Precision medicine originates from the development of genomics over the last two decades.

- 2005
  Human Genome Project
  2.7 BUSD
  2 years / genome

2007
  454 / Pyrosequencing
  240 days / human genome

2018
  NovaSeq
  2 day / human genome
  <1000 USD / genome

>100,000 fold reduction in sequencing cost during last 15 years

Today genome sequencing is comprehensive, affordable and rapid.
Next-generation sequencing is ready for clinical use in the routine healthcare.
A surge of treatment options...

FDA approved drugs for lung cancer

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<tbody>
<tr>
<td>Drugs</td>
<td>Chemotherapy</td>
<td>Targeted Drugs</td>
<td>Immunotherapy</td>
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</tbody>
</table>
...and of data in need of storage, treatment and analysis
Multimodal patient stratification and monitoring is key to precision medicine

Predictive medicine for effective customized treatment and treatment monitoring
Multimodal patient stratification and monitoring
Knowledge base for PM research and development

Multi-modal patient profiling
precision medicine knowledge base

Healthcare data
A paradigm shift in health care

• The body of knowledge is increasing exponentially
• Rapid development in advanced technology and diagnostic tools
• New biomarkers explored and available
• Increasing amount of complex data per patient
• More and more advanced treatments that use biomarkers
• New opportunities require new conditions

The right treatment at the right time for every individual patient
Precision medicine presents many challenges

Separate organizations for health care (regional) and research and education (state)

Health care run by 21 regions
New reimbursement schemes

Secure storage and management of large scale data

New competencies and ways of working within health care

Legal and regulatory challenges
Precision Medicine Centre Karolinska
A unique collaboration

- New seamless organization
- Cross collaboration between disciplines, academy and health care
- Sharing knowledge and infrastructure
- Geographic proximity
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Examples of focus areas

• Academy integrated in health care
• Data handling
  – Storage and computation capacity
  – Bioinformatics (new competences)
  – AI will be instrumental
• Diagnostic development
  – Testbeds
  – Integrated research platforms
  – Structures for implementation of research and innovation
• Clinical trial unit as an integrated part of the patient’s treatment
## Examples of AI applications

<table>
<thead>
<tr>
<th>Case</th>
<th>Purpose of AI solution</th>
<th>Implementation Level (34)</th>
<th>TRL(38)</th>
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</thead>
<tbody>
<tr>
<td>DeepNews Neo</td>
<td>Risk prediction/early warning system of Sepsis in premature infants.</td>
<td>Not yet reached Level 1. Retrospective pilot finalized at KS.</td>
<td>TRL 4; technology validated in lab</td>
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<tr>
<td>PathFX</td>
<td>Survival prediction of metastatic bone cancer patients to support in treatment decision.</td>
<td>Level 2. Integrated into Orthopedic unit Care Plan at KS.</td>
<td>TRL 8; system complete and qualified (CE-marked)</td>
</tr>
<tr>
<td>DeepMed</td>
<td>Decision support system to classify fractures according to guidelines to support in treatment decision.</td>
<td>Level 1. Clinical pilot finalized.</td>
<td>TRL 5; technology validated in relevant environment</td>
</tr>
<tr>
<td>I-AID</td>
<td>Integrated AI Diagnostics - Three pilots, all within image processing.</td>
<td>MS: None.</td>
<td>TRL 4; technology validated in lab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EEG: None.</td>
<td>TRL 2 – technology concept formulated</td>
</tr>
<tr>
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<td></td>
<td>Cancer: None.</td>
<td>TRL 4; technology validated in lab</td>
</tr>
</tbody>
</table>

Source: From pilot to clinical practice: Barriers and facilitators in the implementation of artificial intelligence in health care, S. Lerenius, 2021
Decision support based on multimodal diagnostics

The future of AI in PM?

- Genomics
- Proteomics
- Image analysis
- Plasma analysis
- Drug screening
- Patient symptoms

Clinical decision support tool
Thank you!
karolinska.se/precisionsmedicin