

Perspective of Medical Research in the 21st Century

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Introduction

- In the 21st century, there are thousands of scientific innovations. These have helped in improving our way of living while some are the keys for greater discovery in the future. In this workshop, we are going to review the main themes and missions of medical research in 21st century.

Introduction

- Medical research in the 21st century is undergoing **unprecedented transformation**.
- Advances in genomics, artificial intelligence, big data, digital health, demographic change, epidemiologic transition, and systems biology are reshaping how diseases are understood, prevented, diagnosed, and treated.

Introduction

- At the same time, global challenges—including population aging, emerging infectious diseases, climate change, and health inequities—require multidisciplinary and collaborative research approaches.

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“Best Research for Best Health”.

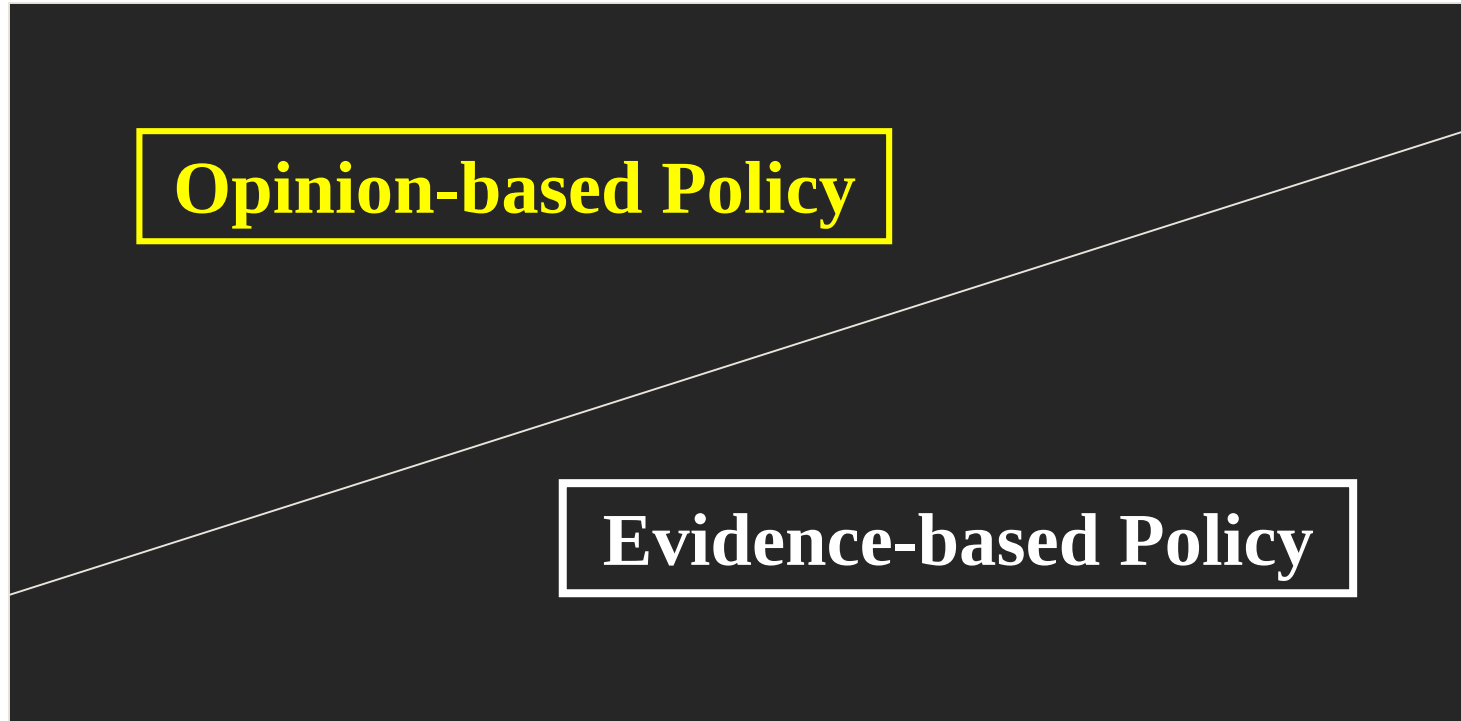
What are the main roles of Medical Research?

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- To help Health Practitioners, Populations and patients to Make:
the *Right Decisions*
at the *Right Time*

- During the past decades there was a change in policy of health from “Opinion-based Policy” to “Evidence-based Policy” to find the best answer for that essential mentioned question.

Change in Policy of Health



Key Themes of Medical Research in 21st Century

- From Disease-Centered to Person-Centered Research
- The Digital Revolution
- Population Health and Epidemiology
- Translation Research
- Global Collaboration
- Ethical Challenges
- Future Directions

What is the role of Artificial intelligence in
Medical Research?

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Artificial intelligence is transforming medical research by converting vast amounts of health data into actionable knowledge, enabling faster discoveries, more precise care, and more efficient healthcare systems.

how medical research has evolved

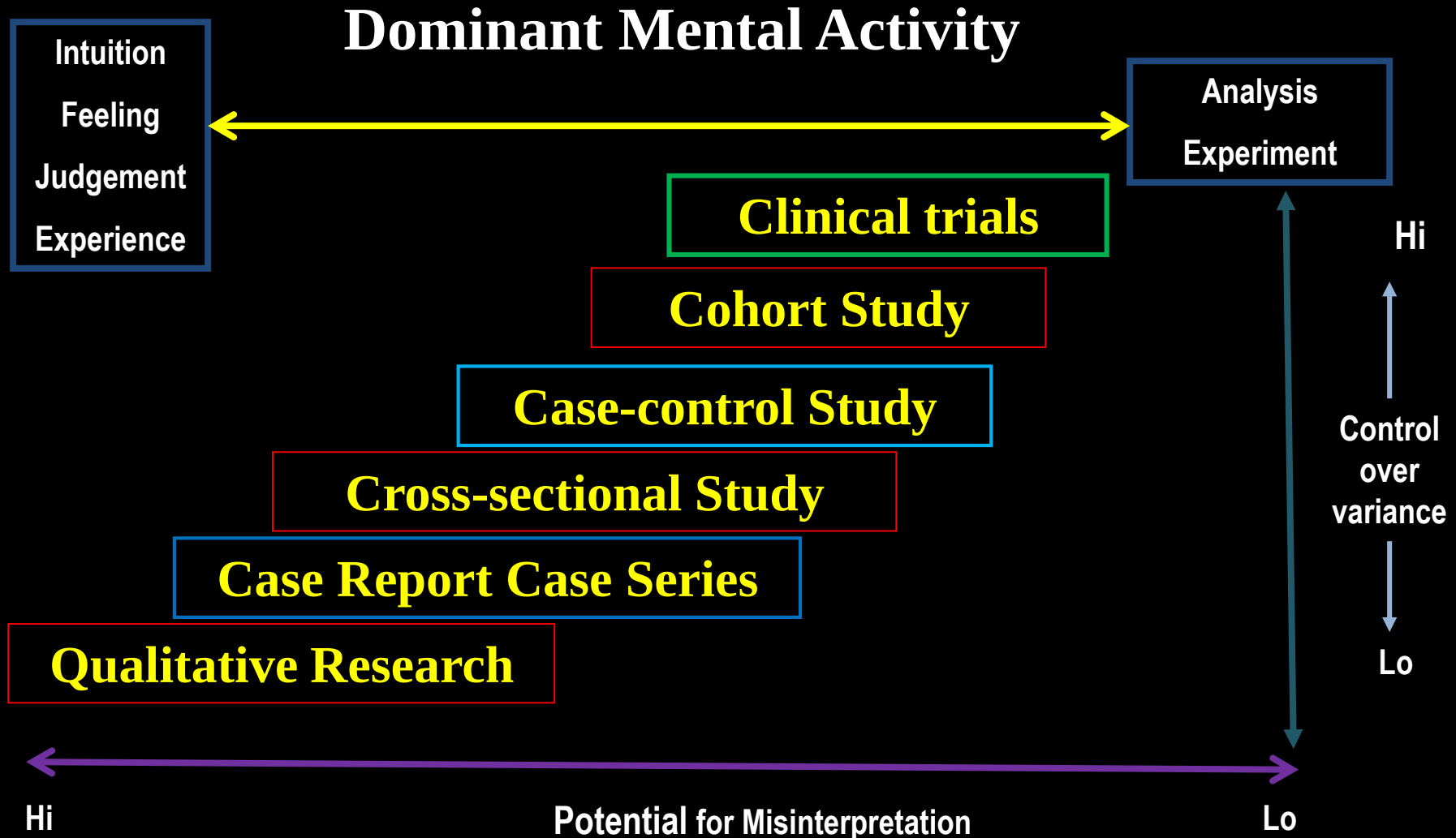
- 20th century: Infectious diseases and biomedical discoveries.
- Early 21st century: Chronic diseases, genomics, and evidence-based medicine.
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how medical research has evolved

- 20th century: Infectious diseases and biomedical discoveries.
- Early 21st century: Chronic diseases, genomics, and evidence-based medicine.
- Mid-21st century: Artificial intelligence, precision public health, planetary health, SDH, equity, learning health systems and genomics.

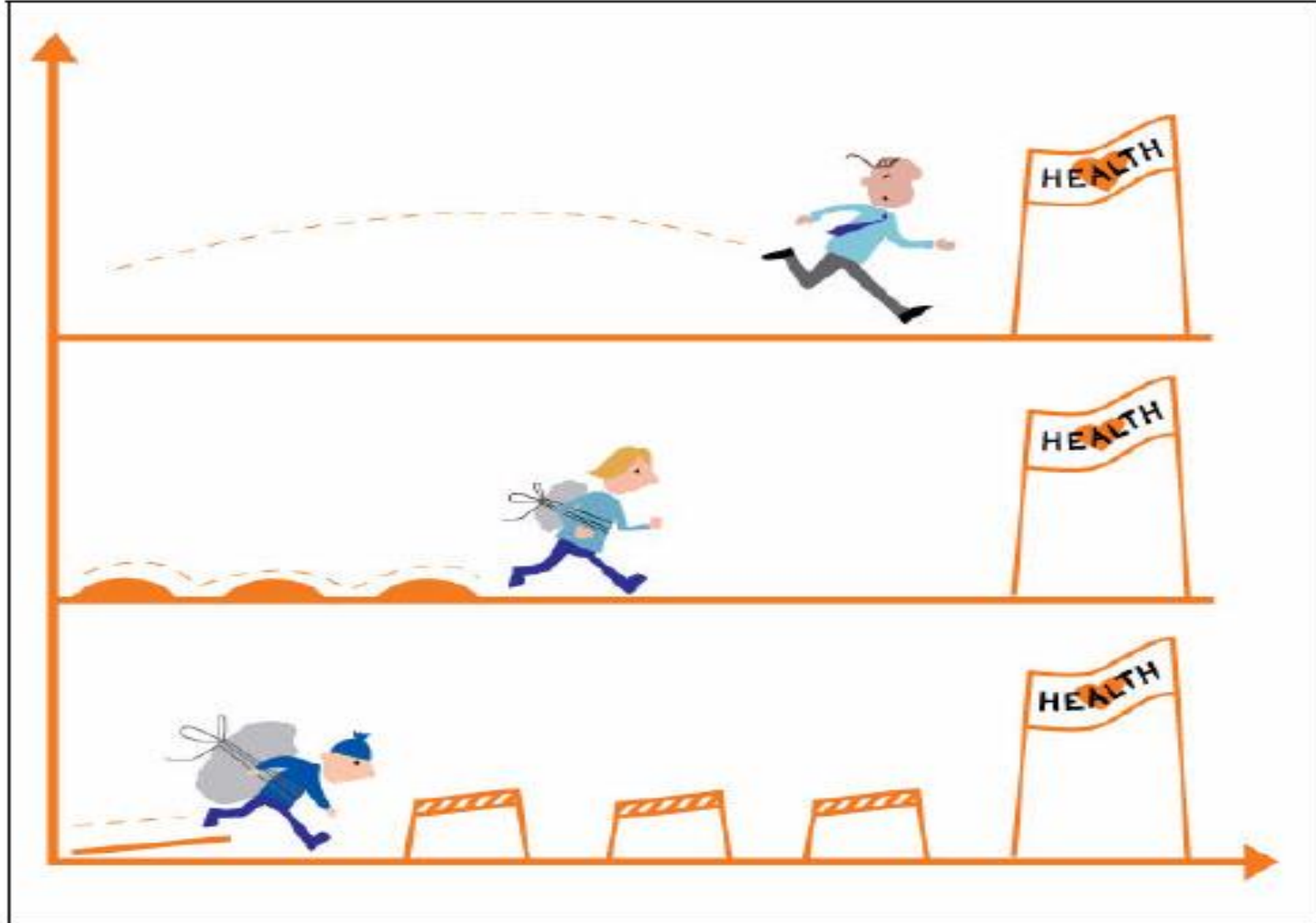
- **Precision health** is an approach that aims to prevent disease and promote health by tailoring care to each individual, using information such as genetics, lifestyle, environment, and personal health data. Unlike **precision medicine**, which focuses mainly on treating disease, **precision health** emphasizes prediction, prevention, and early intervention before disease develops.

Intuition and Logic in Research



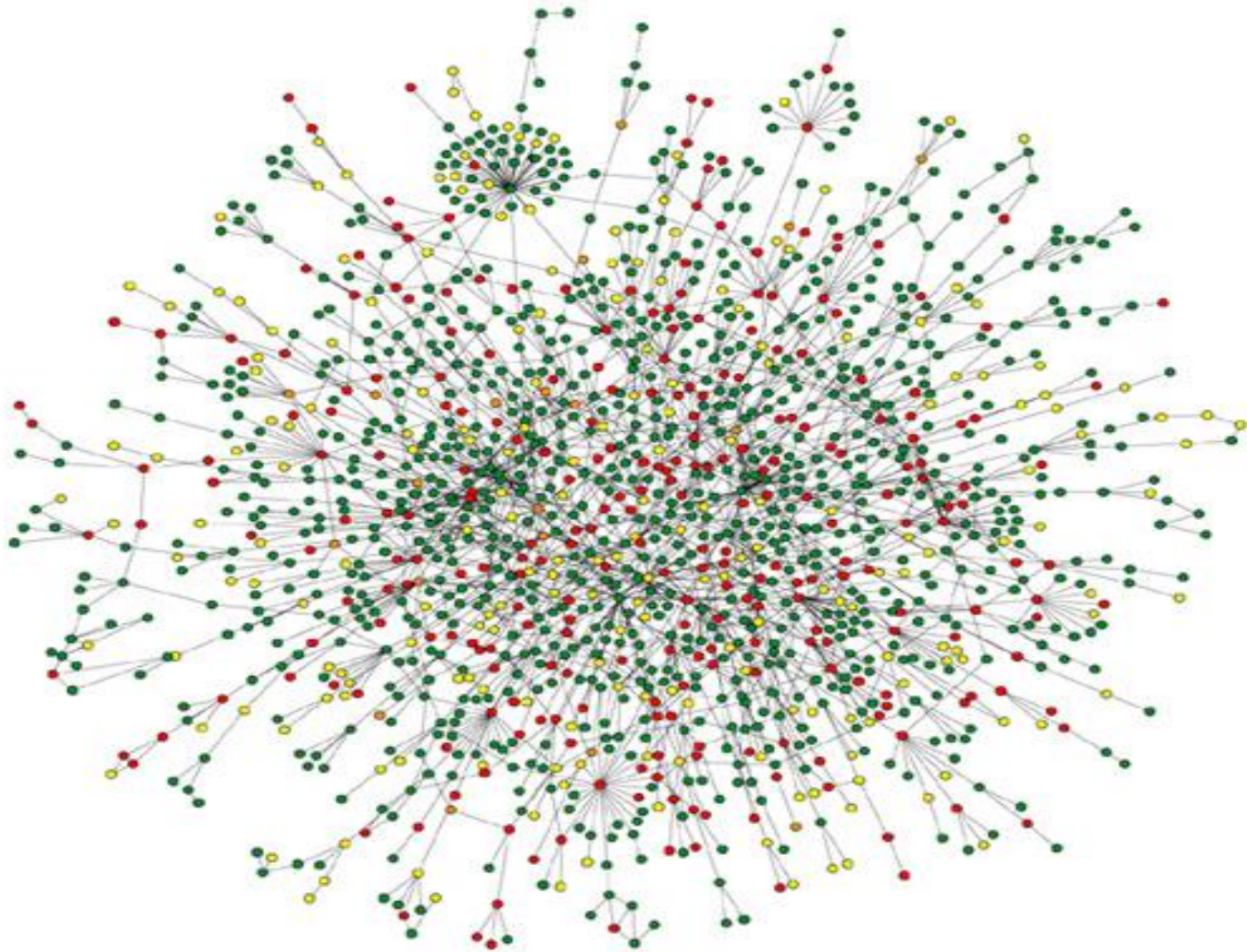
- **Planetary Health** is an emerging interdisciplinary field that recognizes that human health is inseparable from the health of Earth's natural systems. It studies how environmental changes caused by human activities affect human health and seeks solutions that protect both people and the planet.

Social Inequities in health



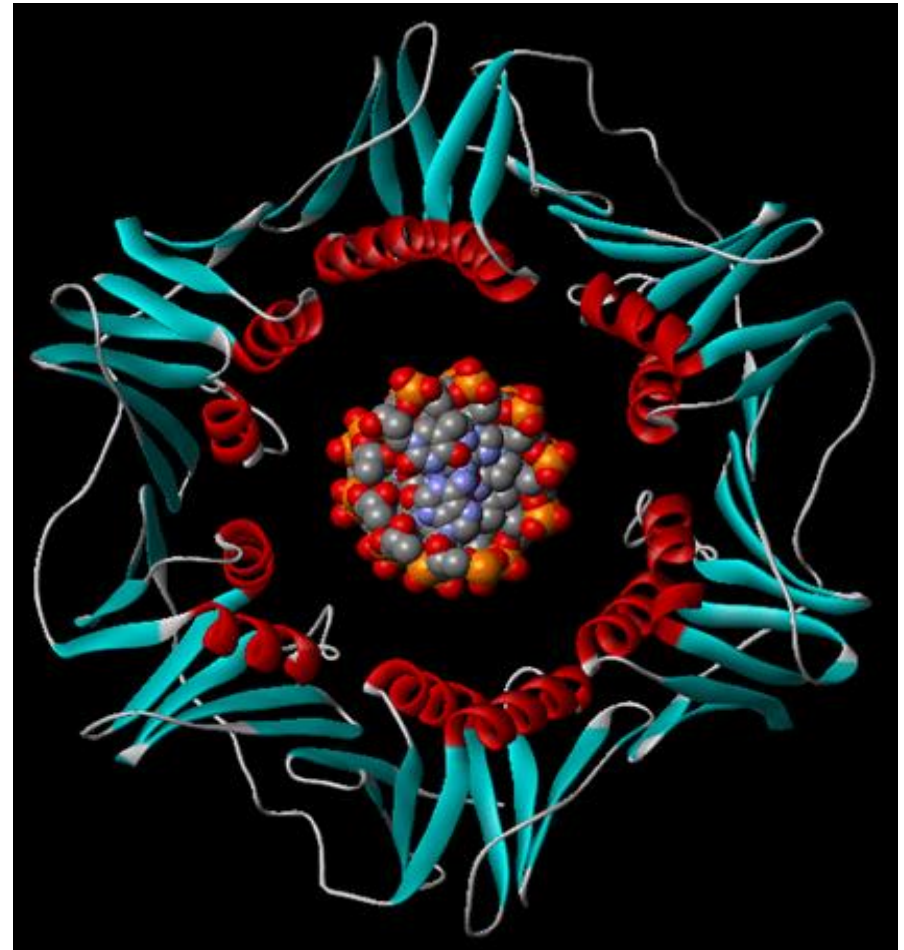
- A **Learning Health System (LHS)** is a healthcare system that continuously learns from its own data to improve patient care and health outcomes.
- A Learning Health System continuously uses real-world healthcare data to generate evidence and improve patient care, creating a cycle of learning and improvement.

Complexity of Biological Networks



“All molecules are created equal, but some are more equal than others.”

*Animal Pharm**



***Adapted from George Orwell's Animal Farm**

Multi- and Interdisciplinary Research will be Required to Solve the “Puzzle” of Complex Diseases and Conditions.

Genes

Behavior

Diet/Nutrition

Infectious agents

Environment

Society

???



Spiritual Health

Spirit is the missing piece of the health puzzle?!

Summary

- Health is fundamentally engaged in the broader quest for social justice and Health equity. There is a need for innovative, transdisciplinary approaches so medical research is both; broad and special.

Summary

- We need to design the roadmap for medical research: New Pathways to Discovery, Research Teams of the Future, Re-engineering the Clinical Research function and we have to understand and clarify P4 Medicine: Predictive, Preventive, Personalized and Participatory.

Conclusions

- Medical research is evolving from isolated laboratory investigations toward integrated, multidisciplinary, and patient-centered science.
- Future success will depend not only on technological innovation but also on ethical governance, international collaboration, equity, and effective translation of research findings into improved population health.



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