IT Future of Medicine
Rationale and Public Health Importance
The European Commission have set a marvellous challenge by establishing a search for a Flagship Scheme within their Information and Communication Technologies Programme.

It has forced covert thoughts of peta-bytes and tera-flops into the open.

It has led to the creation of consortia which bring together diffuse elements to focus on the challenge.

‘Le grandeur d’un métier c’est d’unir les hommes’
(Antoine de Saint Exupery)
Our consortium focussed on taking up the challenge of developing a competitive Flagship programme based on a vision of the Future of Medicine.

The presentations which follow will describe the elements of this consortium and demonstrate the computing and scientific challenges which we face and the talent which exists within the ITFoM to overcome these challenges.

I will focus on the importance of the subject matter of our programme.
The last two decades have witnessed some great medical progress including in anaesthesia, keyhole surgery, long-acting insulins, statins etc etc.

There have been notable disappointments: ten years after the sequencing of the Human Genome, the therapeutic progress triumphed when it was announced has not materialised.

There has been a failure make significant progress in curing cancer or diabetes despite huge investments of finance and personnel in research.
• The world cannot continue to spend extravagant sums of money on health particularly in the absence of curative treatments becoming available for common diseases which carry a high case-fatality rate.

• Continuation to develop pharmaceuticals which only work in a small percentage of cases is to continue with a broken model.

• Need to develop a model which can accurately predict which treatment approach is optimal given key information about the patient’s constitution and the specific disease characterisation.
Age-Structure of the European Union (27 Member States) 1950-2050

• Today there are 7 billion persons alive and this will increase to 9 billion by 2050. Between eighty and one hundred and twenty billion persons have ever lived.

• In 1820, the median age in United States was 17. In 1990, it was 33. It is projected to be 42 in 2030.

• By 2080, it is projected that there will be one million people over the age 100.

• Two-thirds of all seniors (over 65) in the world who have ever lived are alive today.
### Global Cancer Burden (millions)

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<thead>
<tr>
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<th>2008</th>
<th>2030</th>
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<tbody>
<tr>
<td>New cases</td>
<td>12.5</td>
<td>26.4</td>
</tr>
<tr>
<td>Deaths</td>
<td>7.6</td>
<td>17.1</td>
</tr>
<tr>
<td>Alive with cancer</td>
<td>28.0</td>
<td>80.0</td>
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</table>

Boyle and Levin, 2009
Global Prevalence of Diabetes and Impaired Glucose Tolerance (IGT) in 2010 and 2030.

<table>
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<tr>
<th>AT A GLANCE</th>
<th>2010</th>
<th>2030</th>
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<tr>
<td>Total world population (billions)</td>
<td>7.0</td>
<td>8.4</td>
</tr>
<tr>
<td>Adult population (20-79 years, billions)</td>
<td>4.3</td>
<td>5.6</td>
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**DIABETES AND IGT (20-79 years)**

**Diabetes**
- Global prevalence [%] | 6.6 | 7.8 |
- Comparative prevalence [%] | 6.4 | 7.7 |
- Number of people with diabetes (millions) | 285 | 438 |

**IGT**
- Global prevalence [%] | 7.9 | 8.4 |
- Comparative prevalence [%] | 7.8 | 8.4 |
- Number of people with IGT (millions) | 344 | 472 |
Global projections for the number of people with diabetes (20-79 years), 2010-2030
Big steps forward in Public Health ..... and Big Steps backwards.

For a man born in France in 1890, all the gains in life expectancy brought about by the great engineering and medical progress of the first half of the 20th Century were lost due to the two great European Wars.

For United Kingdom doctors born in the early part of the 20th century, all the gains in life expectancy brought about by the fantastic medical progress in the second half of the century were lost among those doctors who continued to smoke after 1950.
The priority for the future of epidemiology, the basic population science, must be a focus on several key areas:

• Finding effective ways to implement what is currently known in order to reduce the incidence and mortality of disease;

• Researching efficient methods of reducing disease disparities in all global settings;

• Establishing a clear focus on prevention in order to improve healthy life expectancy.

• Developing an effective Public Health voice in determining future health priorities.

These are the reasons why epidemiology needs to be integrated into ITFoM.
Prevent those cancers that can be prevented
Treat those cancers that can be treated
Cure those cancers that can be cured
Provide Palliation wherever necessary

• There is a great need to make progress in treating those patients with cancer and developing more cures for this group of diseases.

• Farewell Magic Bullet and Welcome Science. Targeted therapy is widely recognised as one of the most important ways forward.
Targeted Therapy: The Future of Treating Chronic Disease

• Originally discovered in lymphomas, the anaplastic lymphoma kinase (ALK) fusion gene has since been identified as an oncogenic driver in several cancers including non-small cell lung cancer (NSCLC), neuroblastomas, and rare sarcomas.

• Approximately 3–5% of NSCLC tumors manifest ALK gene rearrangements, with these occurring more frequently among those with adenocarcinoma histology and in non- or light-smokers.

• Crizotinib (PF-02341066) is a first-in-class, oral, potent, and selective small-molecule competitive inhibitor of ALK with additional anti-MET activity.

• Phase II study conducted in patients with advanced NSCL who had previously failed at least three chemotherapy regimens.
Objective response rate (ORR; N=105): 56% (95% CI: 46, 66%)

Best Percent Change in Tumor Size

Is the Health Care System ready for the change?

The Challenge?

… genomics as a highly dynamic „moving target“ …
… from the Human Genome Project (HGP) to the Personal Genome Project (PGP) …
… from single systems to non-linear networks in systems biology and systems medicine …
… genome-environment interactions …

…all this information will be integrated into a model of the individual
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The Future Paradigm: The 4 P’s
Transform Medicine from Curative to Preemptive

Predictive ↔ Personalized ↔ Preemptive

Participatory Era of Precision Medicine

fet11 The European Future Technologies Conference and Exhibition 4-6 May 2011 Budapest, Hungary
Science beyond fiction
... need for *translating these innovations timely* into health *policies*

into evidence-based health *practice*

... key task of Public Health Genomics
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... radical paradigm shift in healthcare

health promotion and prevention

“one size fits all”

or

risk groups

communities

settings

prevention

individuals

family history

lifestyle

genomic profiling

risks for “diseasomes”

risk groups with similar risk patterns
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Costs?

ITFoM = high accuracy of diagnosis and treatment (~ 100%)

e.g.
- no confirmation diagnosis
- no multiple laboratory tests
- no invasive diagnostics
- no side effects
- replacing other diagnostic tools and treatments

>> Cost-benefit analysis as part of Health Technology Assessment (HTA)
• Confronted with the challenge of developing Information and Communication Technology, the ITFoM Consortium has taken on the challenge of developing an important, innovative application which will have major implications for the Future of Medicine.

• The IT challenge is addressed and the application chosen is important, has global implications, has the potential to involve many public and private sources and has an identifiable product which will improve healthy life expectancy, overall life expectancy and global health.
The project outcomes will enable the prediction of health, disease, therapy and its effects for individual patients and through application in the clinic will change the future of medicine.

For more information:
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