

# CHALLENGING FUTURE GENERATIONS

Complementary in knowledge  
and talent, driven to contribute  
to societal transitions.



Utrecht University



# BUILDING ON A UNIQUE SET OF RESEARCH INFRASTRUCTURES

4PH builds on the unique set of complementary research knowledge and resources within the EWUU, covering a wide range of scientific disciplines, of high relevance to preventive health.



## DATASCIENCES AND ARTIFICIAL INTELLIGENCE

- Digital twins for cells, organs, neighbourhoods, behavioural interventions etc;
- AI methodology for assessment of individual dietary habits and risk;
- Digital and hardware technology platforms;

## LARGE CLINICAL AND POPULATION DATASETS

- Integrated clinical databases across the spectrum from general population cohorts to general practitioners, and hospitals with care paths;
- Integrated clinical epidemiology; diagnostic and prognostic prediction research, evaluation through registry based trials with early HTA;
- Learning Health Care System: Electronic health care data & real world evidence & ethics;

## HIGH-TECH SYSTEMS AND METHODOLOGIES

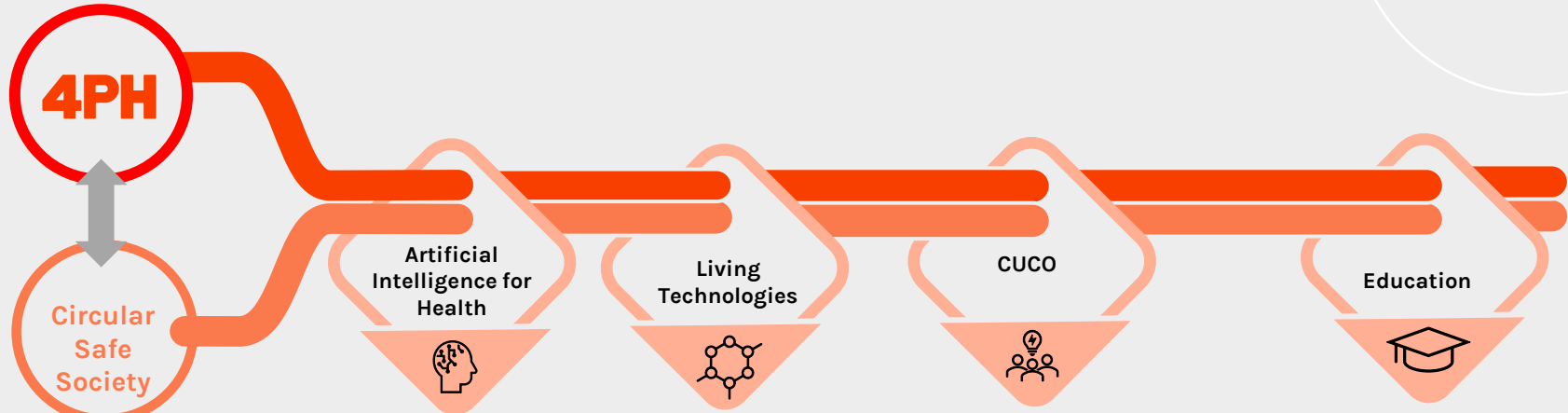
- Molecular devices, (bio)sensors, organ-on-a-chip, robotics, plasma-devices);
- (Nano-) Materials and polymer science;
- Advanced imaging technologies (incl. microscopy);
- Molecular science, bio- fabrication and disease modelling;
- Chemical biology (Immuno-engineering, nano-medicine, drug discovery);
- Microbiome research, metabolomics;
- Microfluidics;

## STRATEGIC PROGRAMMES ON STRUCTURAL HEALTH DETERMINANTS

- Exposome research: link between nutrition, physical- and social environment and health;
- Human Nutrition Research, Health and Society with advanced facilities for human studies;
- Interdisciplinary diet- and lifestyle research: combining biomedical research with behavioural research;
- Knowledge hub Healthy Urban Living;
- Youth-Lab 030: research on prevention of somatic and psycho-social health;

# EMBEDDING OF 4PH IN EWUU ALLIANCE

Together with the programme on “Circular Safe Society”, 4PH will be positioned as one of the strategic programmes in the EWUU Alliance, building on and linked to the activities and results in the other four strategic working groups of the EWUU: Artificial Intelligence for health, Living Technologies, Young Academies and Education.



4PH will leverage the knowledge and tools developed in the enabling technology working groups of Artificial Intelligence (AI) for Health and Living Technologies (LTs) which can serve as technological cornerstones for preventive health interventions.

4PH utilise the Young Academies (YA) as the breeding ground for new small-scale research projects. These can develop into full-scale R&D projects on Preventive Health if proven to contribute to our mission and vision and sufficient funds can be made available.

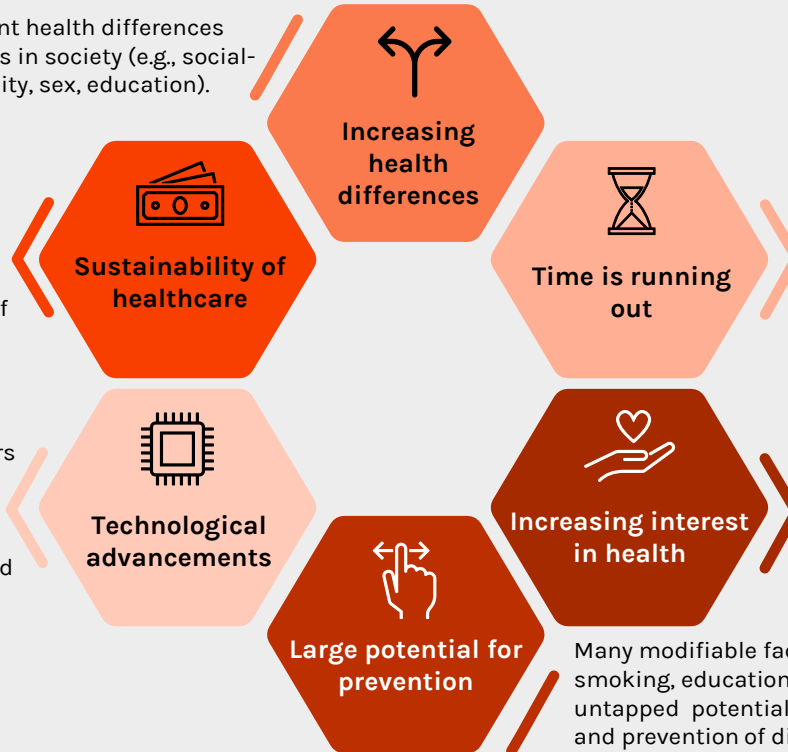
4PH will support the development and build on the educational programmes of the EWUU to deliver the future generation of scientists in the EWUU that are well equipped to meet the health challenges of tomorrow.

# WHY INVEST IN PREVENTIVE HEALTH?

There are large, persistent health differences between different groups in society (e.g., social-economic status, ethnicity, sex, education).

Labour intensity and associated costs of healthcare provision are increasing to unsustainable levels. In the Netherlands, the costs of healthcare amount over 100 Billion Euros (2019), which is about 13% of our Gross Domestic Product (GDP).

Technological advancements in e.g., DNA sequencing, -omics, imaging and sensors stem cell biology and organoid biology enable us to measure structures and biological processes with increasing precision and opens up a whole new world for prevention, diagnosis and treatment.



Trends such as urbanisation, climate change and an ageing population will put increasing pressures on our health and the way we deliver healthcare.

People are increasingly interested in taking control over, and participating in ways to improve their health (e.g. through monitoring their activity and dietary intake), supported by a wide scope of technologies.

Many modifiable factors, (e.g., nutrition, physical activity, overweight, smoking, education, social and living environment) form a large untapped potential for improving our (biological and mental) health and prevention of disease.

# CENTRAL MISSION OF 4PH

4PH aims to contribute to the central mission of the Knowledge and Innovation Agenda 2020-2023 of Health Holland and its supportive long term goals.

+5  
-30

Our mission is for all Dutch people to live for at least five years longer in good health, and to decrease the health differences between the lowest and highest socio-economic groups by 30%.

Supportive long term goals:

- I. By 2040 the burden of disease caused by unhealthy lifestyles and living environment has decreased with 30%.
- II. By 2040 50% or more of healthcare will be provided in the own living environment, instead of in healthcare settings.
- III. By 2030, the share of people living with chronic diseases or disabilities, that can participate in society, to their wish and capacity, has increased by 25%.

# RESEARCH LINES IN 4PH

4PH will cover four complementary Research Lines in pursuit of the overall long term goals of the Knowledge and Innovation Agenda 2020- 2023 of Health Holland.



## HEALTHY START

Research targeting youth (<20) facing economic, educational disadvantages and societal challenges, increasing our understanding of the factors that shape youth development, that explain why some successfully navigate transitions, and adapt to setbacks and adversity, and others do not and factors increasing the odds of favourable developmental outcomes.

### KIA Mission I:

By 2040 the burden of disease caused by unhealthy lifestyles and living environment has decreased with 30%.



## PRESERVING HEALTH

Research targeting persons facing economic, educational disadvantages and societal challenges, aimed at increasing our knowledge in support of preventive interventions aimed at reducing health inequalities and the burden of disease.

### KIA Mission II:

By 2040 50% or more of healthcare will be provided in the own living environment, instead of in healthcare settings.



## HEALTH@HOME

Research in support of providing preventive health services in the own living environment of people, instead of in healthcare settings and supporting healthy living.

### KIA Mission III:

By 2030, the share of people living with chronic diseases or disabilities, that can participate in society, to their wish and capacity, has increased by 25%.



## LIVING WITH DISEASE

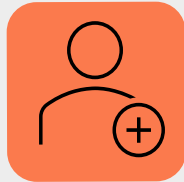
Research aimed at increasing our knowledge and developing precise interventions that support the quality of life, participation in society of patients of all ages living with (chronic) disease and/or disabilities.

# CENTRAL CONCEPTS IN 4PH

The Research Theme Preventive health draws from four, highly complementary concepts. Adopting a holistic *positive health* perspective and *participatory health* approach, and making use of the growing knowledge and technological capabilities on *personalised health* and *predictive health*, it develops and evaluates new knowledge and solutions for application in *preventive health*.

Health is more than the absence of disease. Moreover, health is broader than 'biological' health and also encompasses one's mental health. Important is how positive we perceive our life and how well we are able to live the life that we want to live, given any disease one may have.

## POSITIVE



## PERSONALISED

Each person is unique in terms of physical characteristics, genetic make-up, lifestyle, social and physical environment. Health interventions should be tailored as precisely as possible to the person(s) targeted by the intervention and by the expected benefit for that individual.



## PARTICIPATORY

Health research is a joint effort, where patients and people targeted, participate in the research either through citizen-science research and/or through being closely involved in the design and implementation of new health practices.

## PREDICTIVE

Interventions that support the early detection of risk for developing disease, or prediction of the health benefit that can be expected from a preventive intervention, can increase the positive impact of preventive interventions on health.



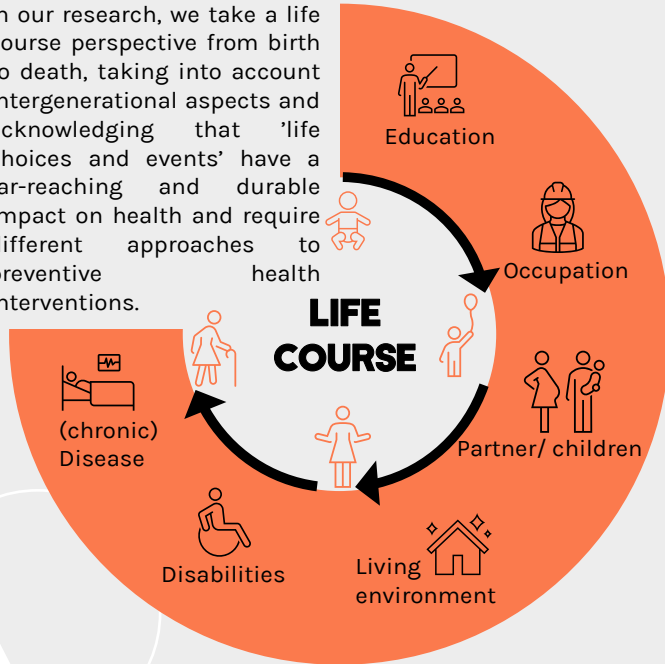
## PREVENTIVE HEALTH

4PH has a broad focus covering:

- **Primary prevention:** Interventions (see next slide) aimed at avoiding the occurrence and exposure to risk factors and reducing or limiting the risk of developing disease and/or promoting mental health;
- **Secondary prevention:** Interventions (see next slide) aimed at detecting and/or predicting occurrence and progression/worsening of an existing disease;
- **Tertiary prevention:** Interventions (see next slide) aimed at reducing the negative impacts of symptomatic disease (e.g. stroke or cancer);

# 4PH'S LIFE-COURSE PERSPECTIVE

In our research, we take a life course perspective from birth to death, taking into account intergenerational aspects and acknowledging that 'life choices and events' have a far-reaching and durable impact on health and require different approaches to preventive health interventions.



## Key life choices and events regarding e.g.:

- **Education:** the physical/built environment of the school, social environment, quality of education etc.);
- **Occupation:** level of physical activity, stress, physical and social work environment, economic rewards, self fulfilment, job security etc.
- **Partner:** choice of partner (with his/her own life choices and events, and influence on your lifestyle and environment).
- **Children:** whether or not you have children also has durable and far-reaching implications for preventive health, e.g., via influence on other life choices such as choice of neighbourhoods, influence on the parent's physical and/or mental health, choice of occupation, lifestyle choices etc.)
- **Where to live:** where you live (which country, rural versus urban, neighbourhood, type of house and surroundings) are known health determinants) choices regarding your living environment therefore have a far-reaching and durable impact on your health and preventive interventions
- **Living with disease and/or disabilities:** for obvious reasons, life 'events' leading to chronic disease and/or disabilities have a significant and durable impact on health, behaviour and preventive interventions. Although graphically placed here at the last stages of the life-course, both can occur from birth onwards.

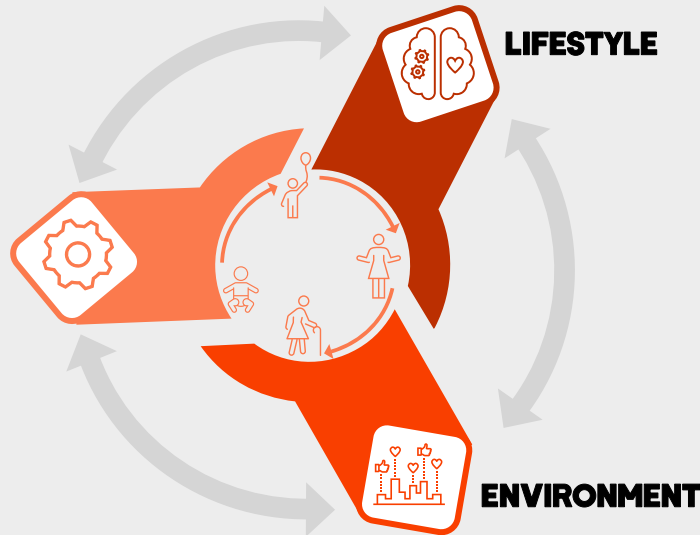


# INTEGRAL PERSPECTIVE ALONG 3 COMPLEMENTARY ROUTES

Preventive interventions will cover three, highly complementary and mutually reinforcing routes: technology, lifestyle and the environment (physical and social). Some may also add a fourth route – policy – encompassing guidelines, laws, regulations, incentives, and strategies employed by public sector and private sector actors. Core to 4PH is the view that preventive interventions are most effective at the intersections of these routes (e.g., promoting healthy nutrition (lifestyle), through municipal permits (policy), that promote nearby healthy food outlets (environment) and supported by an app and wearable sensor (technology) that monitors dietary intake.

## TECHNOLOGY

Preventive health can be supported by the use of technologies that provide information directly or through Artificial Intelligence (AI) approaches that allow us to tailor interventions as much as possible to the person that will benefit most. 4PH aims to develop and pilot both technologies outside of care settings (e.g. remote sensing) as well as technologies applied in healthcare (e.g., imaging, genetic sequencing, risk prediction models, computer decision support systems) supportive of primary, secondary and tertiary prevention.



## LIFESTYLE

Our lifestyle (e.g. diet, physical activity, smoking, alcohol use, healthcare seeking behaviour) is an important health determinant. The Research Theme Preventive Health aims to increase our knowledge on these determinants and translate these into *preventive lifestyle interventions*, to evaluate their impact on our health in primary, secondary and tertiary prevention and subsequently implement them.

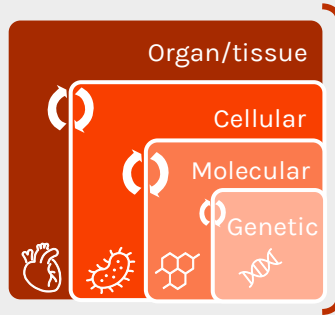
## ENVIRONMENT

Our physical and social environment (e.g. where we live and work, our social economic status, social networks and interactions) can have a large negative or positive influence on our health and disease condition, either directly (e.g. exposure to fresh air or unhealthy substances and chemicals) or through their influence on our lifestyle (e.g. access to healthy food outlets, access to green spaces, health seeking behaviour, user-friendly easy-accessible buildings). 4PH aims to increase our knowledge on these environmental determinants and translate these into *interventions in our environment* (e.g. design of grey and green spaces, education, access to healthcare), to evaluate their impact on our health and subsequently implement them.

# MULTIFACTORIAL AND MULTISPATIAL PERSPECTIVE

4PH takes an integral, holistic perspective on Preventive Health, acknowledging the interdependencies between biological, lifestyle and environmental health determinants, at different spatial and temporal scales.

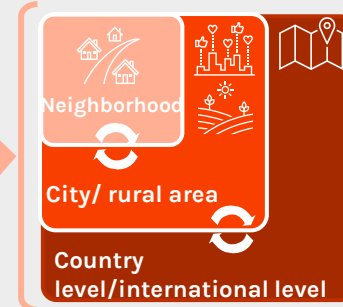
Biological structures and processes at different scales



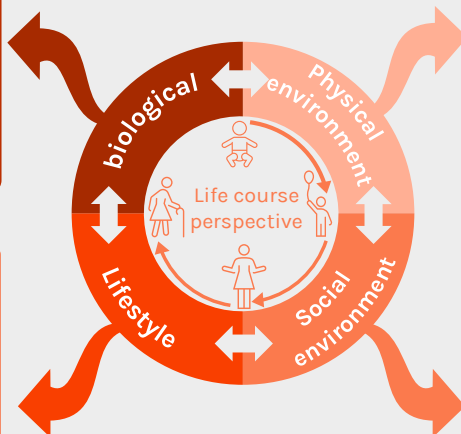
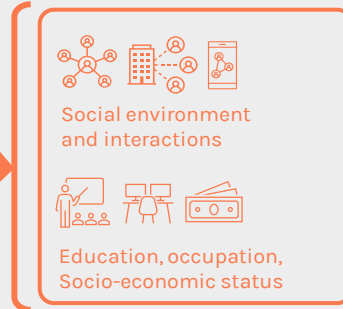
Lifestyle/ behavioral health determinants, e.g.,



Physical components of the environment at different spatial scales



Social and socio-economic health determinants e.g.,



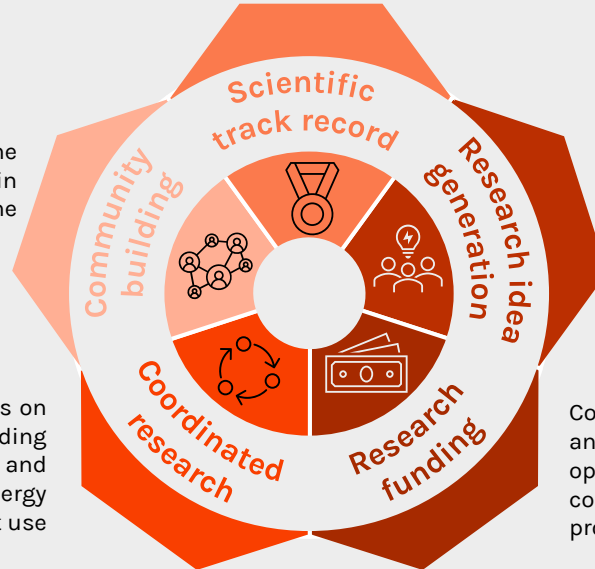
# KEY PRIORITIES IN BUILDING 4PH

4PH will focus its efforts on fulfilling five key functions. Combined, these functions support and promote the EWUU partners to 'act as one' on the ideation and implementation of Preventive Health research.

Building 'thought leadership', supported by a portfolio of prestigious research projects, nationally and internationally recognised as being at the scientific forefront of Preventive Health.

Building a sense of community within the EWUU across the researchers active in preventive health and connecting the broader ecosystems.

Aligning research priorities and agenda's on preventive health and building interoperability in technologies and systems, ensuring optimal use of synergy and avoiding redundancy and inefficient use of research resources.



Connecting EWUU scientists from different disciplinary backgrounds and - where appropriate - collaborating partners from private and public sector, to spawn new, innovative research ideas, in pursuit of new knowledge, approaches and strategies for preventive health interventions.

Continuous, coordinated and targeted screening and follow up of national and international funding opportunities (public and private), supporting coordinated and competitive responses to call for proposals of relevance to preventive health.

# JOIN THE CLUB!

— Challenging future generations

**TU/e** EINDHOVEN  
UNIVERSITY OF  
TECHNOLOGY

 **WAGENINGEN**  
UNIVERSITY & RESEARCH



Utrecht University



UMC Utrecht