Biomedical engineering master program in Hungary for engineers and medical doctors

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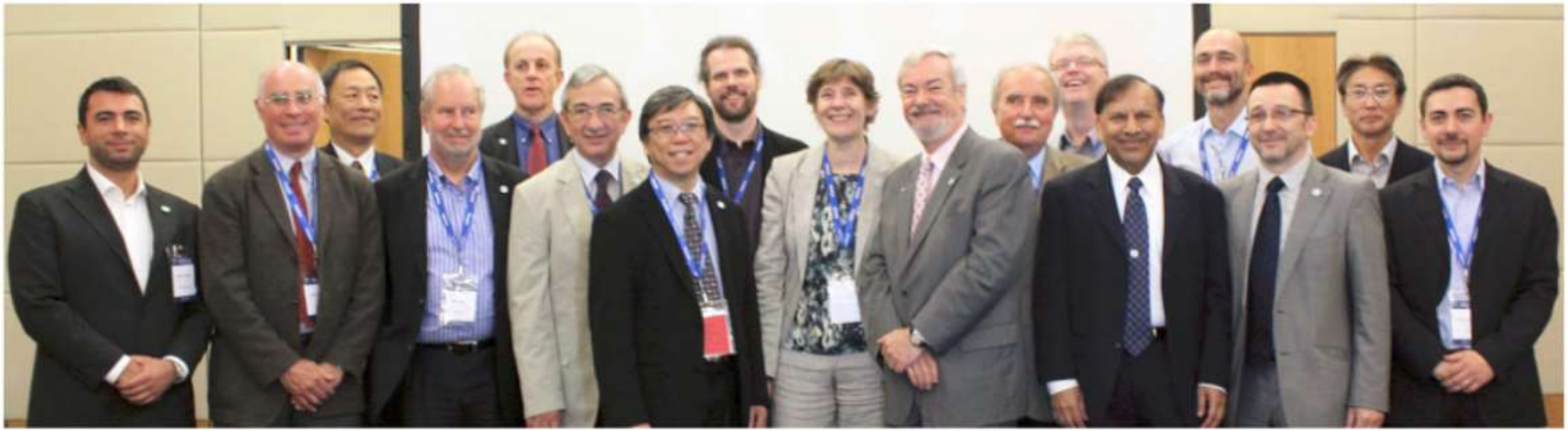
Budapest University of Technology and Economics

Federation of 120,000 biomedical engineers

IFMBE



IFMBE

International Federation for Medical and Biological Engineering

A member of the International Union on Physical and Engineering Science in Medicine (IUPESM)

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CRITERIA FOR THE ACCREDITATION OF BIOMEDICAL ENGINEERING PROGRAMS IN EUROPE

BIOMEDEA

There are no predetermined curricula, nor specific requirements or percentages for individual courses in the different categories. With regard to accreditation, the outcome, i.e. the aptitude or the acquired skills of the graduates, is more important than the curriculum that may very well contain some specific local profile.

More important than adherence to the listed percentages is a reasonable concept for the curriculum. Therefore, the application for accreditation must contain a detailed description for the objectives of the program, its quality and compatibility as well as the professional qualification of its graduates. It should be explained how students can acquire the general professional competencies.

7.2. *Organization of Programs*

As general guidelines, the following principles should be adhered to:

1. In addition to lectures, practice, lab courses and projects must be offered. Professionally oriented Programs should normally offer at least 30% of courses as practice or lab courses. In research oriented programs, all mandatory courses should be complemented by practice.
2. The curriculum of Bachelor programs should contain at least one project.
3. Groups should have the following sizes:
    a. Practice: no more than 15 students
    b. Lab courses: 1 or 2 students per workplace
    c. Projects: 5 to 12 students, depending on conception and goals.
4. All mandatory courses must be offered on an annual basis, or each semester if new students are admitted each semester.
5. The workload caused by mandatory and optional courses must be limited such that the students have the opportunity for additional, self-determined studies.
6. The percentage of necessary optional courses being offered must be sufficient, and they should be distributed equally on summer and winter semesters. There should be a sufficient number to allow a genuine selection, i.e. about twice the amount of necessary courses.
7. There should be a selection of courses being offered in the English language.
8. The course offering should normally be such that the program can be completed as a part time study.
9. Intensive counseling must be available.

33rd Annual International Conference of the IEEE EMBS
Boston, Massachusetts USA, August 30 - September 3, 2011

Promoting Harmonization of BME Education in Europe: The CRH-BME Tempus Project

Nicolas Pallikarakis, *Member, IEEE,* Zhivko Bliznakov, Damijan Miklavcic, Tomaz Jarm, Ratko Magjarevic, *Member, IEEE*, Igor Lackovic, *Member, IEEE*, Leandro Pecchia, Rita Stagni, Akos Jobaggy, *Senior Member, IEEE,* Joseph Barbenel

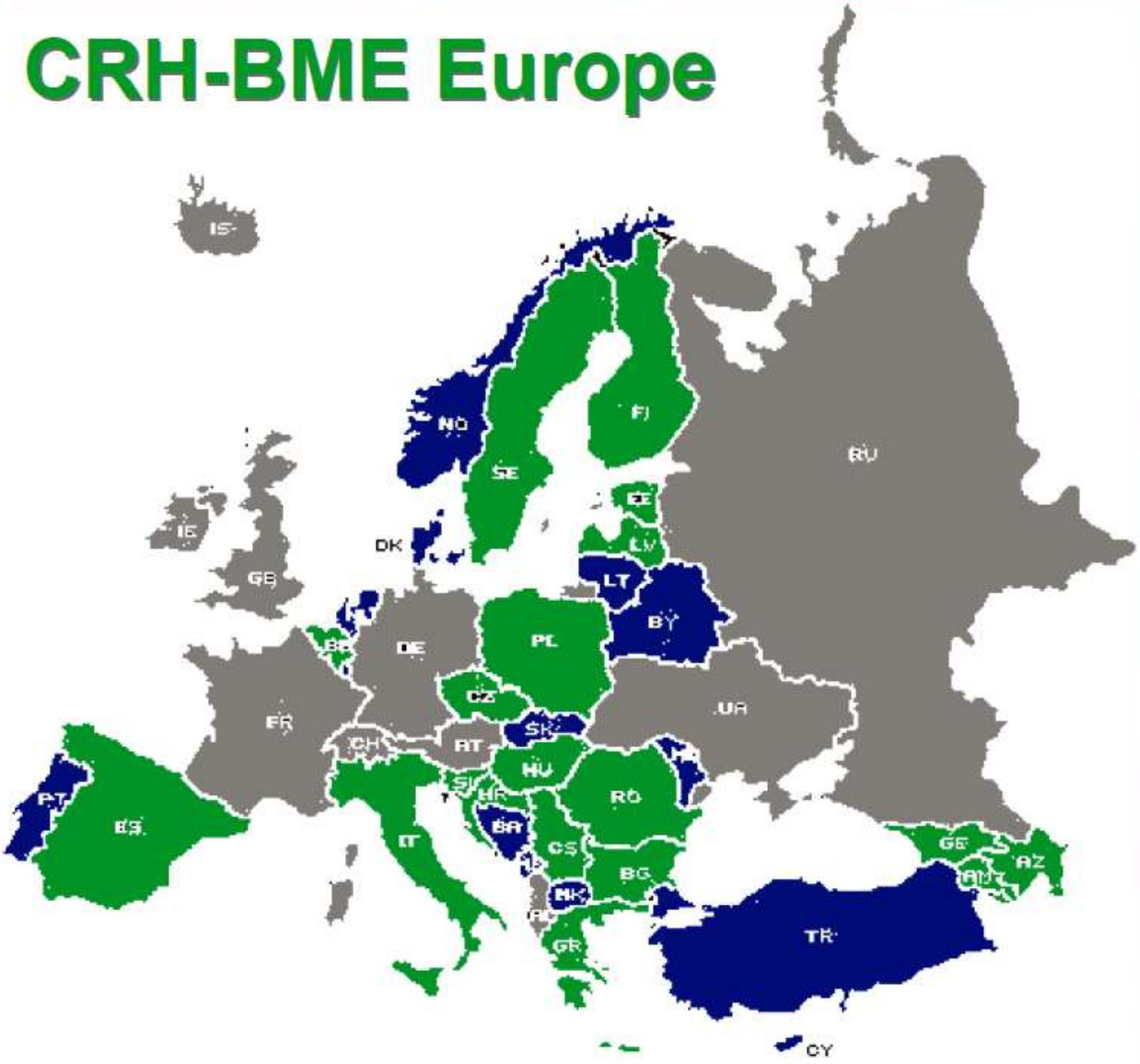
„Two-third of the BME programs available in Europe in 2011 started after 2000.”

TEMPUS IV

CRH-BME

CURRICULA REFORMATION AND HARMONISATION IN THE FIELD OF BIOMEDICAL ENGINEERING

CRH-BME Europe



BME studies in Europe in 2000

Study performed by INBIT in 2000 reveals:

- 50 Universities deliver BME program
  - 26 Undergraduate, 30 Postgraduate programs
  - 6 of them offer more than one program

- 33 Institutions run their program within a national or international inter-university collaboration scheme
  - 15 under the ERASMUS program

- 20 Universities apply ECTS
- 29 Institutions apply Quality Assessment schemes

WP1 Preliminary Results

Review of the BME programs in Europe

- 50 Countries in Europe covered
- 38 Countries have BME program
- ~ 150 Universities across Europe
- 295 BME programs
  - 77 Undergraduate - BSc
  - 218 Postgraduate - 159 MSc, 59 PhD

26 % BSc, 54 % MSc, 20% PhD

Budapest University of Technology and Economics

Nobel laureates of the university

Dénes GÁBOR (1900 – 1979)

holography, in 1971

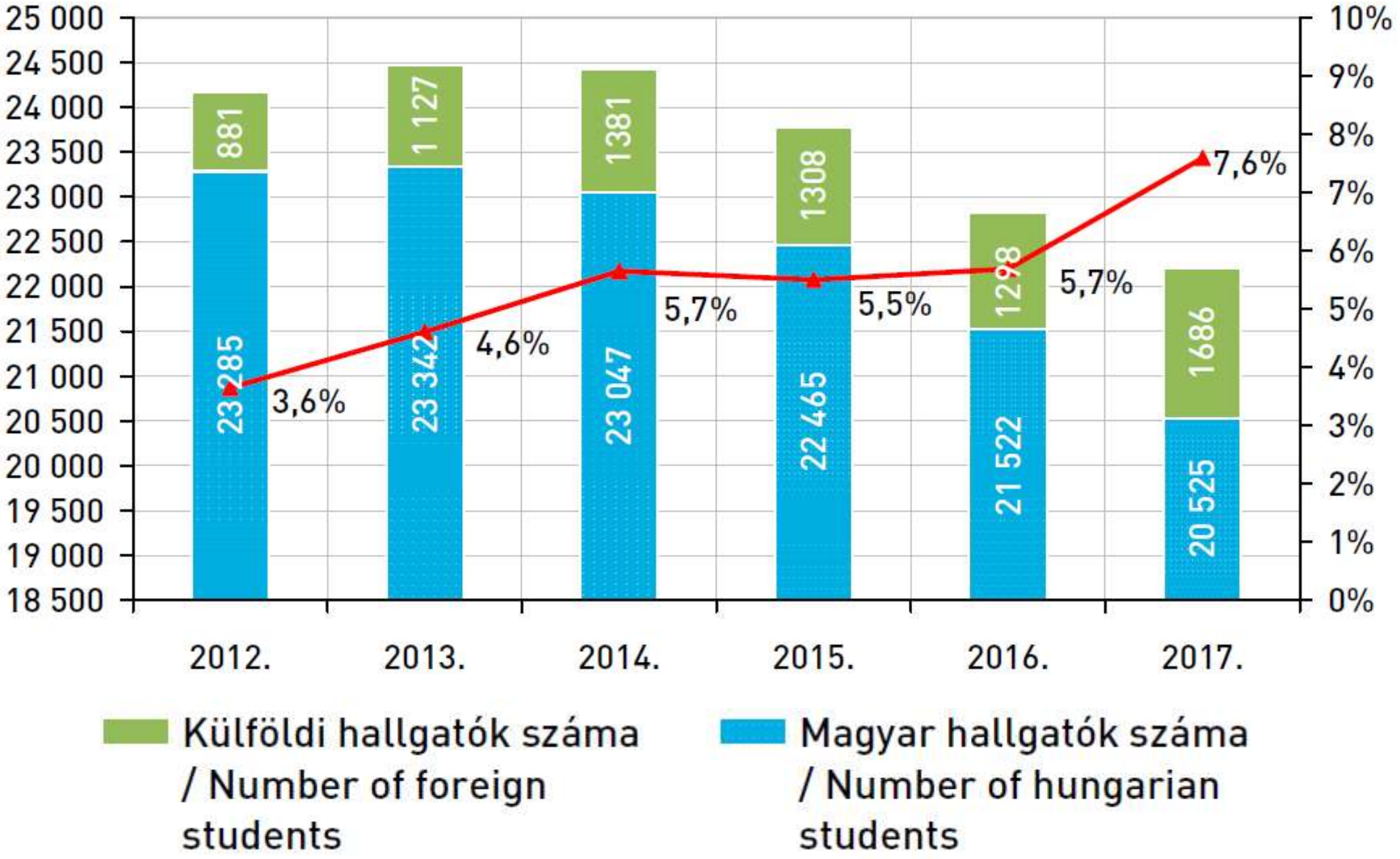
Jenő WIGNER (1902 – 1995)

theoretical physics, in 1963

György OLÁH (1927 – 2017)

organic chemistry, in 1994

Budapest University of Technology and Economics



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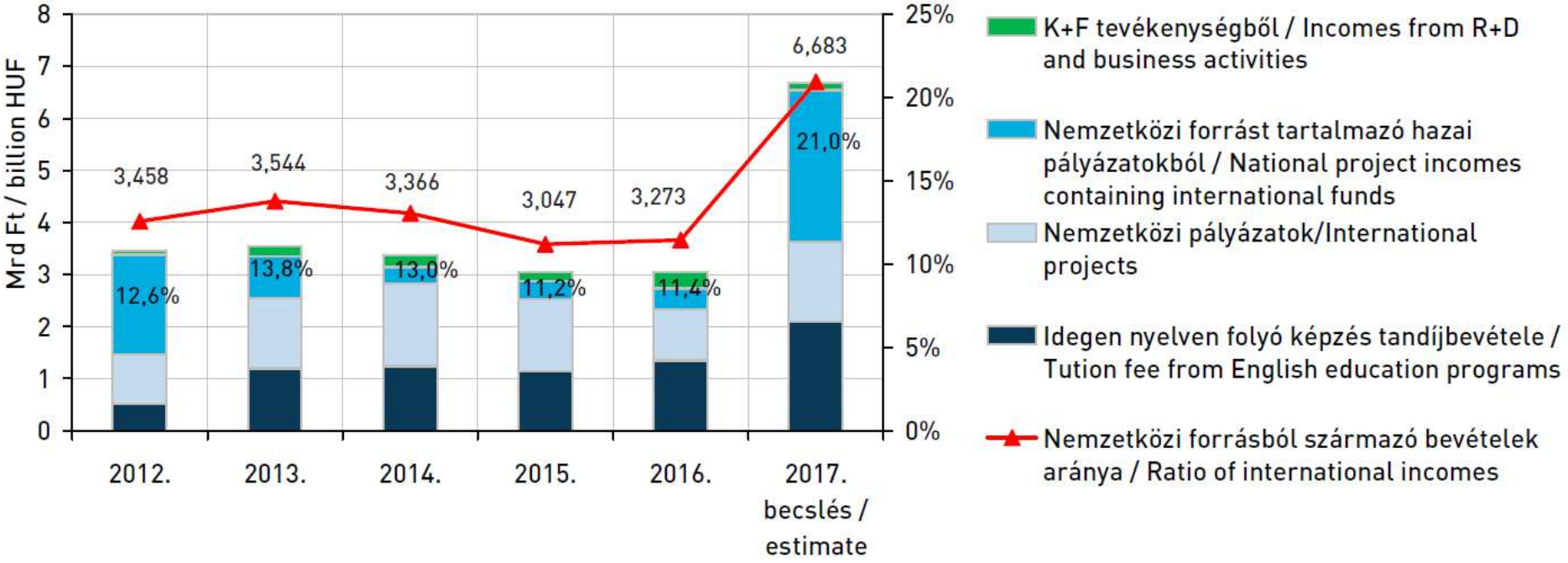


A BME NEMZETKÖZI FORRÁSBÓL SZÁRMAZÓ BEVÉTELEI 2012-2017
INCOMES FROM INTERNATIONAL SOURCES OF BME 2012-2017

BME education in Hungary

up to 1995: a BME specialization existed within electrical engineering programs.

1995 – 2009: special, parallel BME program, 3+3 semesters, 130 ECTS credits.

2009 – : 120 ECTS credit MSc course, (no BME BSc course exists)

Budapest University of Technology and Economics in co-operation with Semmelweis University of Medicine

MSc course: entry requirements

- natural sciences (35 credits): **mathematics** (12 credits), **physics** (5 credits), **anatomy** (6 credits), **physiology** (6 credits), **biochemistry** (5 credits).
- **engineering basics** (10 credits): design and analysis of systems.
- **basic programming** (5 credits).
- economic and social skills (10 credits): economics, management, quality assurance.

Biomedical engineers: excellent workers

Biomedical engineers are good at individual work, are able to ***communicate with specialists of another field***.

The workload of the program exceeds the average of engineering programs thus ***students of the BME master program are highly motivated***.

These are invaluable features even if they start working on a field different from biomedical applications.

Twenty years of experience of our BME program

BME program can be composed for ***students with different first degrees*** (engineers, medical doctors, pharmacists, computer scientists, physicists, medical analysts).

Students with different first degrees help each other very effectively.

Individual (project) work is extremely important, it may add up to one third of the total credits.

International co-operation of Budapest University of Technology and Economics

in the field of

bioinformatics,
biomechanics,
robots in rehabilitation,
medical image processing,
pharmaceutical engineering,
biomedical engineering,
biosensors.

International co-operation of Budapest University of Technology and Economics

in the field of biotechnology and biomedical engineering:

UCL,
KU Leuven,
Janssen (J & J),
Sanofi,
Servier,
Pfizer,
GE Healthcare,
Richter Gedeon,
EGIS,
B. Braun,
University of Minnesota.

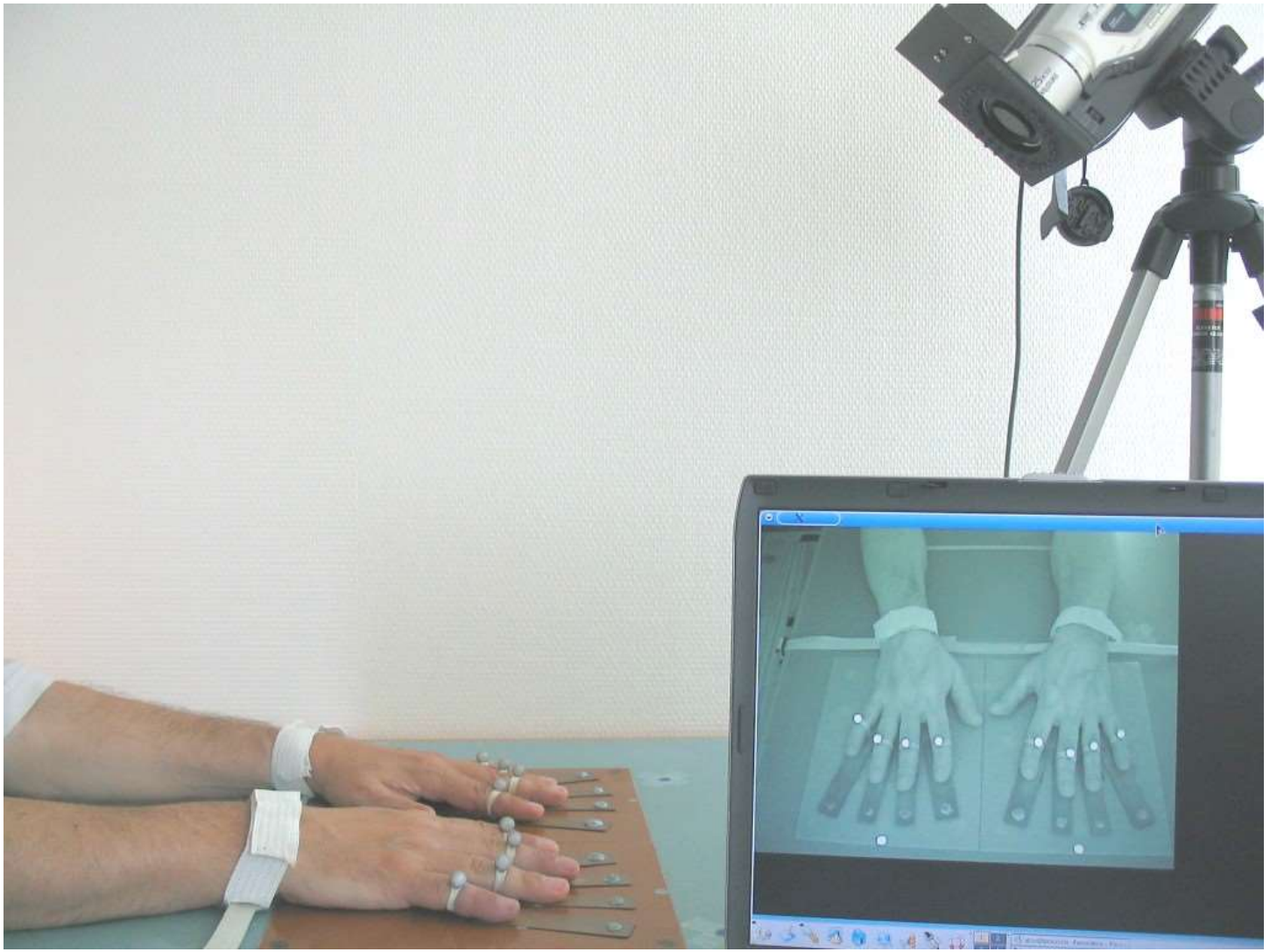
Research topics related to healthcare

- home health monitoring,
- bioinformatics,
- new generation medical implants,
- genetics,
- biochemistry,
- medical image processing,
- intelligent data analysis.

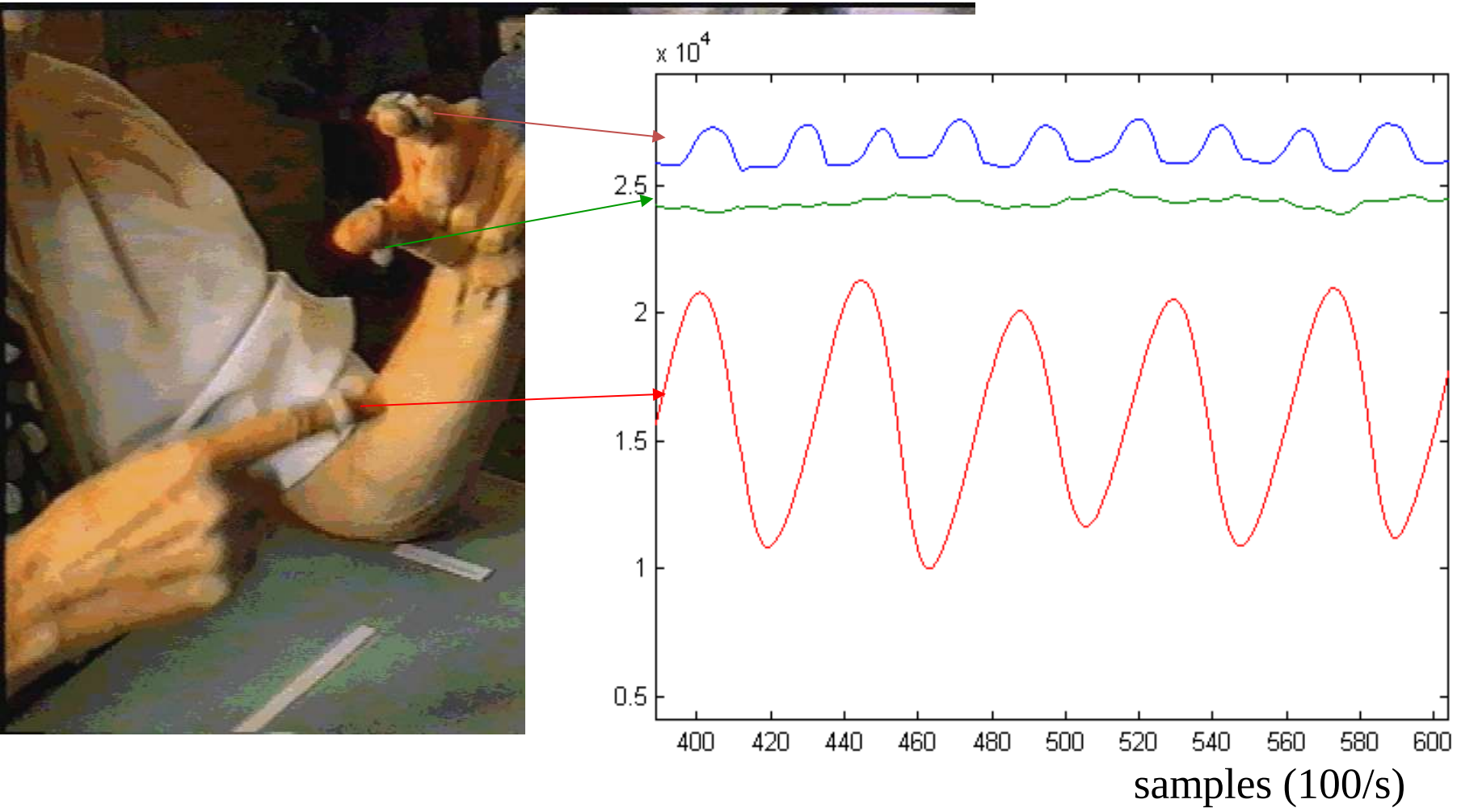
Smart Nine-Hole Peg Tester

Smart Nine-Hole Peg Tester

Simple 2-D movement analyzer, PAM



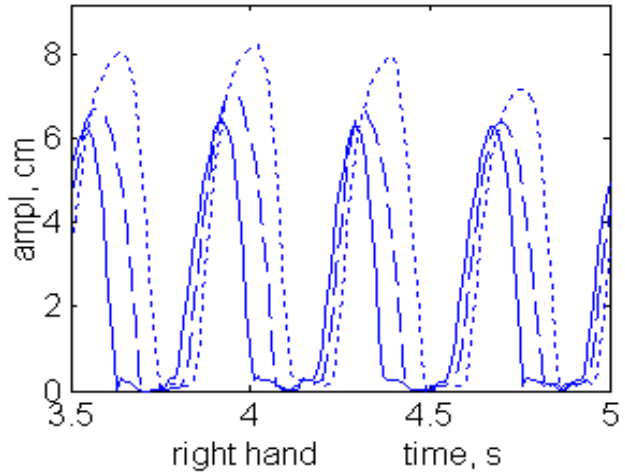
Marker trajectories

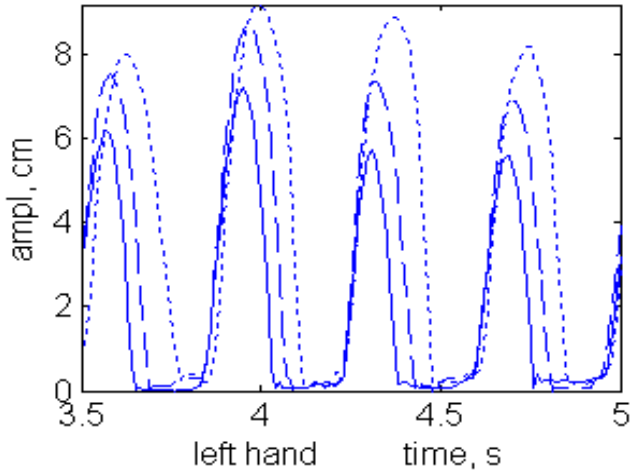


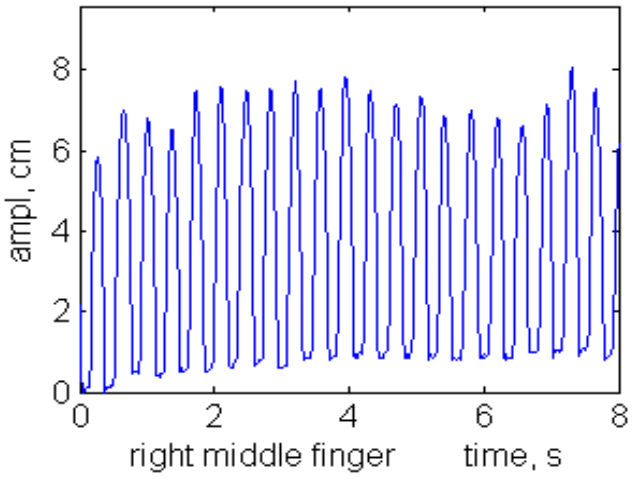
Objective assessment of Parkinsonians

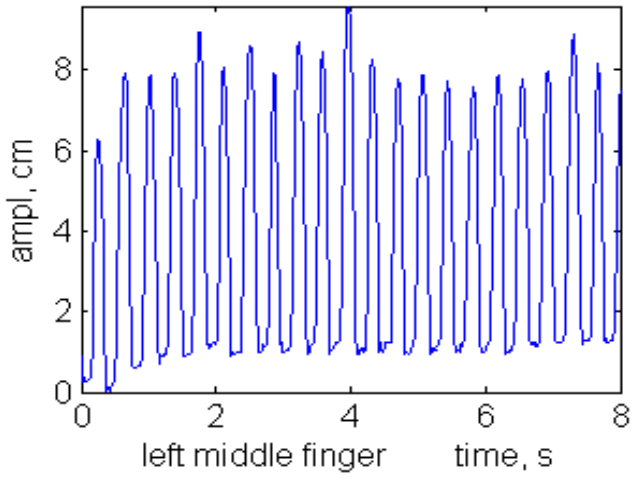
Objective assessment of Parkinsonians

Finger tapping - young healthy subject

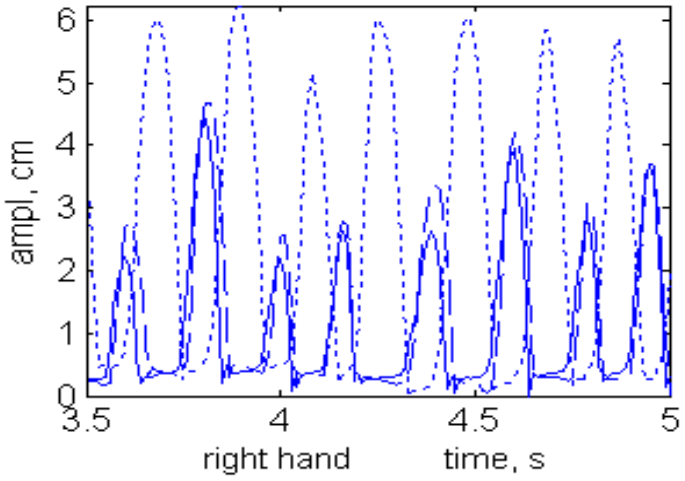


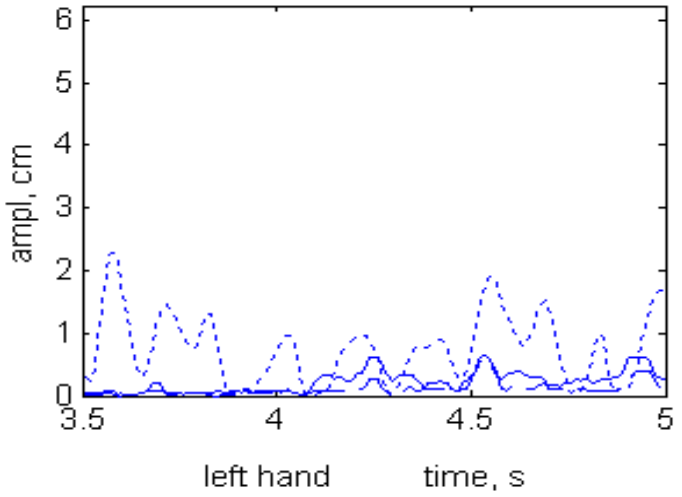


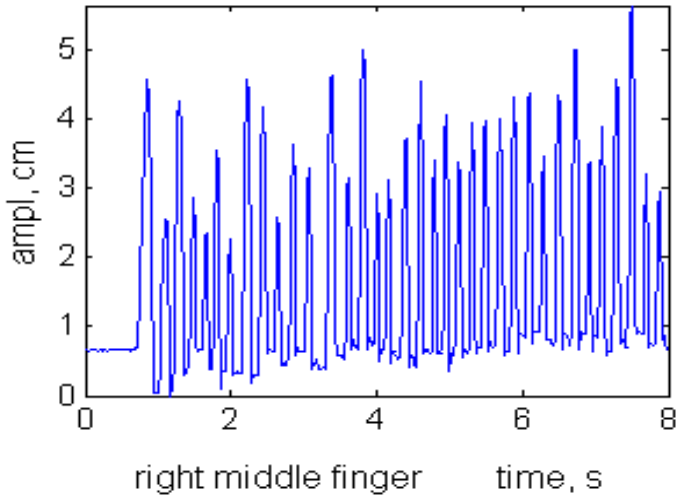


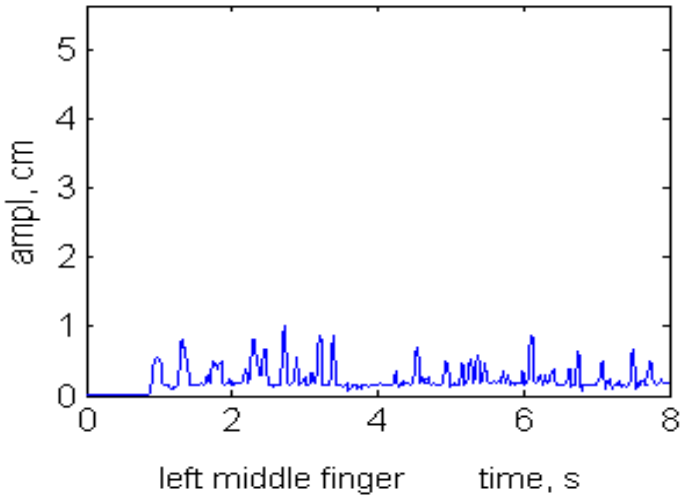


Finger tapping - Parkinsonian patient, H –Y scale 1

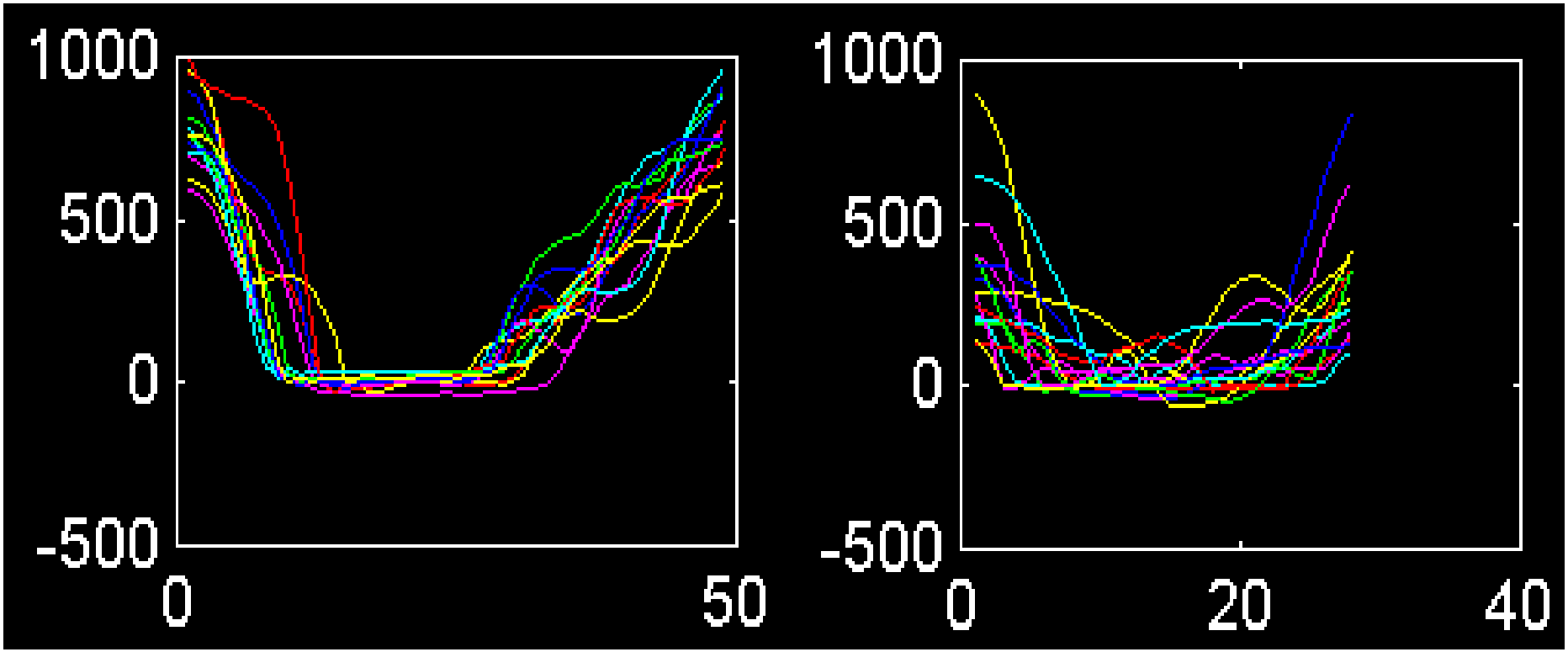








Feature extraction: regularity characterised by SVD



healthy subject

Parkinsonian patient

Characterisation of regularity

$$y = y(1)\ y(2) \ldots y(k) \ldots y(\lambda)$$

$$X = \begin{bmatrix} yr(1,1) & yr(1,2) \Lambda & yr(1,n) \\ yr(2,1) & yr(2,2) \Lambda & yr(2,n) \\ M & & \\ yr(m,1) & yr(m,2) \Lambda & yr(m,n) \end{bmatrix}$$

$$PM = \frac{\sigma_1^2}{\sum_{i=1}^{n} \sigma_i^2}$$

Suggested parameter to characterise finger-tapping

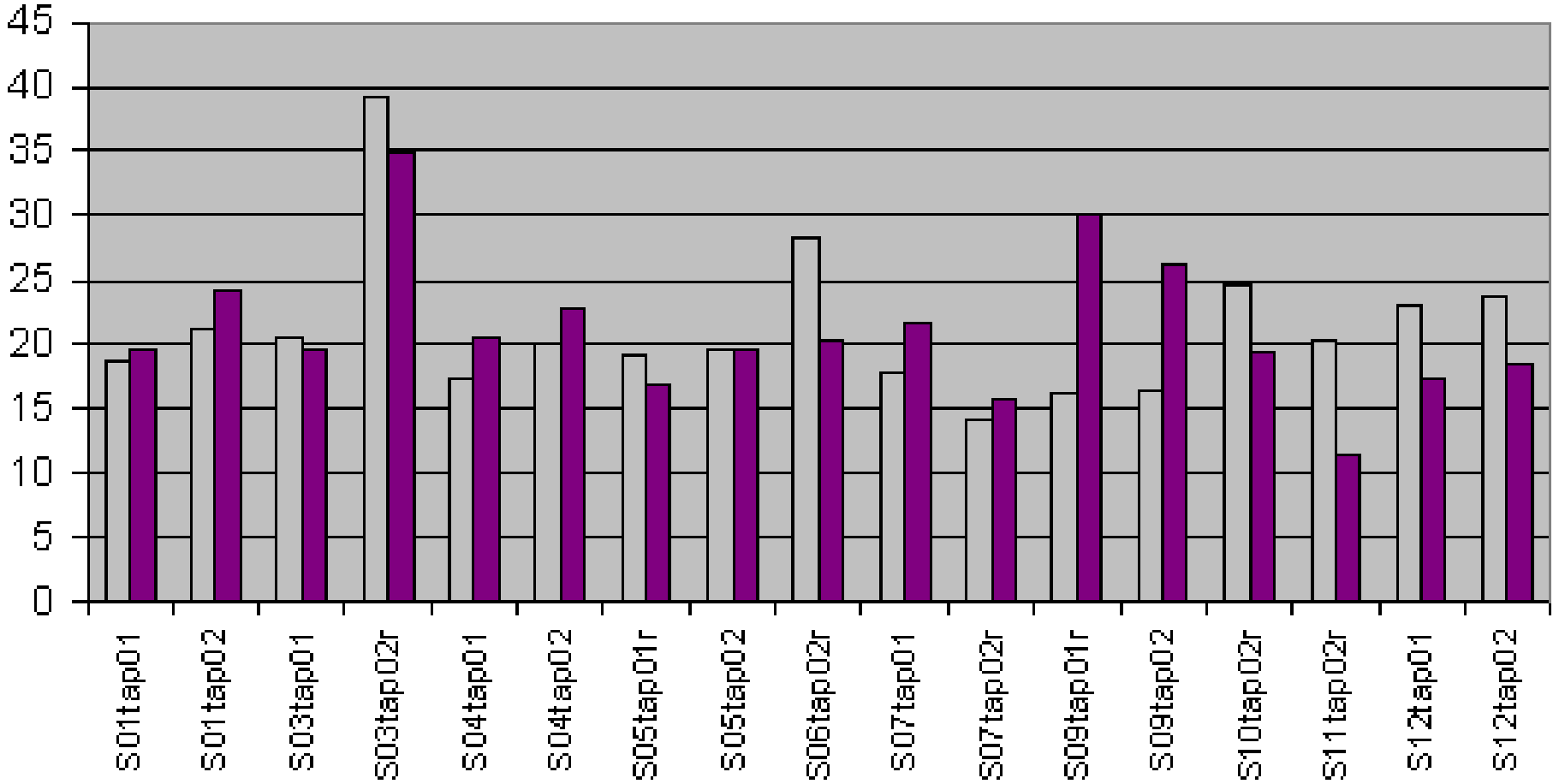
Speed: amxfr =amplitude x frequency

Regularity: PM computed using SVD

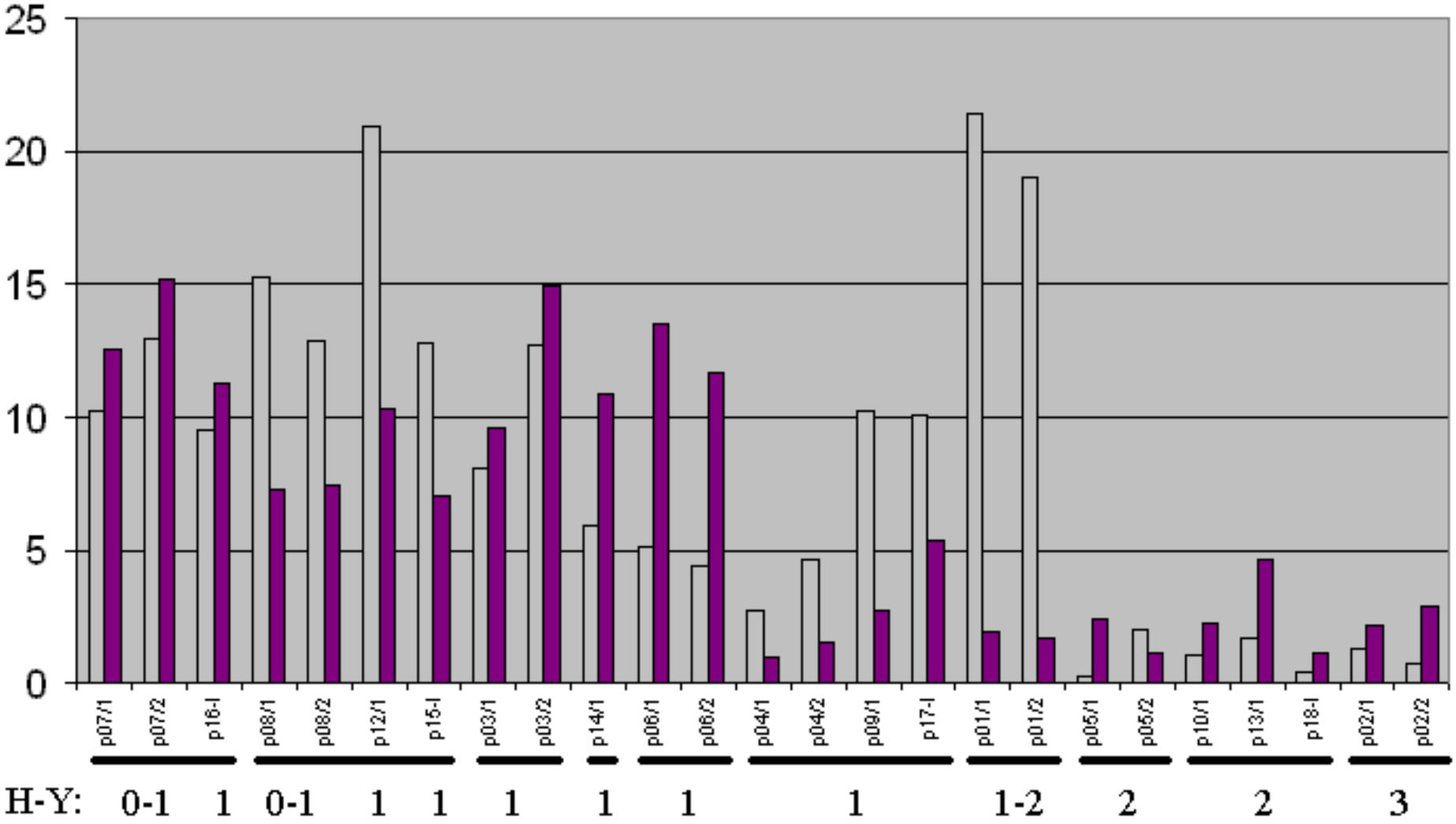
Score of Finger Tapping, FTTS

FTTS = PM x amxfr

FTTS of senior healthy subjects



FTTS of Parkinsonian patients



Habilitation aid Huple®

Object moving in 1D

Object moving in 1D

Monitor Your Own Health

You live in your body every day, which makes you the best judge of your own health. You just need to know what to look for—such as your heartbeat after exercise and unusual hair loss. This checklist will allow you to play medical detective between checkups.

READER'S DIGEST CANADA

Think PERF

Every evening, think PERF. Essentially, there are four things you should monitor every day to make sure you are living healthy:

Produce: the amount of vegetables and fruits you ate that day.

Exercise: whether you walked and were active.

Relaxation: whether you got at least 15 minutes of laughter and fun time for yourself.

Fibre: whether you got enough beans, grains, and other high-fiber food in your diet.

NHS England

Involving people in their own health and care:

Statutory guidance for clinical commissioning groups and NHS England

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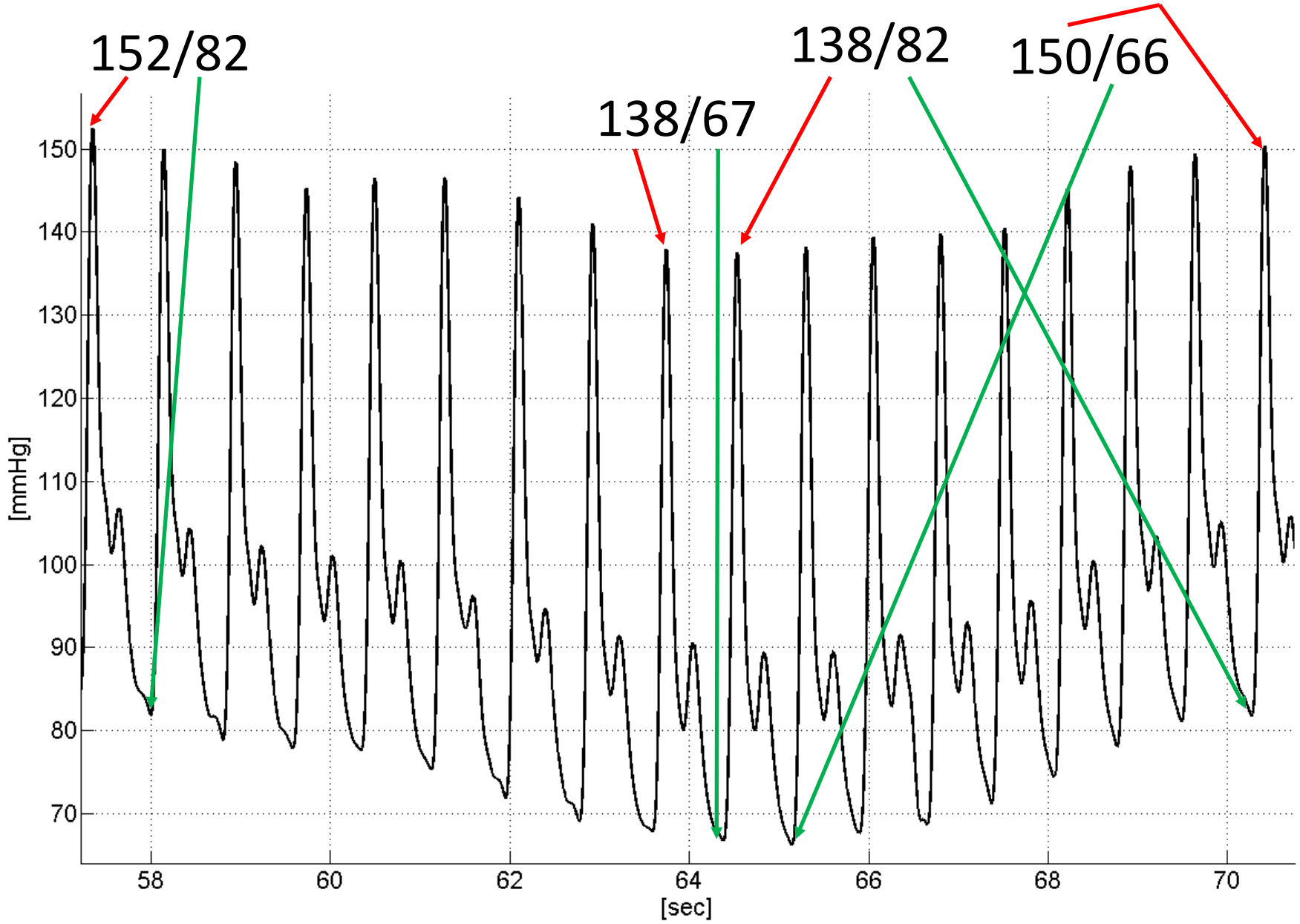
If you would like a plain text version please visit the NHS England website

Blood pressure measurement



Device for home health monitoring


Thank you for your attention!