to the design, development and evaluation of biological and health systems and products such as artificial organs, prostheses and instrumentation;

(b) designing devices used in various medical procedures and imaging systems such as magnetic resonance imaging, and devices for automating insulin injections or controlling body functions;

(c) designing components of optical instruments such as lenses, microscopes, telescopes, lasers, optical disc systems and other equipment that utilize the properties of light;

(d) designing, testing and coordinating the development of explosive ordnance material to meet military procurement specifications;

(e) designing and overseeing the construction and operation of nuclear reactors and power plants and nuclear fuels reprocessing and reclamation systems;

(f) designing and developing nuclear equipment such as reactor cores, radiation shielding and associated instrumentation and control mechanisms;

(g) assessing damage and providing calculations for marine salvage operations;

(h) studying and advising on engineering aspects of particular manufacturing processes, such as those related to glass, ceramics, textiles, leather products, wood and printing;

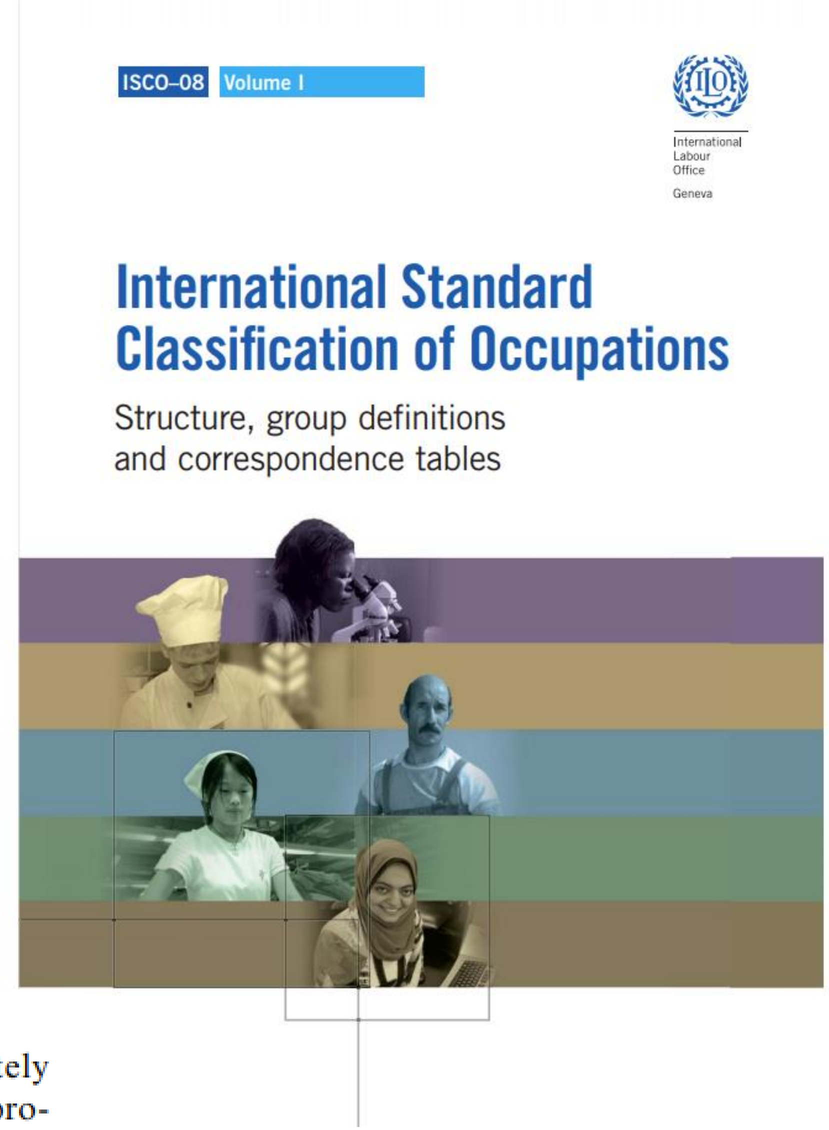
(i) identifying potential hazards and introducing safety procedures and devices.

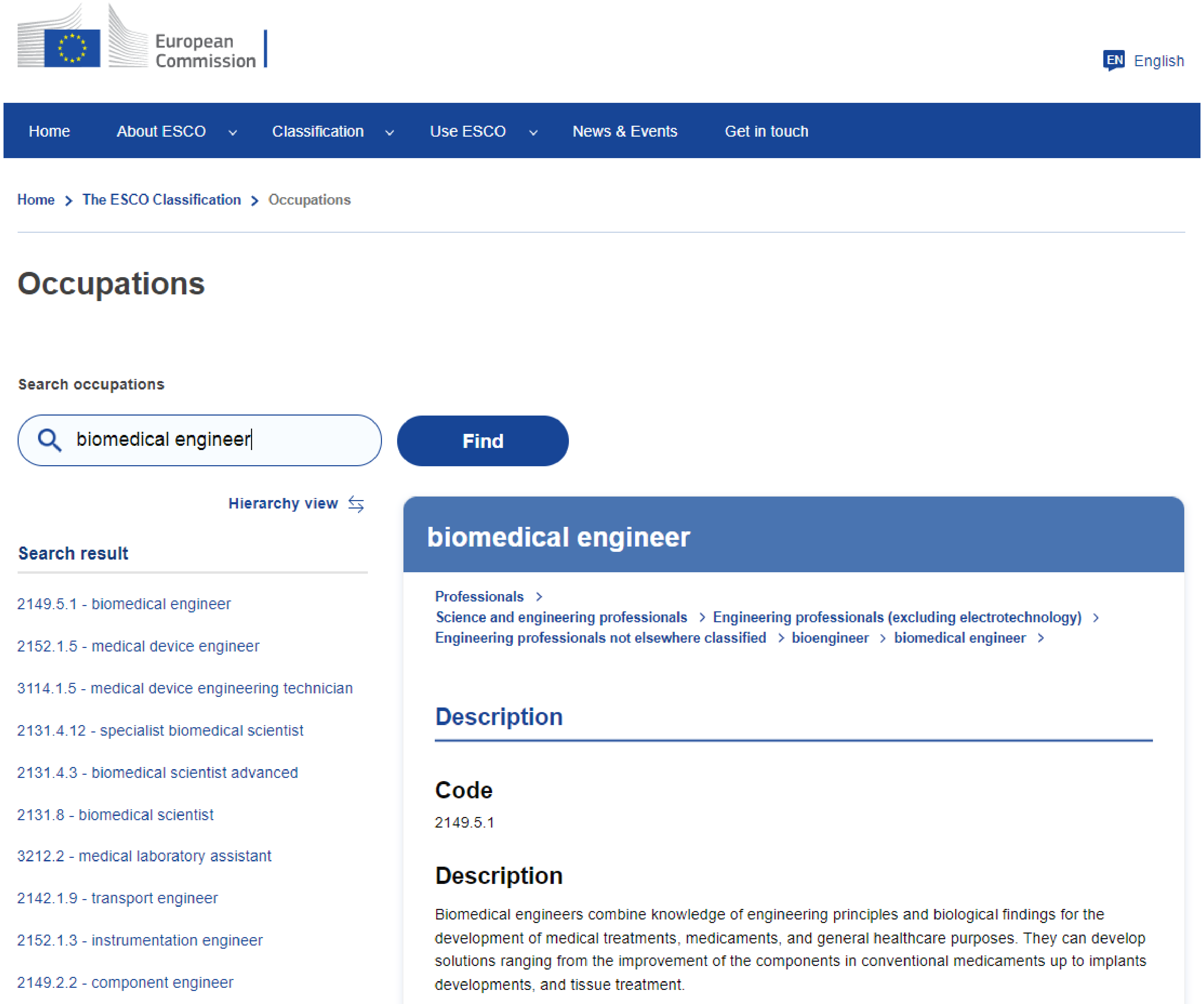
Examples of the occupations classified here:

- Biomedical engineer
- Explosive ordnance engineer
- Marine salvage engineer

Note

It should be noted that, while they are appropriately classified in this unit group with other engineering professionals, biomedical engineers are considered to be an integral part of the health workforce alongside those occupations classified in Sub-major Group 22: Health Professionals, and others classified in a number of other unit groups in Major Group 2: Professionals.





Code

2149.5.1

Description

Biomedical engineers combine knowledge of engineering principles and biological findings for the development of medical treatments, medicaments, and general healthcare purposes. They can develop solutions ranging from the improvement of the components in conventional medicaments up to implants developments, and tissue treatment.

National Standards Classification of Occupations

IPEM
Institute of Physics and Engineering in Medicine

Job codes for medical physicists and clinical engineers changed in UK

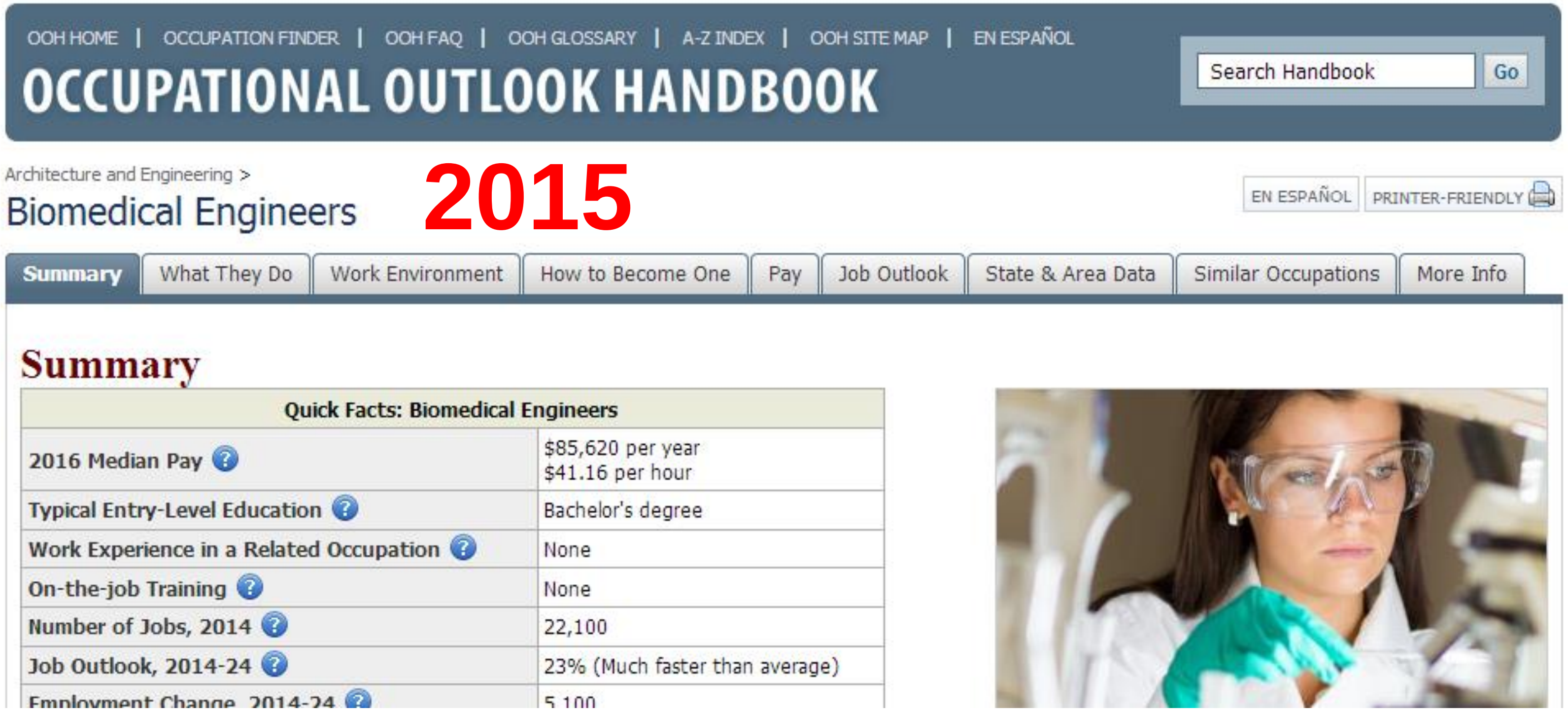
A CHANGE to the job codes used to classify medical physicists and clinical engineers has been achieved thanks to lobbying by the Institute of Physics and Engineering in Medicine.

The clinical engineers code has also been changed to SOC2020 group *2129: Engineering Professionals N.E.C*. While IPEM believes this is an acceptable coding, a better coding would also be under *health professionals N.E.C.*, reflecting clinical engineers’ status as a profession essential to the provision of a cutting edge healthcare service. IPEM is currently in discussions with the ONS about this.

Job Oportunities - Labor Market

“Biomedical engineers are projected to be the fastest growing occupation in the economy.”

Source: 2008-2018 prediction by the US Department of Labor



Quick Facts: Biomedical Engineers	
2016 Median Pay	$85,620 per year $41.16 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	22,100
Job Outlook, 2014-24	23% (Much faster than average)
Employment Change, 2014-24	5,100

https://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm

Job Oportunities - Labor Market

"Biomedical engineers are projected to be the fastest growing occupation in the economy."

Source: 2008-2018 prediction by the US Department of Labor

The Jobs of the Future – extected growth

Biomedical engineers 72%

Network systems analysts 53

Home health aides 50

Personal and home-care aides 46

Financial examiners 41

Medical scientists 40

Physician assistants 39

Skin-care specialists 38

Biochemists and biophysicists 37

Athletic trainers 37

Source: Wall Street Journal, 26 May 2010

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Bureau of Labor Statistics > Publications > Occupational Outlook Handbook > Architecture and Engineering

OOH HOME | OCCUPATION FINDER | OOH FAQ | OOH GLOSSARY | A-Z INDEX | OOH SITE MAP

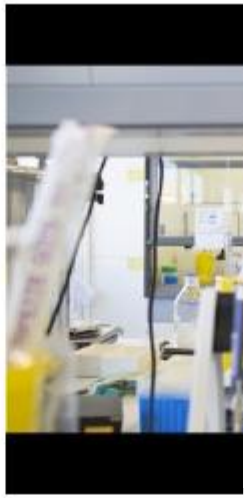
OCCUPATIONAL OUTLOOK HANDBOOK

Bioengineers and Biomedical Engineers

Summary | What They Do | Work Environment | How to Become One | Pay | Job Outlook | State & Area Data

Summary

Quick Facts: Bioengineers and Biomedical Engineers	
2021 Median Pay	$97,410 per year $46.83 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2021	17,900
Job Outlook, 2021-31	10% (Faster than average)
Employment Change, 2021-31	1,700



An official website of the United States government Here is how you know

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clinical engineer

About 6,330 results (0.32 seconds)

Bioengineers and Biomedical **Engineers** : Occupational Outlook ...
https://www.bls.gov/ooh/architecture...**engineering**/biomedical-**engineers**.htm
www.bls.gov › ooh › architecture-and-engineering › biomedical-engineers
Bioengineers and biomedical engineers typically need a bachelor's degree in bioengineering or **biomedical engineering** or in a related engineering field. Some ...

Bioengineers and Biomedical **Engineers**
https://www.bls.gov/oes/current/oes172031.htm
www.bls.gov › oes › current › oes172031
17-2031 Bioengineers and Biomedical **Engineers**. Apply knowledge of **engineering**, biology, chemistry, computer science, and biomechanical principles to the design, ...

Medical Equipment Repairers : Occupational Outlook Handbook ...
https://www.bls.gov/ooh/installation.../medical-equipment-repairers.htm
www.bls.gov › ooh › medical-equipment-repairers
... candidates who have an associate's degree in biomedical technology or **engineering**. ... Medical and **clinical** laboratory technologists and technicians ...

Is Clinical Engineering an occupation or profession?

By Y. David[1], S. Calil[2], N. Pallikarakis[3], M. Poluta[4], S.Bergamasco[5], D. Clark[6], T. Judd[7], J. Wear[8], K. Fukuta[9], S. Mullaly[10], W. Morse[11]

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[4] Clinical Engineer, South Africa
[5] Italian Clinical Engineers Association (AIIC), Italy
[6] Clinical Engineering, Nottingham University Hospitals NHS Trust, UK
[7] IFMBE/Clinical Engineering Division Chairman, USA
[8] Clinical Engineering Consultant, USA
[9] Clinical engineer lecturer at Osaka University, Japan
[10] Biomedical Engineer at Consultant, Ottawa, Ontario, Canada
[11] Founding member of ACCE and President in Bellegrove Medical, USA

J Global Clinical Engineering Vol.4 Issue **2**: 2021

Original Article | Open Access | Published: 10 August 2019

Evidence-based medical equipment management: a convenient implementation

Ernesto Iadanza, Valentina Gonnelli, Francesca Satta & Monica Gherardelli

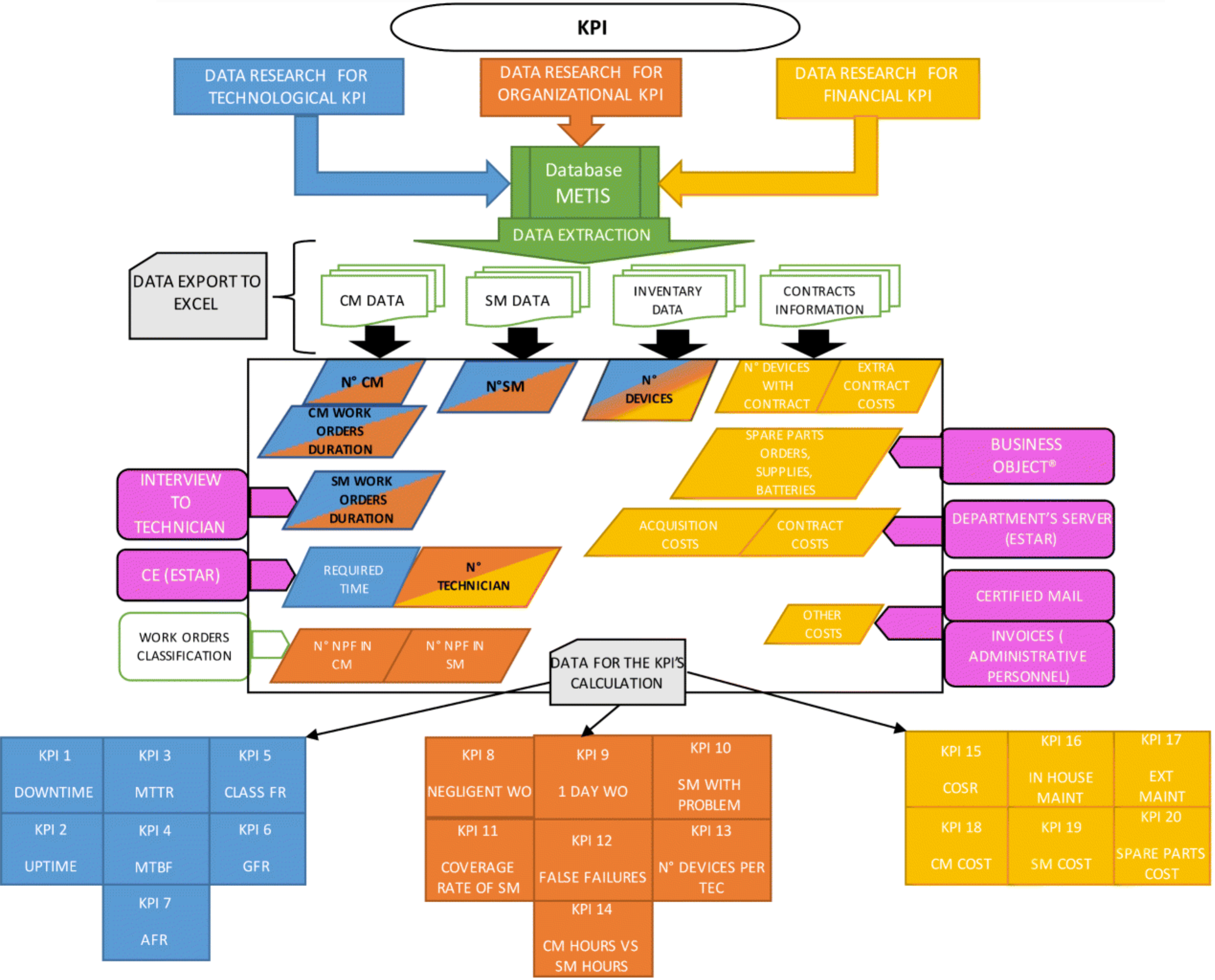
Medical & Biological Engineering & Computing **57**, 2215–2230 (2019) | Cite this article

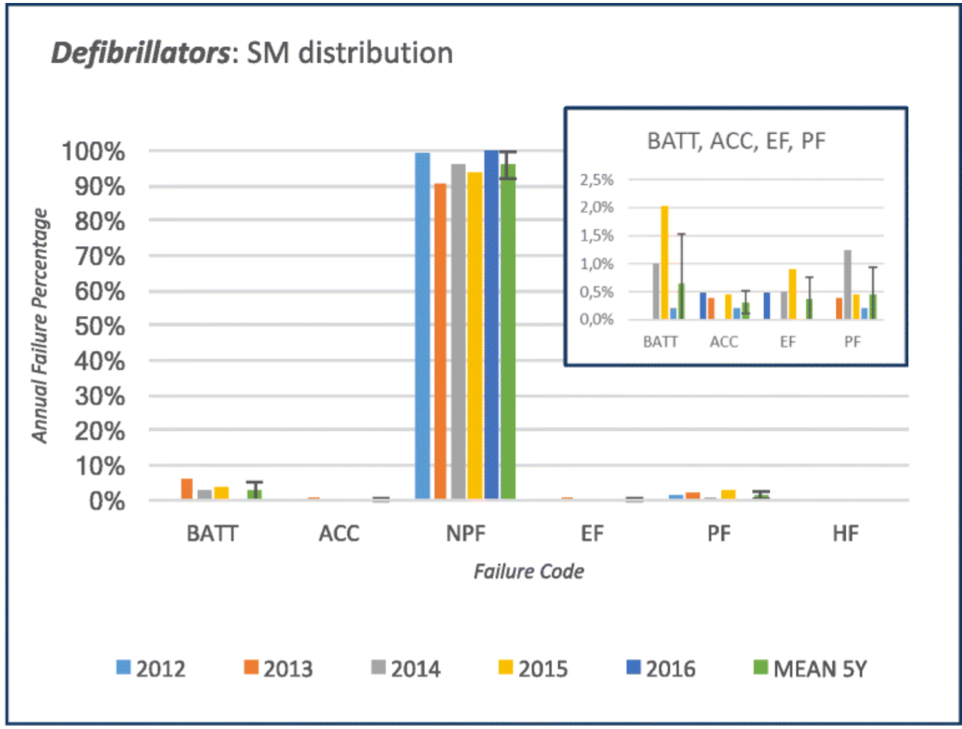
Most cited article in MBEC

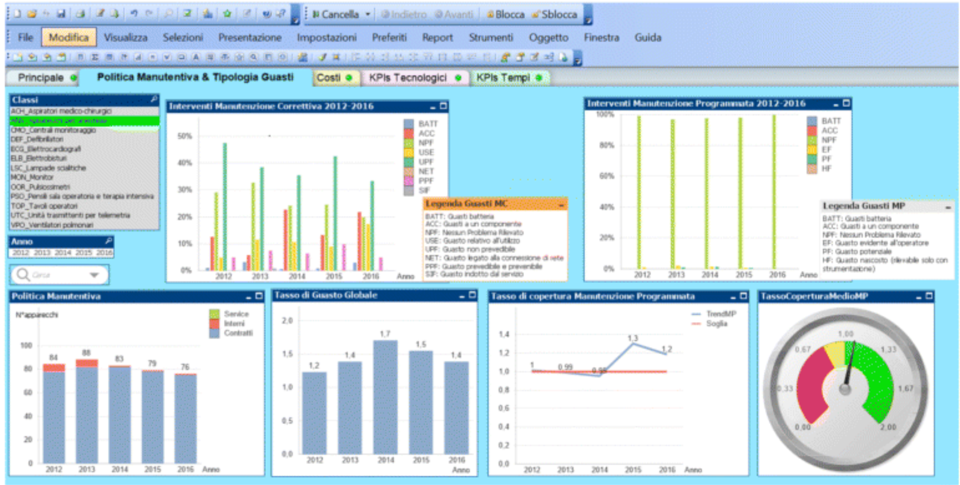
Abstract

Maintenance is a crucial subject in medical equipment life cycle management. Evidence-based maintenance consists of the continuous performance monitoring of equipment, starting from the evidence—the current state in terms of failure history—and improvement of its effectiveness by making the required changes. This process is very important for optimizing the use and allocation of the available resources by clinical engineering departments. Medical equipment maintenance is composed of two basic activities: scheduled maintenance and corrective maintenance. Both are needed for the management of the entire set of medical equipment in a hospital. Because the classification of maintenance service work orders reveals specific issues related to frequent problems and failures, specific codes have been applied to classify the corrective and scheduled maintenance work orders at Careggi University Hospital (Florence, Italy). In this study, a novel set of key performance indicators is also proposed for evaluating medical equipment maintenance performance. The purpose of this research is to combine these two evidence-based methods to assess every aspect of the maintenance process and provide an objective and standardized approach that will support and enhance clinical engineering activities. Starting from the evidence (i.e. failures), the results show that the combination of these two methods can provide a periodical cross-analysis of maintenance performance that indicates the most appropriate procedures.

Original Article | Open Access | Published: 10 August 2019







performance that indicates the most appropriate procedures.

Medical Engineering and Physics 72 (2019) 19–26

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Medical Engineering and Physics

journal homepage: www.elsevier.com/locate/medengphy

Health Technology Assessment and Biomedical Engineering: Global trends, gaps and opportunities

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ABSTRACT

The diffusion of medical devices is expanding at an astonishing rate. The increasing number of novel patents per year suggests this growth will continue. In contrast to drugs, medical devices are intrinsically dependent on the environment in which they are used and how they are maintained. This created an unprecedented global need for well-trained biomedical engineers who can help healthcare systems to assess them. The International Federation for Medical and Biological Engineering (IFMBE) is the global scientific society of biomedical engineers in official relations with the United Nations World Health Organisation (WHO) and has been very active in promoting the role of the biomedical engineer in Health Technology Assessment (HTA). The IFMBE Health Technology Assessment Division (HTAD) is the IFMBE operative branch in this field, promoting studies, projects and activities to foster the growth of this specific and very important science sector, including summer schools, training material, an HTA eLearning platform, HTA guidelines, awards and more. This article describes the vision, the mission and the strategy of the HTAD, with a focus on the results achieved and the impact this is having on global policymaking.

Vision & Mission

IFMBE
Clinical Engineering Division

CED Vision Statement

To be an international federation for developing and promoting of the clinical engineering profession resulting in improvement of global healthcare delivery through the advancement of safe and effective innovation, management and deployment of healthcare technology.

The International Federation for Medical and Biological Engineering (IFMBE) is the only international professional federation that has a Clinical Engineering Division focusing specifically on the life cycle management of healthcare technology and embracing all those who professionally practice in the clinical engineering field, whether in academic institutions, health care facilities, industry, business, voluntary sector, or government.

CED Mission Statement

- To advance worldwide learning, research, knowledge, deployment and communication of healthcare technology management within the clinical engineering community and its understanding by other stakeholders.
- To promote global communication, networking, and understanding of challenges related to healthcare technology management.
- To define and promote an international body of knowledge, skills and competences on which the profession of clinical engineering can be practiced in various clinical settings.
- To advance and disseminate worldwide safety tools and effective decision-making processes within the healthcare technology management system.
- To define and promote quality standards in clinical engineering practices worldwide.
- To stimulate innovation and efficient use of technology-related resources in healthcare worldwide.
- To internationally represent and advocate the interests of the profession of clinical engineers and their global exchange.
- To encourage, through education and training, clinical engineering practices and processes worldwide.

About Us

The IFMBE's Healthcare Technology Assessment Division (HTAD) aims at promoting Healthcare Technology Assessment (HTA) within the biomedical and clinical engineering community and at supporting biomedical engineering activities in this field.

According to WHO, health technology refers to the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of lives. Healthcare technology is defined as prevention, care and rehabilitation, vaccines, pharmaceuticals and devices, medical and surgical procedures, and the systems within which health is protected and maintained. Health Technology Assessment is a multidisciplinary field of policy analysis. It is clear from this definition that the scope of HTA is very broad. The HTAD focuses mainly on the medical devices, the procedures, and the systems used in healthcare delivery.

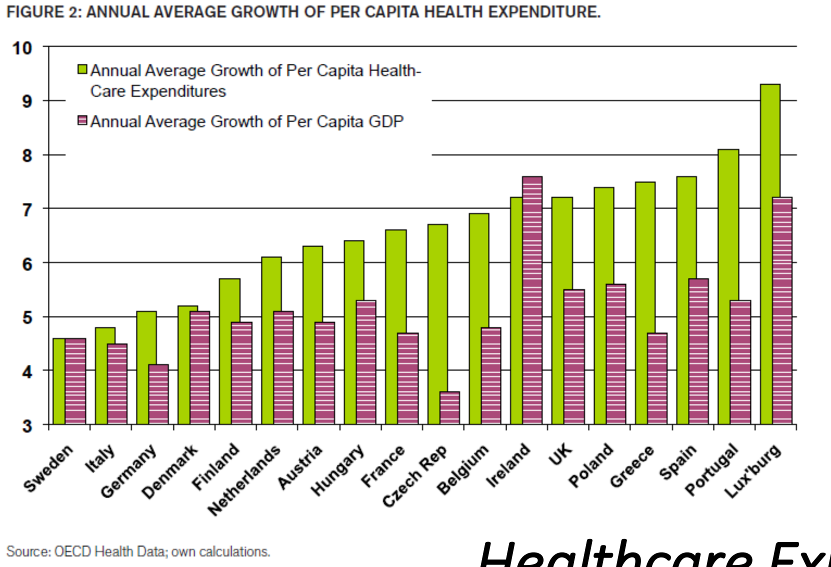
The purpose of HTA is to support the process of decision-making in health care at policy, clinician and management levels by providing reliable and timely information on some or all of the evaluative dimensions mentioned earlier. In this respect, HTA has been compared to a bridge between the world of research and the world of decision-making since assessment of currently adopted technologies can inform both research and adoption strategies. HTA provides a unique input into the decision-making processes of the healthcare system.

This web portal will report on the specific projects of the HTAD, which aims to:

- Increase the knowledge of HTA among BMEs, supporting the introduction of HTA related contents at Bachelors, Master, PhD and continuous education level and developing didactic contents. At this regard, the division:
  - has produced more than 100 hours of eLerning contents on HTA methods, tools and case studies, which will be are freely accessible to the IFMBE associates through their member societies websites since October 2016;
  - organizes several training events during IFMBE Conferences and a summer school o HTA, specifically conceived for BMEs and medical physicists was launched in 2015 and will run each 2 years, First IFMBE summer School on HTA. The next Edition will be held in Greece in 2017, Chaired by Prof Nicolas Pallikarakis.

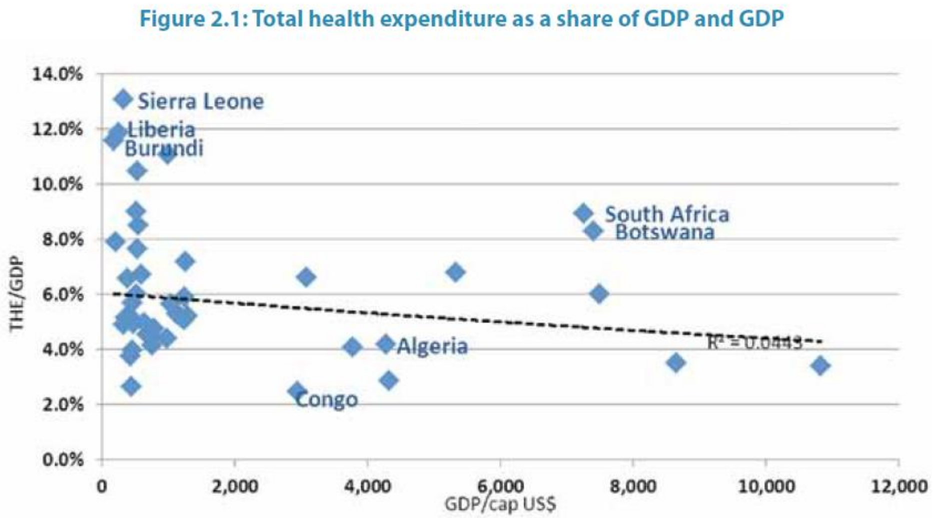
Challenge for EU and worldwide: Expenditures

Healthcare Expanditures in Europe

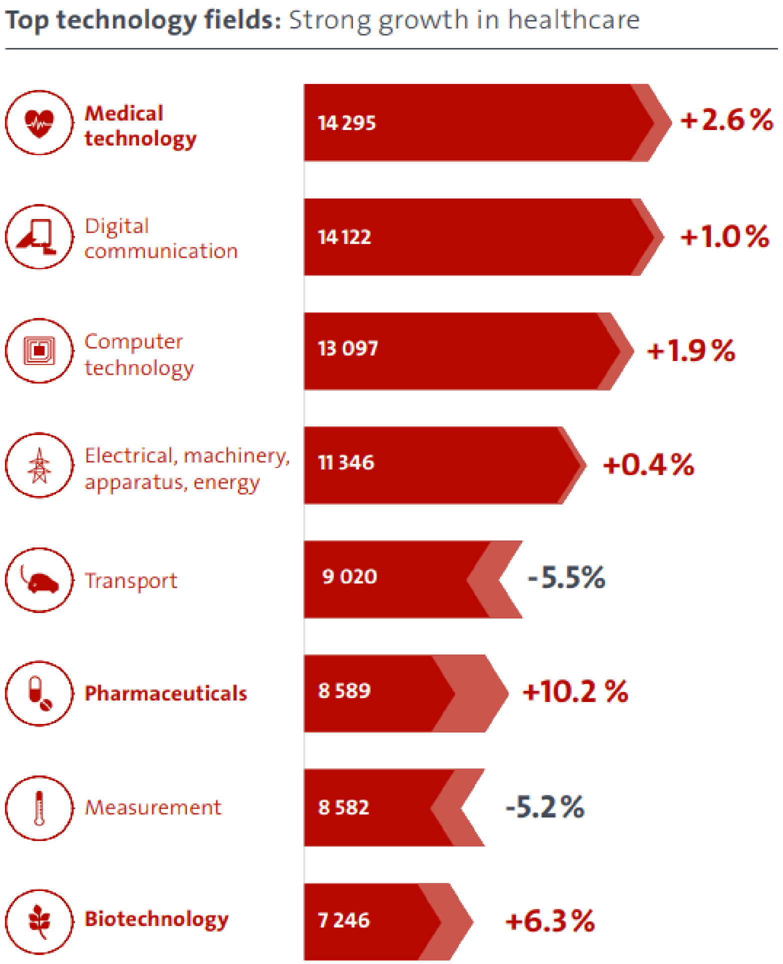


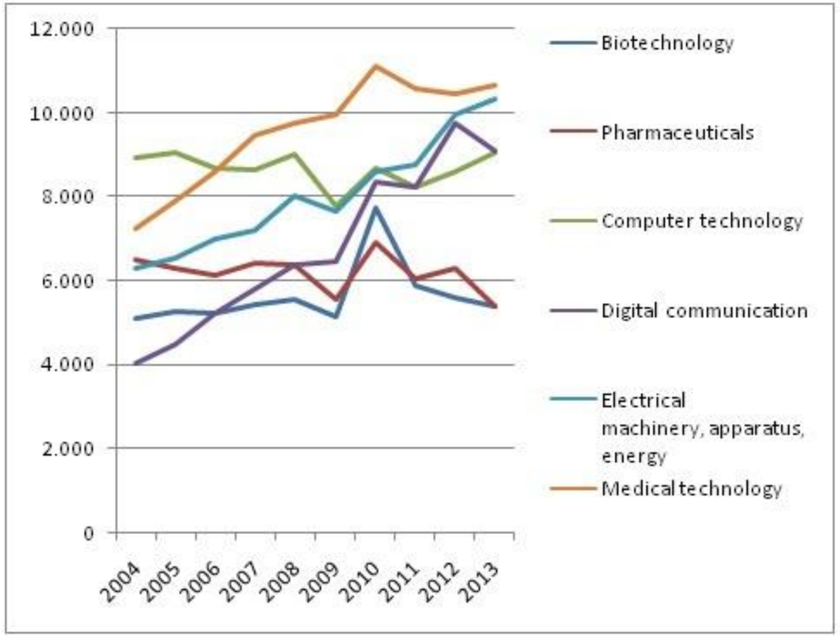
- Increase of Healthcare Insurance/National Healthcare system expenditures
- Increase of medical staff workload

Healthcare Expanditures in Africa



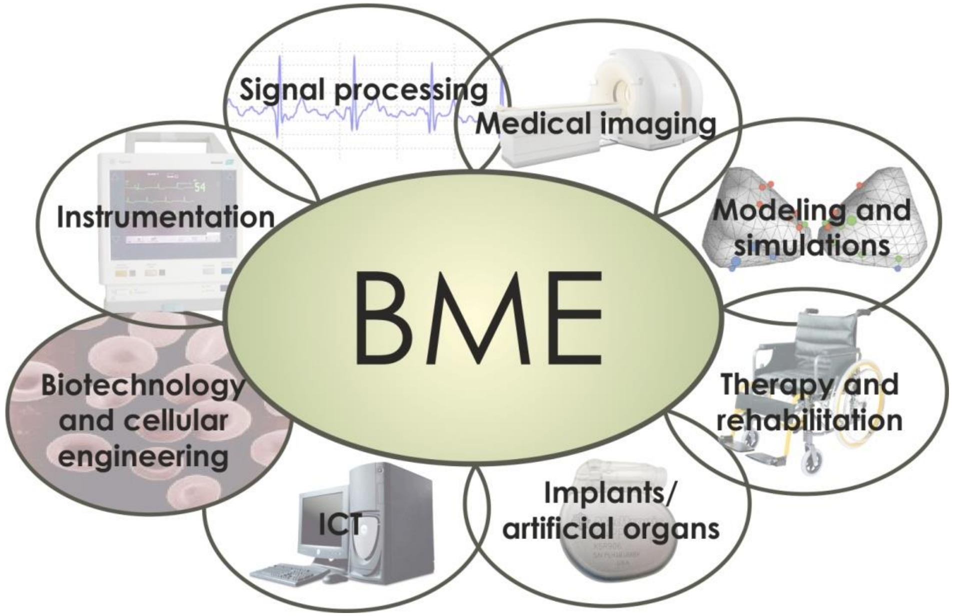
Inovation in Europe





https://documents.epo.org/projects/babylon/eponet.nsf/0/837DBDFC91C99042C12586950032FDBD/$FILE/epo_patent_index_2020_infographic_en.pdf

Biomedical engineering



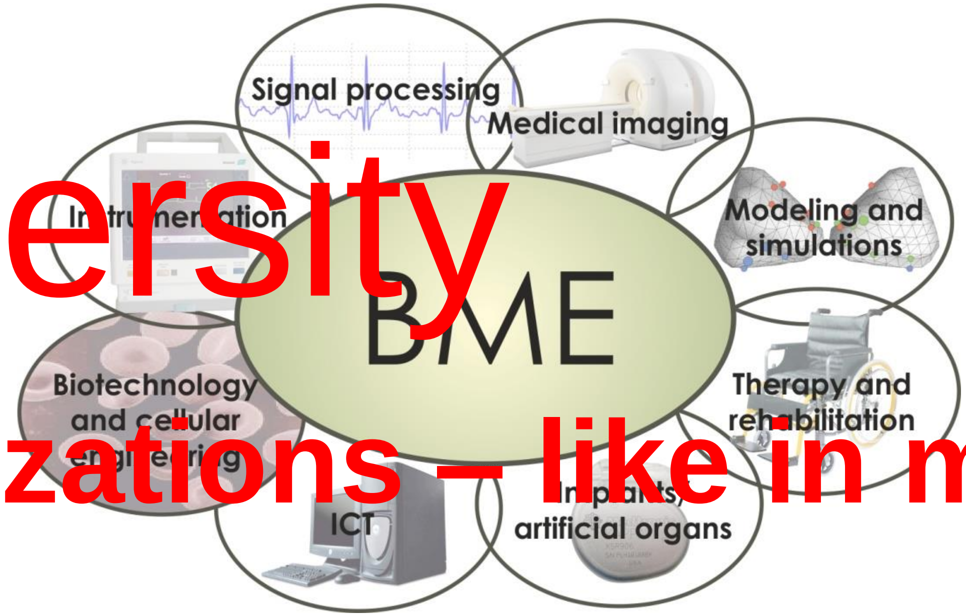
Biomedical engineering is an engineering discipline that:

- advances **knowledge** in engineering, biology and medicine, and in basic sciences,
- improves human health by **design and problem solving skills** of **engineering science** applied to diagnosis, monitoring, therapy and rehabilitation, but also to prevention and prediction
- integrates engineering sciences with biomedical sciences and **clinical practice**

http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=106041

Biomedical engineering

Diversity



Specializations – like in medicine

Biomedical engineering is an engineering discipline that:

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- improves human health by **design and problem solving skills** of **engineering science** applied to diagnosis, monitoring, therapy and rehabilitation, but also to prevention and prediction
- integrates engineering sciences with biomedical sciences and **clinical practice**

http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=106041

Grand Challenges in 21st Century Reverse-engineer the brain

NATIONAL ACADEMY OF ENGINEERING
OF THE NATIONAL ACADEMIES

- The intersection of engineering and neuroscience promises great advances in health care, manufacturing, and communication.
  - Understanding how and why brain works and fails
  - Simulations leading to more sophisticated methods for testing new technologies like drugs and neural implants
    - Artificial retina
    - Cohlear implants
    - Movement and prosthesis control
    - Fighting dementia, Parkinson disease….
  - Building smarter computers

- http://www.engineeringchallenges.org/cms/8996/9109.aspx

Challenge – Artificial Retina

- Artificial Retina or Bionic Eye
- Bionic eye is a mesh prosthesis designed to restore vision to people blind due to degenerative retinal disease. This technology uses a retina implant and a digital camera mounted on spectacles. The camera captures images, processes them and sends data to the implant.
- It should allow the blind to see the light and contours of the object, differentiate colors and even mood.
- This technology will enable blind people to see objects as dots or colors. With Face Recognition programs, the user will be able to recognize people.

View an image as it is described by blind with a bionic eye

Bionic eye - emerging technology

Currently, five models of artificial retina are present at the market: Argus II, Boston Retine Implant Project, Epi-Ret 3, Intelligent Medical Implants (IMI) and alfa-IMS (Retina Implant AG).

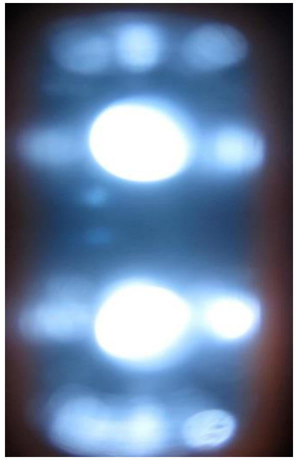
Argus II is the only FDA approved device in USA, Alpha-AMS in Germany and IRIS V2 in France.

The resolution of the devices is theoretically in correlation with the number of electrodes connected to the optical nerve. IRIS V2 has 150 electrodes, and Argus II 60 electrodes.

Alice T Chuang, Curtis E Margo, Paul B Greenberg: Retinal implants: a systematic review Br J Ophthalmol 2014;98:852-856 doi:10.1136/bjophthalmol-2013-303708

https://medicalxpress.com/news/2017-08-artificial-vision-people-bionic-eyes.html

Bionic eye

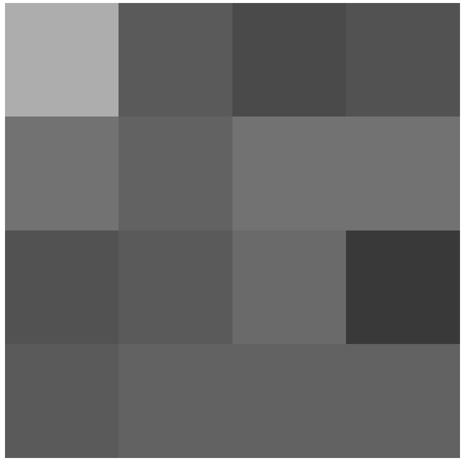


- The Argus II System Retinal Prosthesis is the first implantable device to treat adult patients with *retinitis pigmentosa*. The system consists of three parts :
  - An electronic part implanted in and around the eye,
  - A video camera placed on the glasses
  - A portable processor unit for processing the video signal

  The images captured by the camera are converted into signals transmitted wirelessly to the implanted electronic part. Electric pulses (stimuli) to the retina of the eye are transmitted to the brain by the optical nerves. In the brain, they are recognized as light pulses of different intensity and duration.

http://www.fda.gov/medicaldevices/productsandmedicalprocedures/deviceapprovalsandclearances/recently-approveddevices/ucm343162.htm

Bionic eye



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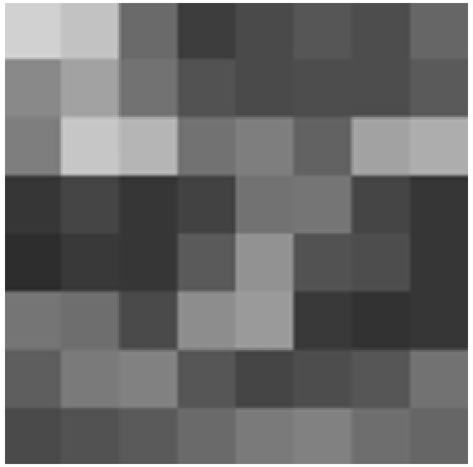


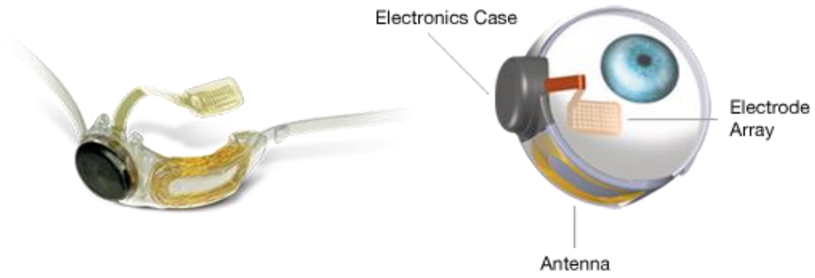
- The same photo of a car in different resolutions :

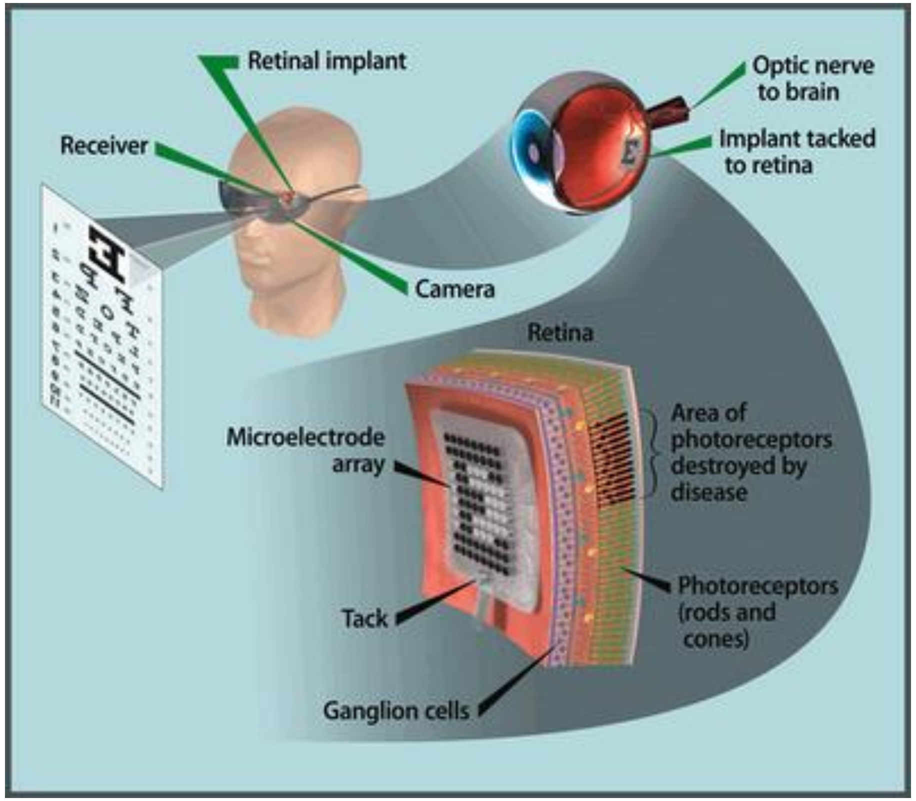
  4x4, 8x8, 12x12, 16x16, 32x32, 64x64, 128x128 pixel

This series of images is intended to show students the level of visual information reduction by reduced resolution of the optical sensor.

Compare with the resolution of the camera in your mobile phone!

Bionic eye





What are the technological reasons that embedded systems can not reach the level of image quality that a healthy eye has?

http://triplehelixblog.com/2014/09/hope-for-the-blind-first-bionic-eye-implants-in-the-united-states/

Pacemakers - Established technology

Pacemakers - New generation

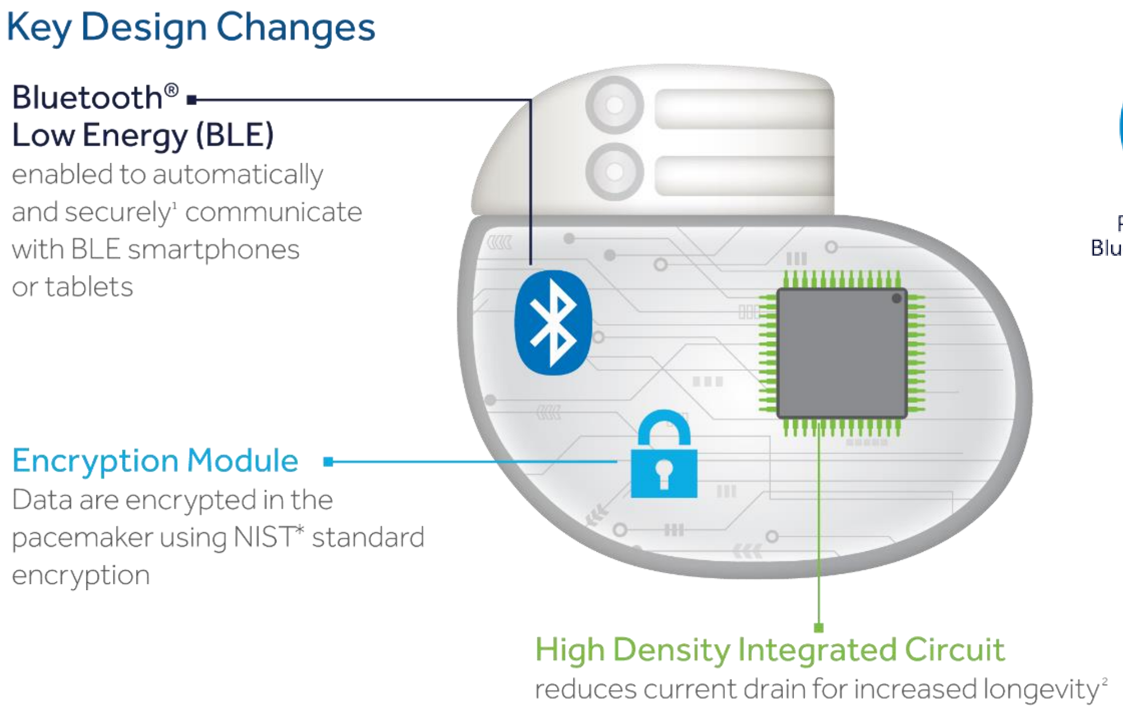
New trends in PM research and development
- miniaturization

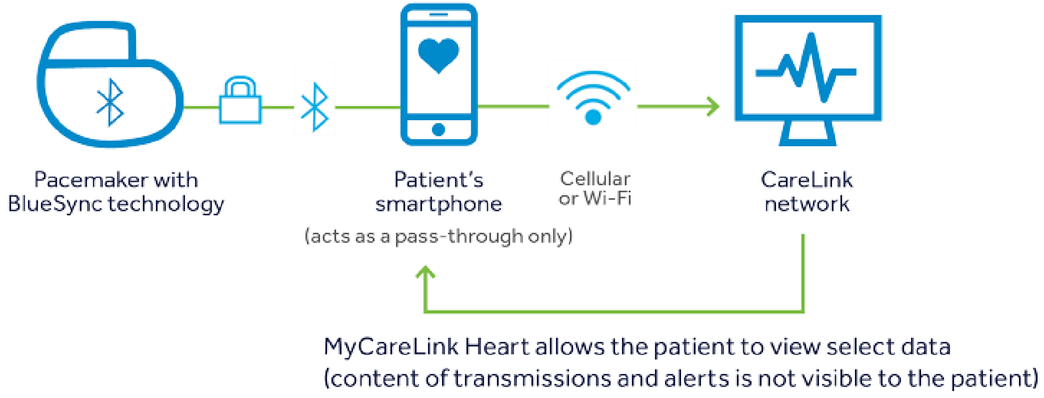
93% smaller than conventional pacemakers

Ultra low-power circuit design delivers an estimated average 12-year battery longevity.

Physical characteristics
Volume 0.8 cc
Length 25.9 mm
Outer diameter 6.7 mm (20.1 Fr)
Mass 1.75 g

Pacemakers - Design for connected health





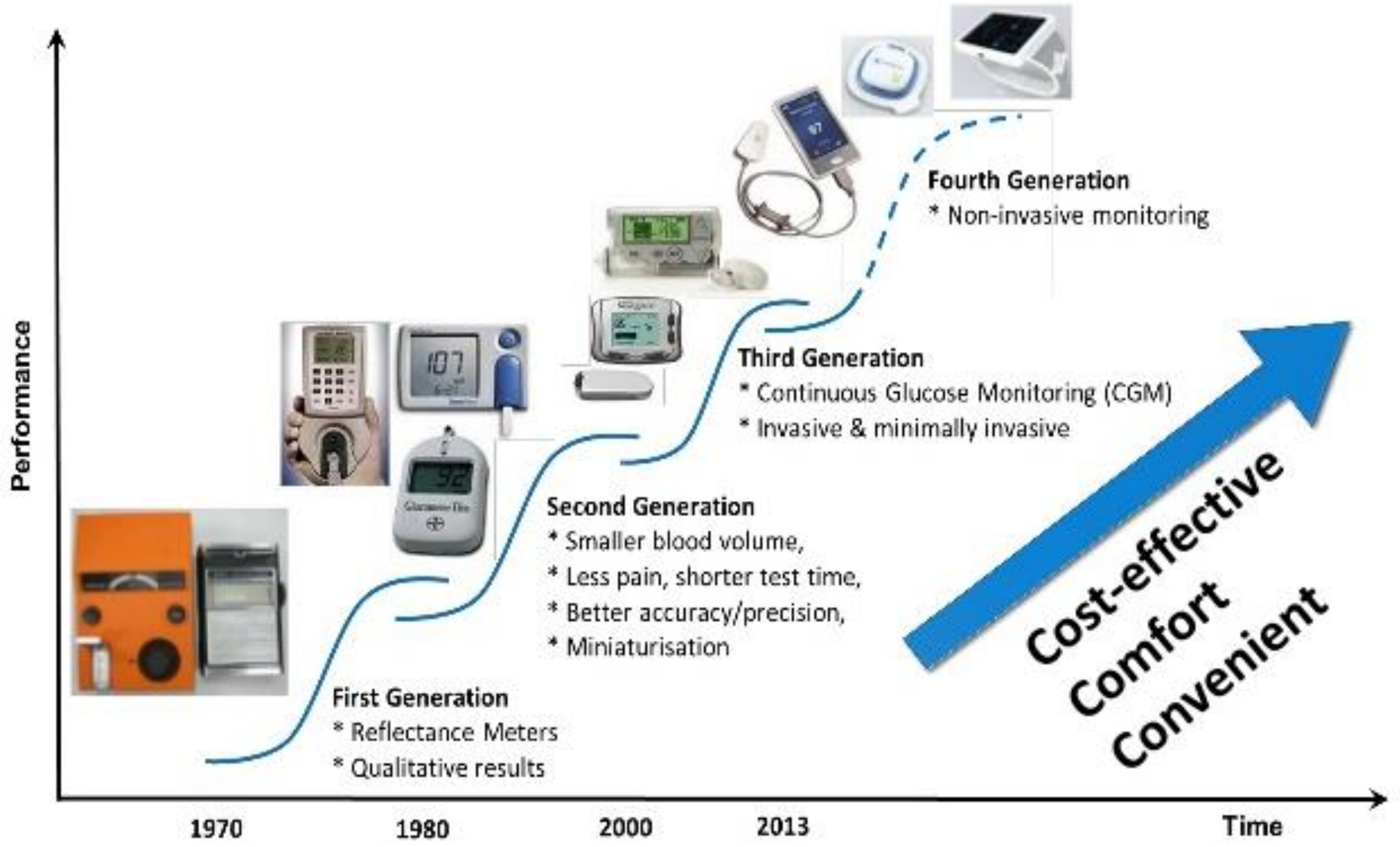
Pacemakers are completely redesigned for secure wireless communication via Bluetooth® Low Energy without compromising longevity

BlueSync™ Technology enables Azure to communicate directly with a patient-owned mobile platform

PMs offer timely alerts of clinically relevant events with accurate AF detection

Source: https://www.medtronic.com/us-en/healthcare-professionals/products/cardiac-rhythm/pacemakers/azure.html

Evolution of blood glucose monitoring



Future trends - Non-Invasive Glucometers

Infrared Technology:

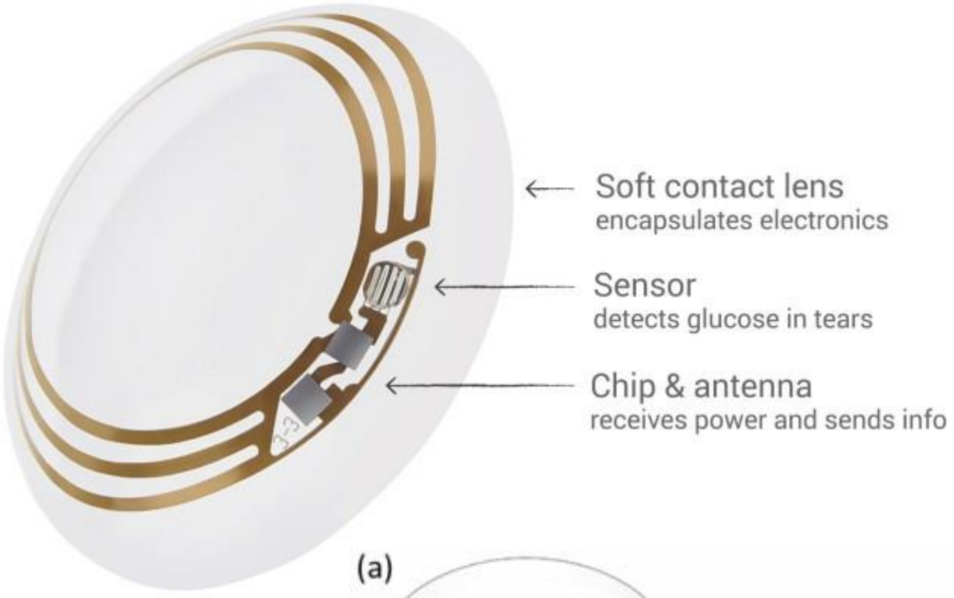
- Finger or Earlobe goes into the slot
- Uses near-infrared light to measure real-time blood glucose levels
- Takes 20 seconds or less

- measurement using both near infrared and mid wavelength infrared radiation

Non-invasive glucose monitoring

Research for easy and less-invasive way to measure glucose daily:

- tears,
- airway mucus,
- sweat,
- saliva or
- the interstitial fluid of subcutaneous tissue



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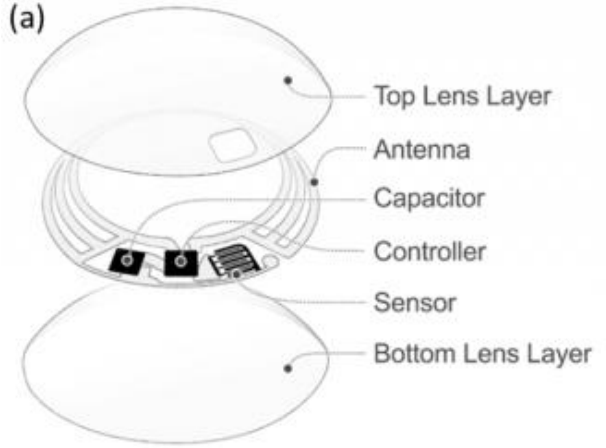
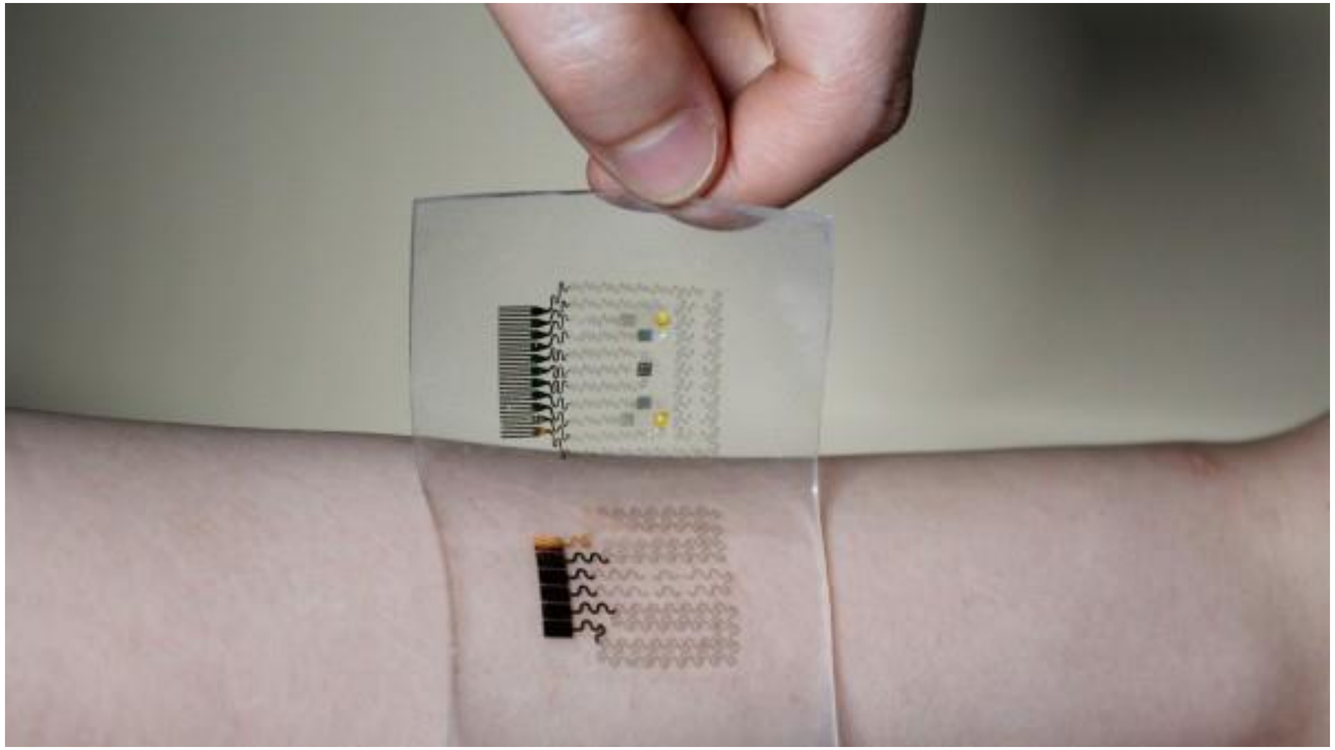


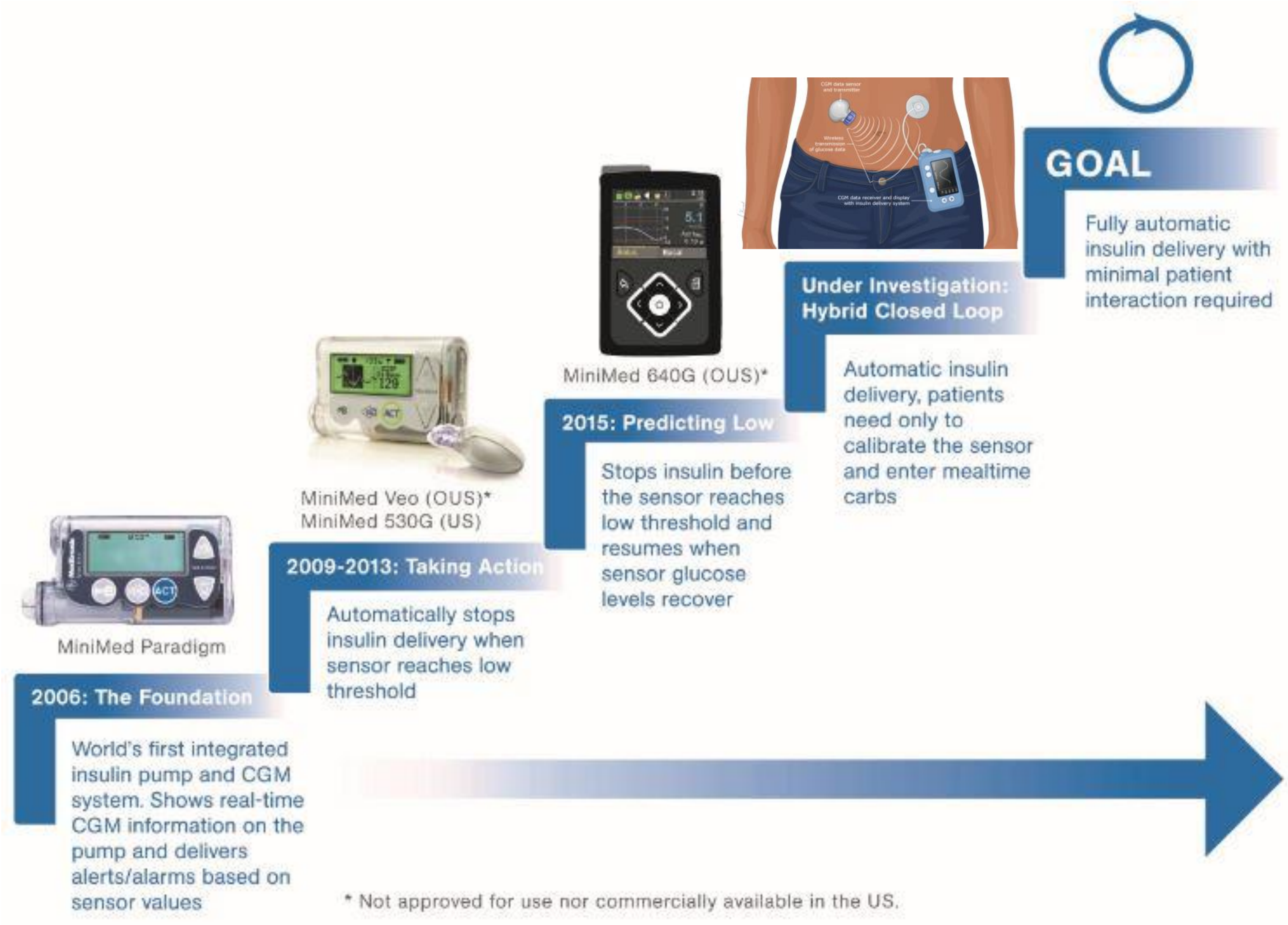
Non-invasive glucose monitoring - research



An electronic skin patch that senses excess glucose in sweat and automatically administers drugs by heating up microneedles that penetrate the skin.

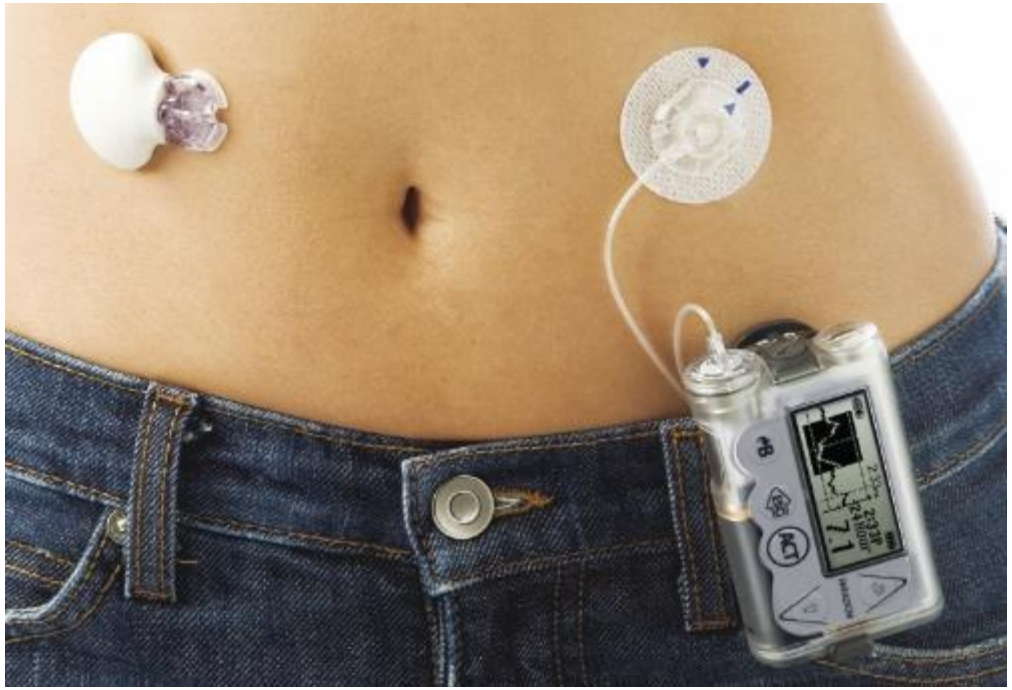
See also: Hyunjae Lee et al., A graphene-based electrochemical device with thermoresponsive microneedles for diabetes monitoring and therapy, Nature Nanotechnology, 2016

Evolution of closed blood glucose control systems



„Artificial pancreas”

- Closed loop glucose control systems
  - Insulin pump
  - Continuous blood glucose monitoring
  - Algorithm for BGL control

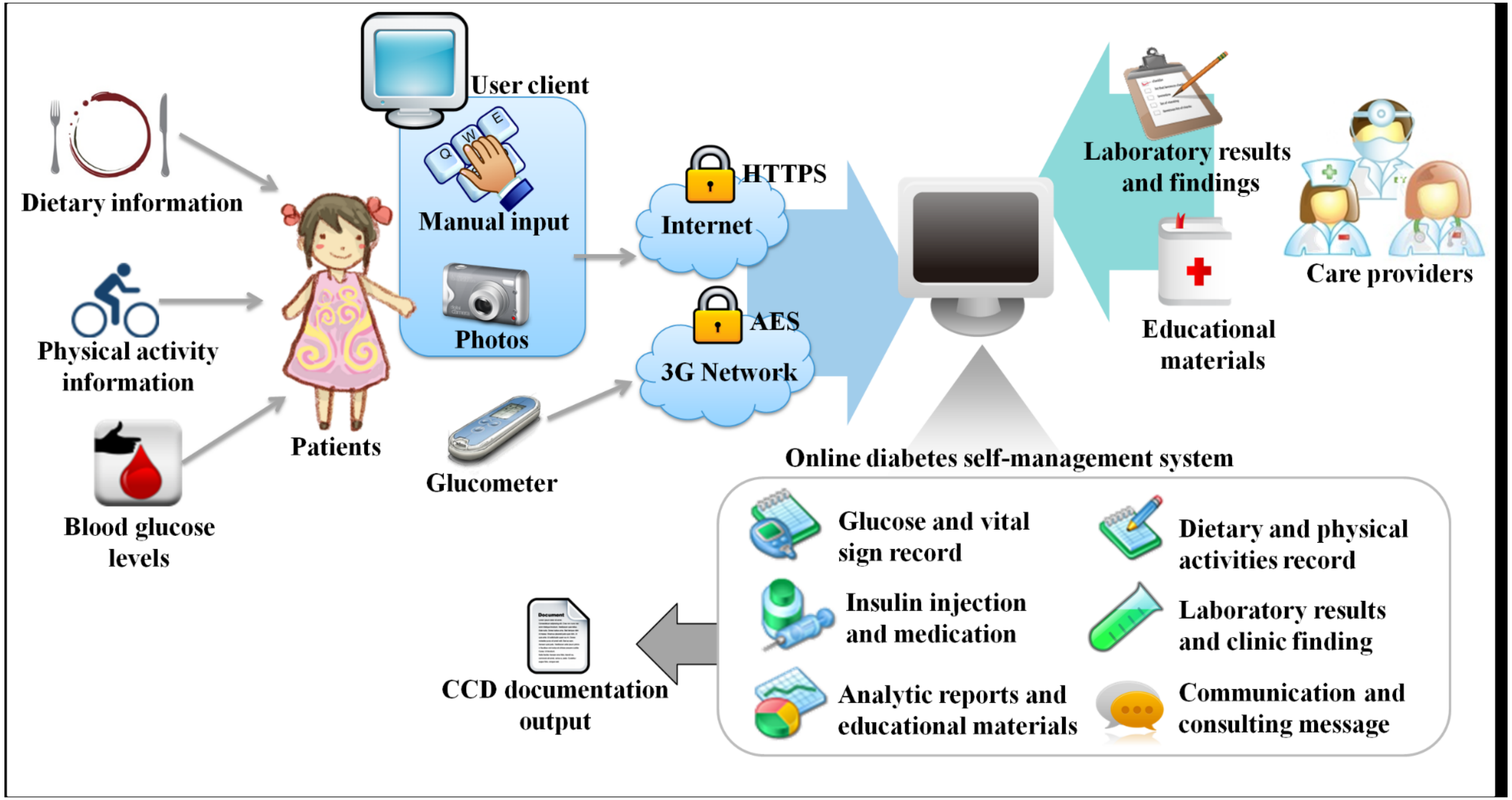


ICT in Healthcare

- Accessibility to information and communication technologies (ICT) provides an opportunity to facilitate acquisition of health data from wide populations, their use in research, analytics and finally in improving the outcomes of health care.

Picture from: ICT-based Convergence Technologies Changing Paradigm of Health Care

Self-Management and Telecare

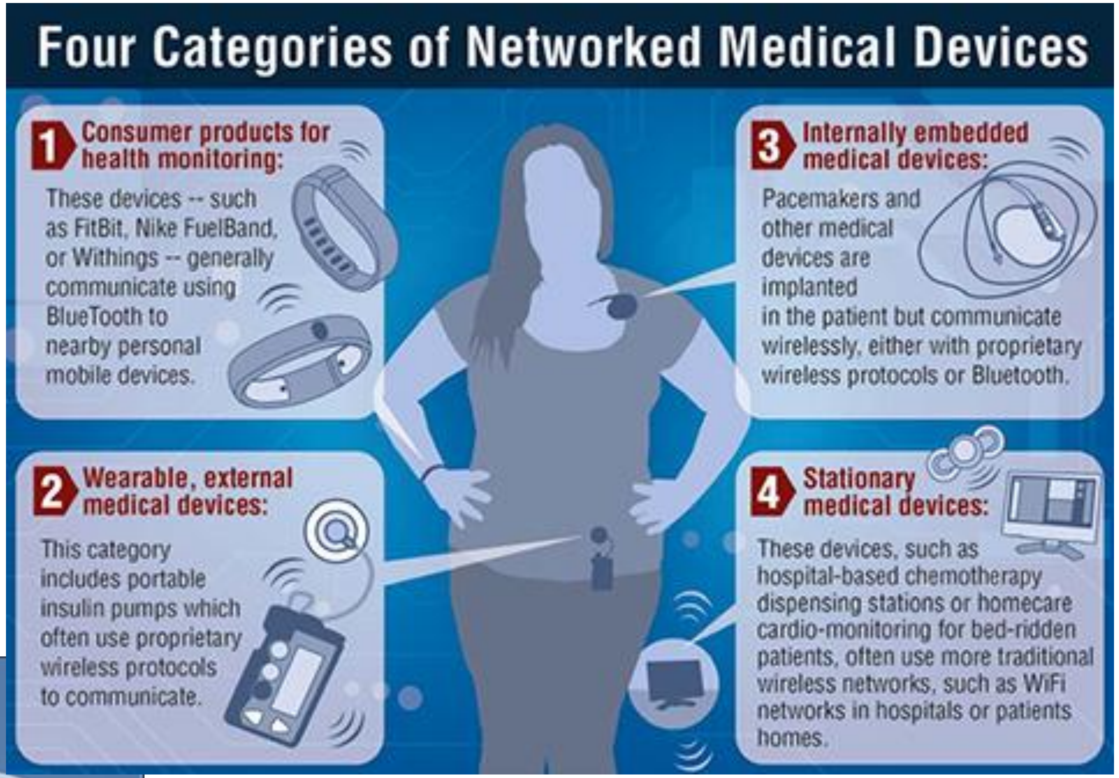


From: Chen L, et al. Evaluating Self-Management Behaviors of Diabetic Patients in a Telehealthcare Program: Longitudinal Study Over 18 Months

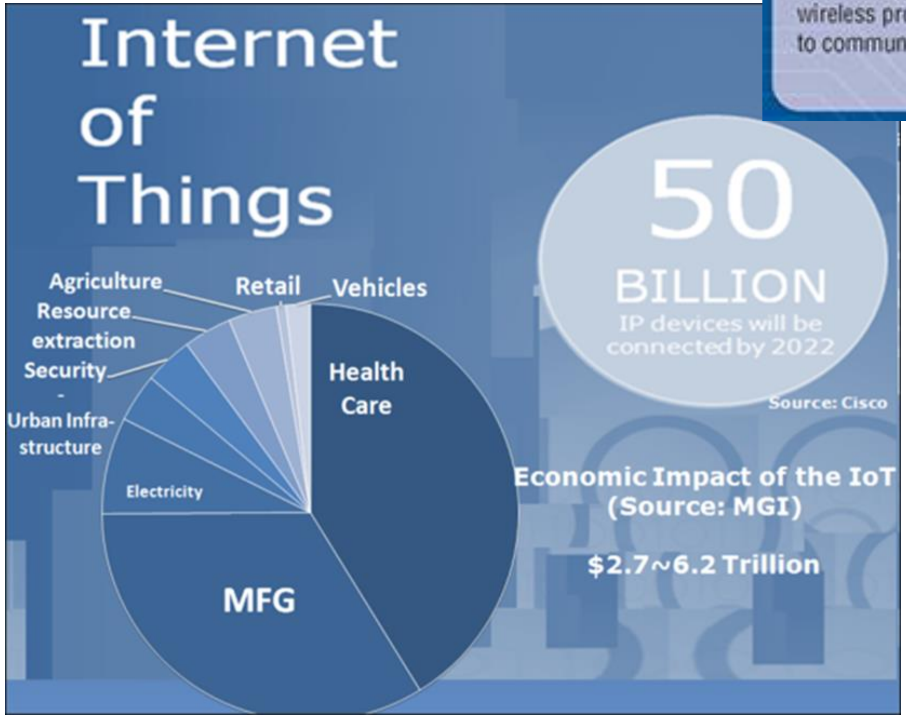
J Med Internet Res 2013;15(12):e266, DOI: 10.2196/jmir.2699

IoT in Health Care

- Global connectivity
- Personal mobile devices
- Digital society

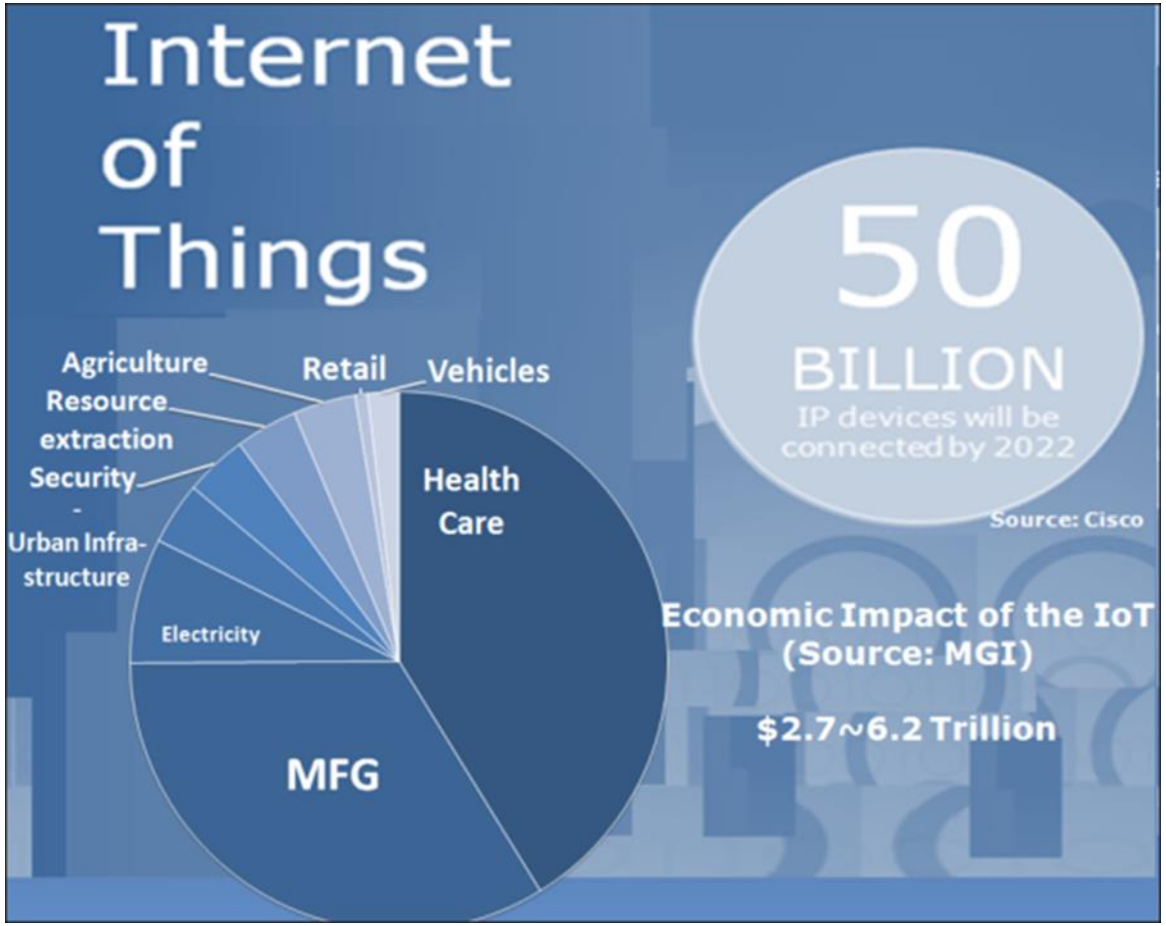


Source: NetSecurity.org



IoT Applications

1. **Consumer applications**
   - 1.1 Smart home
   - 1.2 Elderly care
2. **Commercial application**
   - 2.1 Medical and healthcare
   - 2.2 Transportation
   - 2.3 V2X communications
   - 2.4 Building and home automation
3. **Industrial applications**
   - 3.1 Manufacturing
   - 3.2 Agriculture
4. **Infrastructure applications**
   - 4.1 Metropolitan scale deployments
   - 4.2 Energy management
   - 4.3 Environmental monitoring



Source: https://en.wikipedia.org/wiki/Internet_of_things#cite_note-Definition-IoT-5

IoT Definitions

- The internet of things (IoT) is a **computing concept** that describes the idea of **everyday physical objects being connected to the internet** and being **able to identify themselves to other devices**.
- The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to **transfer data over a network without requiring human-to-human or human-to-computer interaction**.
- In other words, with the internet of things, the physical world is becoming one big information system.

Sources: https://www.techopedia.com/definition/28247/internet-of-things-iot

https://en.wikipedia.org/wiki/Internet_of_things#cite_note-Definition-IoT-5

IoT in Health Care

- The **Internet of Medical Things (IoMT)** is the collection of medical devices and applications that connect to healthcare IT systems through online computer networks.

  (source: https://www.igi-global.com/dictionary/healthcare-data-analysis-in-the-internet-of-things-era/59781)

- Medical devices equipped with **connectivity** allow the machine-to-machine communication that is the basis of IoMT.
- IoMT devices link to cloud platforms such as Amazon Web Services, on which captured data can be stored and analyzed.

Challenges in IoMT

- Interoperability
- Standardization
- Users’ acceptance
- Cost
- Reimbursment
- Data analytics
- From statistics to personalized medicine

Data Analitycs

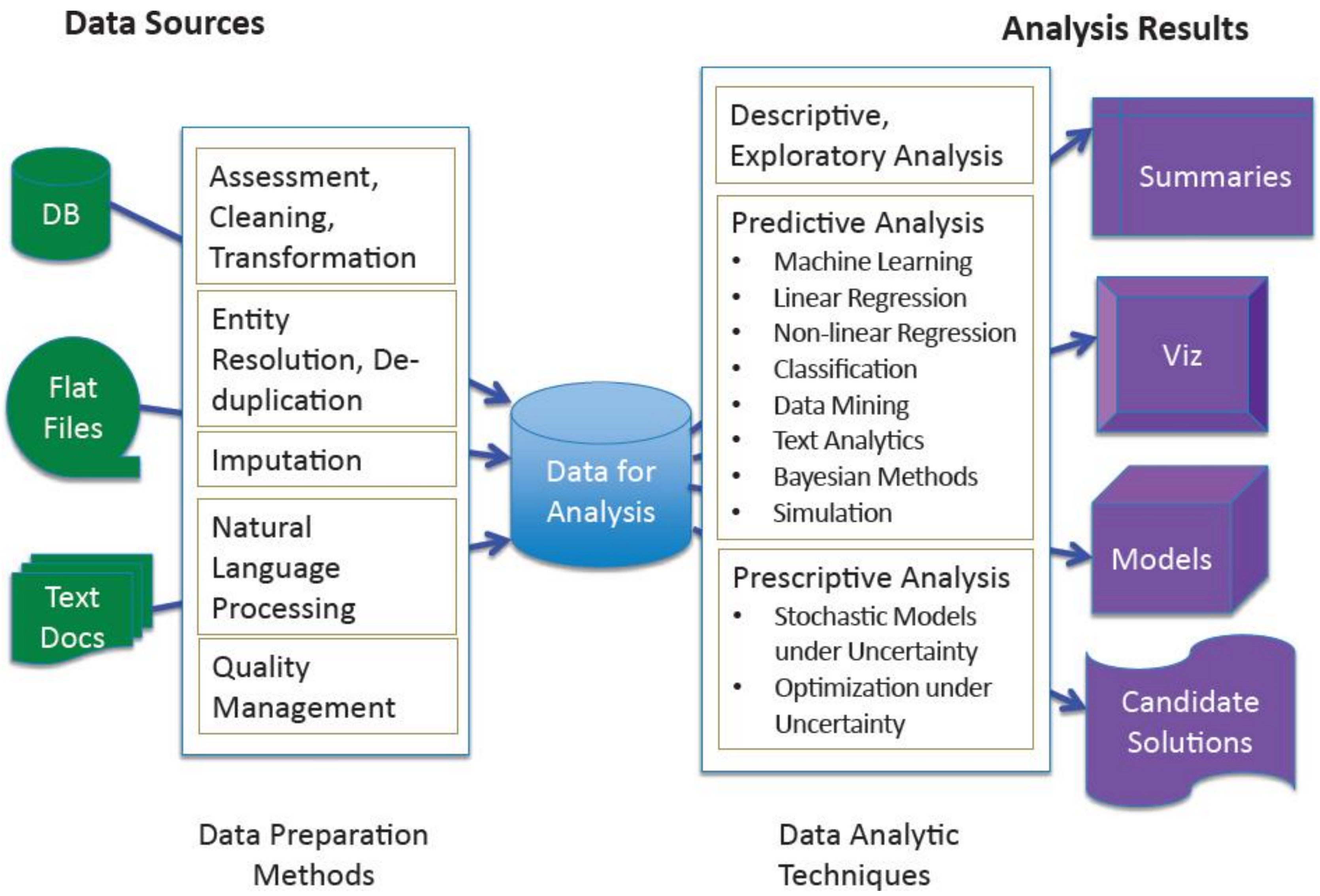


FIGURE 4.1 The evolution from data sources to analysis results passes through several steps. Raw data (captured in databases [DB], flat files, and text documents) must first go through various data preparation methods to prepare them for analysis. The prepared data can then be analyzed using a variety of data analytic techniques to summarize and visualize the data and develop models and candidate solutions.

https://www.nap.edu/read/23670/chapter/6

Digital Health

- Digital health is the field of knowledge and practice associated with the development and use of digital technologies to improve health.
- Digital health expands the concept of eHealth to include digital consumers, with a wider range of smart devices and connected equipment.
- The following areas are commonly understood as being part of, or related to, digital health: artificial intelligence, big data, blockchain, health data, health information systems, the infodemic, the Internet of Things, interoperability and telemedicine.
- From: https://www.who.int/europe/health-topics/digital-health#tab=tab_1

Digital Health

- Digital health and care refers to tools and services that use information and communication technologies (ICTs) to improve prevention, diagnosis, treatment, monitoring and management of health-related issues and to monitor and manage lifestyle-habits that impact health.
- Digital health and care is innovative and can improve access to care and the quality of that care, as well as to increase the overall efficiency of the health sector.
- From: https://digitalhealtheurope.eu/

Secure data access and sharing

- To facilitate greater acces to cross-border healthcare, the Commission is building the eHealth Digital Service Infrastructure to allow e-prescriptions and patient summaries to be exchanged between healthcare providers.
- The first cross-border exchanges started in 2019, with the goal of having all the other EU countries on board by 2025.
- In the longer term, the Commission is working towards establishing a European electronic health record exchange format that is accessible to all EU citizens.

Health data for research

- Connecting and sharing health data for research, faster diagnosis and improved health
- Huge potential of health data to support medical research with the aim of improving prevention, diagnosis, treatments, drugs and medical devices.

Citizen empowerment

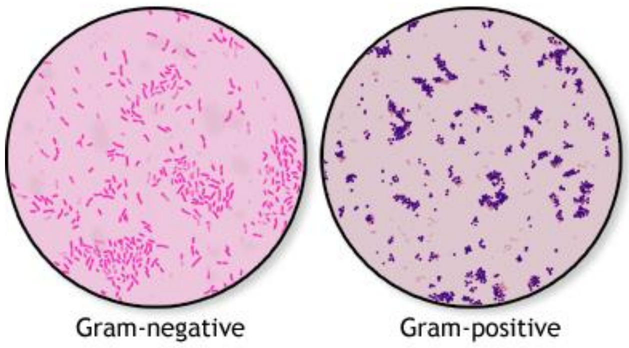
- Strengthening citizen empowerment and individual care through digital services
- Digital services can empower citizens, making it easier for them to take a greater role in the management of their own health from following prevention guidelines and being motivated to lead healthier lifestyles, to managing chronic conditions and providing feedback to healthcare providers.
- Health systems will also benefit from innovative care models that use telehealth and mHealth to address the rising demand for healthcare, helping to shift progessively towards integrated and personalised care systems.

Artificial intelligence in health care

- AI in healthcare, then, is the use of machines to analyze and act on medical data, usually with the goal of predicting a particular outcome.
- A significant AI use case in healthcare is the use of ML and other cognitive disciplines for medical diagnosis purposes.
- By automating daily tasks, such as data entry, claims processing and appointment scheduling, using artificial intelligence in healthcare can free up time for providers and healthcare organizations to focus on patient care and revenue cycle management.

Artificial intelligence in health care

- Example:
- From over 25,000 blood sample images, the machines could learn how to find the harmful bacteria.
- AI allowed the machines to learn to identify these bacteria in the blood and predict their presence in the new samples with an accuracy of 95 percent, reducing fatality by a large margin.



The rise of digital health technologies during the pandemic

- For many years the EU has supported eHealth strategies and action plans, the most recent covering 2012-2020.
- Based on the existing Cross–border Healthcare Directive, Member States collaborate through a voluntary network connecting national authorities responsible for eHealth (the 'eHealth network').
- ' A Europe fit for the digital age is one of the six political priorities of the Commission for the 2019-2024 period, and the EU's digital transformation has been identified as a priority for unlocking future growth.
- The 2018 communication on the digital transformation of health and care in the digital single market includes measures to enable people to access and share their EHRs, pool data across Europe to boost research and spur the development of personalized medicine, and scale up digitally enabled person-centered care models.

On IFMBE

International Federation for Medical and Biological Engineering

Mission

The objectives of the International Federation for Medical and Biological Engineering are scientific, technological, literary, and educational.

The mission of the IFMBE is to encourage, support, represent and unify the world-wide Medical and Biological Engineering Community in order to promote health and quality of life through the advancement of research, development, application and management of technology.

Within the field of medical, clinical and biological engineering its aims are to encourage research and the application of knowledge, to disseminate information and promote collaboration.

IFMBE

Goals

- To function as the **leader** in representing the international community of medical and biological engineering.
- To foster the **creation**, and **application** of medical and biological engineering knowledge and the management of technology for improved health and quality of life.
- To promote the **development** of the medical and biological engineering profession, and the recognition and awareness of the profession by the public.
- To advance **collaboration** between national and transnational societies, industry, government and non- government organizations engaged in health care and in biomedical research and its applications.
- To recommend policies and provide guidelines in appropriate professional, educational and ethical areas.
- To enable IFMBE to achieve its goals effectively, optimize the organizational structure and communication and enhance its finances.

Affiliated Members of IFMBE

Since 1959

INTERNATIONAL FEDERATION FOR MEDICAL AND BIOLOGICAL ENGINEERING

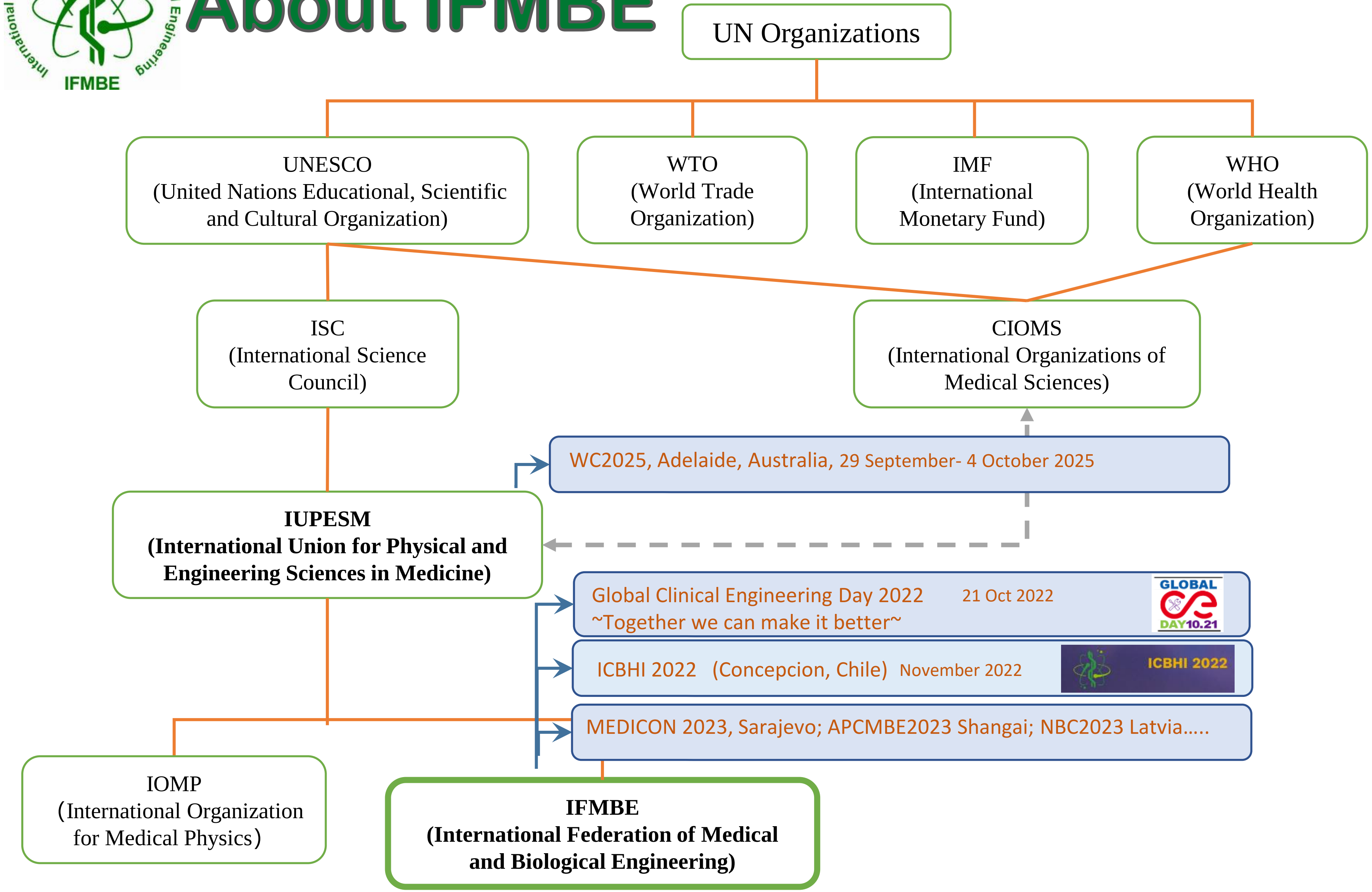
Affiliated with the International Union for Physical and Engineering Sciences in Medicine (IUPESM)

www.ifmbe.org

Affiliated Transnational Organizations:

- **ACCE**
- **AAMI**
- **CAHTMA**
- **CORAL**
- **EAMBES**
- **IEEE/EMBS**

About IFMBE


UN Organizations
UNESCO
(United Nations Educational, Scientific and Cultural Organization)
WTO
(World Trade Organization)
IMF
(International Monetary Fund)
WHO
(World Health Organization)
ISC
(International Science Council)
CIOMS
(International Organizations of Medical Sciences)
WC2025, Adelaide, Australia, 29 September- 4 October 2025
IUPESM
(International Union for Physical and Engineering Sciences in Medicine)
Global Clinical Engineering Day 2022 21 Oct 2022
~Together we can make it better~
GLOBAL
DAY10.21
ICBHI 2022 (Concepcion, Chile) November 2022
ICBHI 2022
MEDICON 2023, Sarajevo; APCMBE2023 Shangai; NBC2023 Latvia…..
IOMP
(International Organization for Medical Physics)
IFMBE
(International Federation of Medical and Biological Engineering)

IFMBE's Liaisons

- Close association with the **International Organization of Medical Physics**

- The two international bodies have established the umbrella organization **International Union for Physical and Engineering Sciences in Medicine**

"The principal objective of IUPESM is to contribute to the advancement of physical and engineering sciences in medicine for the benefit and well being of humanity."

http://www.iupesm.org/

IFMBE's Liaisons

International Science Council

ISC

International Science Council

IUPESM
International Union for Physical and Engineering Sciences in Medicine

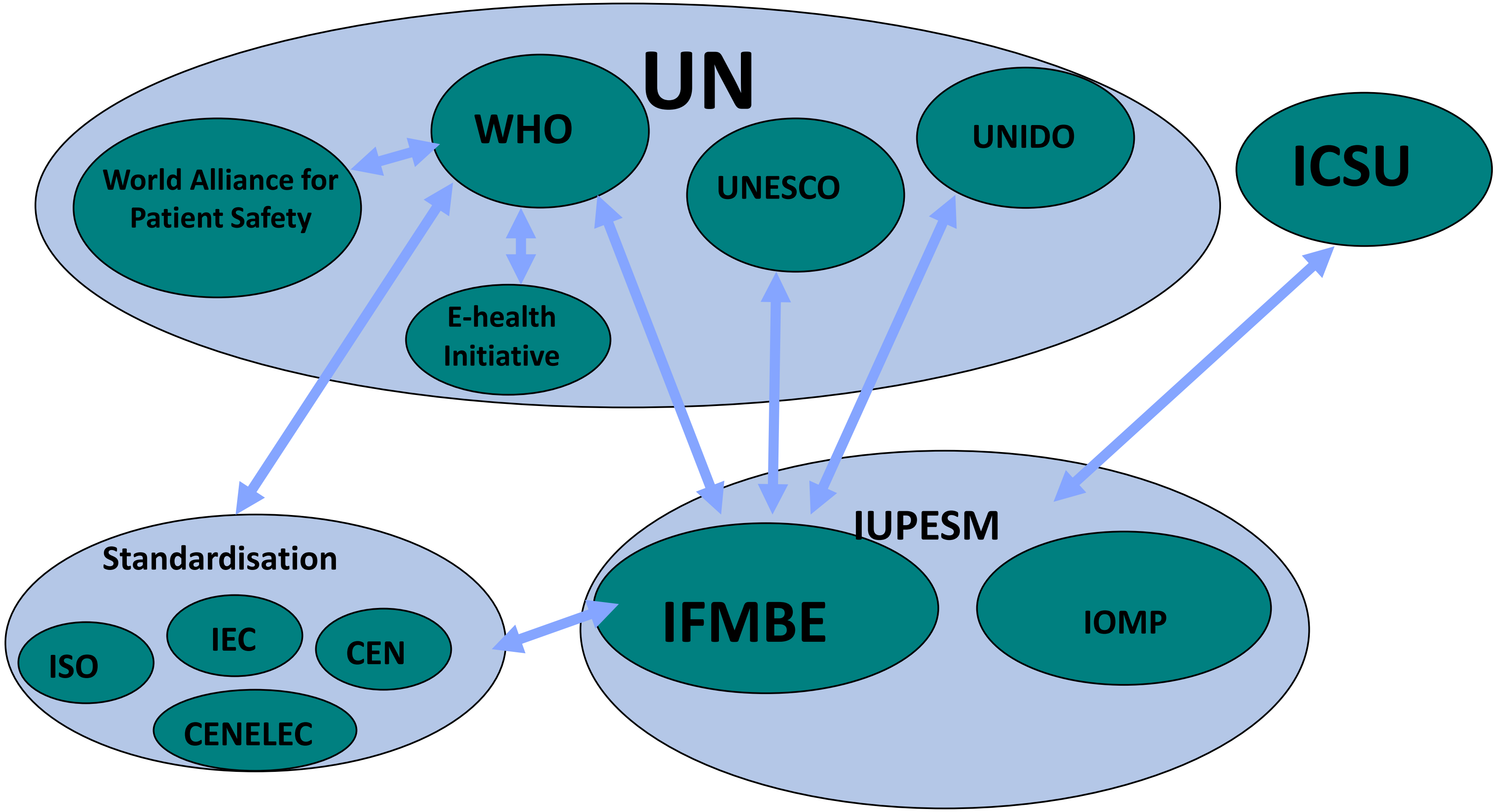
Scientific Unions (39)

Scientific Members
(mainly national Academies of Science, 141)

IFMBE
International Federation for MBE

IOMP
International Organization for Medical Physics

IFMBE’s Liaisons to UN & WHO



World Health Organisation

IFMBE is a non-governmental organisation affiliated to WHO and has major interests in:

- patient safety issues
- human resources program
    - strengthen the position of clinical engineers and biomedical engineers whose workplace is within the healthcare system
- e-health programs
- health technology assessment and management
- evidence based medicine

<u>IFMBE is representing the WHO in international standardisation bodies</u>

IFMBE's Liaisons to WHO resulted in publication:

Human resources for medical devices, the role of Biomedical Engineers

Authors:
WHO

Publication details

Number of pages: 240
Publication date: 2017
Languages: English
ISBN: 978-92-4-156547-9

Downloads

– English

Important for obtaining a code for biomedical engineers in Int'l Labour Organization's (ILO) classification of both, health and of engineering professions

Aim:

- improving employability,
- improved professional status,
- increased income....

http://www.who.int/medical_devices/publications/hr_med_dev_bio-engineers/en/

World Health Organization

Access to medical devices for Universal Health Coverage and achievement of SDGs

WHA60.29 Health technologies[1]

The Sixtieth World Health Assembly,

Having considered the report on health technologies;[2]

Recognizing that health technologies equip health-care providers with tools that are indispensable for effective and efficient prevention, diagnosis, treatment and rehabilitation and attainment of internationally agreed health-related development goals, including those contained in the Millennium Declaration;

World Health Organization

WHO list of priority medical devices for cancer management

WHO Medical device technical series

SUSTAINABLE DEVELOPMENT GOALS

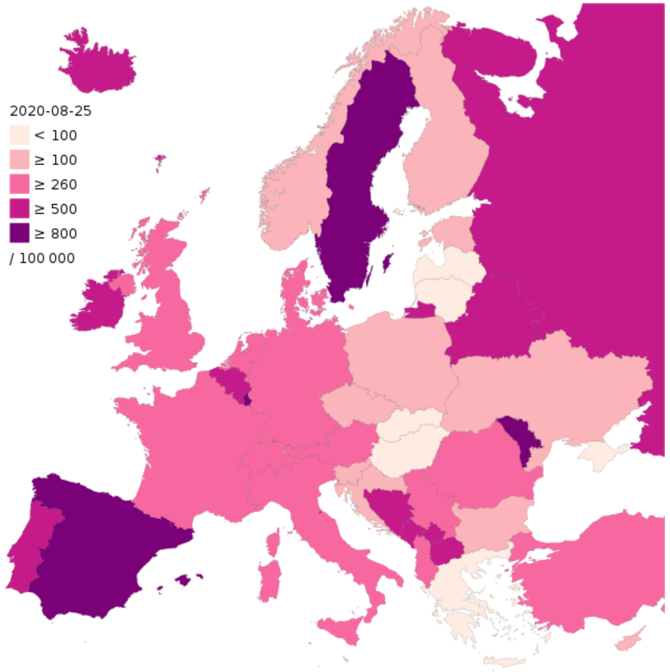
3rd Goal – Good Health and Well-Being

Targets:

- By 2030, reduce the global **maternal mortality** ratio to less than 70 per 100,000 live births.
- By 2030, end **preventable deaths** of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births
- By 2030, **end the epidemics** of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.
- By 2030, **reduce** by one third **premature mortality** from non-communicable diseases **through prevention and treatment** and promote mental health and well-being.
- By ....

COVID – 19 Pandemics

- In Europe:
  - Confirmed cases of SARS-CoV-2 infected people in relation to the population of the country (cases per 100,000 inhabitants)
  - The virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes, or exhales. These droplets are too heavy to hang in the air, and quickly fall on floors or surfaces.



How much time do we need to develop and bring to market new products?

SUSTAINABLE DEVELOPMENT GOALS

3rd Goal – Good Health and Well-Being

- What is the role of science, technology and innovations, in particular from biomedical engineering achieving SDGs?
- What is technology offering today?
- Which technologies may be implemented globaly, efficiently and at a reasonable price?
- How well is the innovation potential from biomedical engineering used in medicine and health care?

LESSONS FROM COVID

Pandemic Management and Preparedness and the Role of Technology in Securing a Safer Future

21 March 2023, 09:00–11:00 am CET
European Parliament 60 Rue Wiertz, Room 6Q1
Hybrid Event
Hosted By MEP Stelios Kympouropoulos (EPP, Greece)

epp group in the european parliament
European Alliance for EAMBES Medical and Biological Engineering & Science
PandeVITA
WARWICK THE UNIVERSITY OF WARWICK
International Federation for Medical and Biological Engineering IFMBE
UNIVERSITÀ CAMPUS BIO-MEDICO DI ROMA

Pandemic Management and Preparedness: Telemedicine and the Role of Innovative Technologies in Securing a Safer Future

- The policy event aimed to pave the way for experts and policymakers to strengthen their dialogue, ensure collaboration between stakeholders and ensure that the EU will exit the pandemic stronger, more resilient, and more autonomous than before.
- In the first part, the event aimed to identify the "lessons learned" from the pandemic, in regard to telemedicine and other health technologies used during this period, in order to highlight various best practices followed. In the second panel, the event yielded the floor to medical technology experts in order to explore efficient measures to prepare for the next health crisis in Europe.

Conclusions

- IFMBE has in the sixty years since its founding grown from a group of enthusiastic researchers, engineers and physicians into the world largest society based association in the field of biomedical engineering
- IFMBE unifies the world-wide Medical and Biological Engineering Community in promoting health and quality of life through the advancement of research, development, application and management of technology.
- Engineering jobs are present in medicine and health care, primarily through research, development and manufacturing of medical products, devices and systems, but is increasingly encountered in clinical settings.

Thank you for your attention!