

# VIROFIGHT Project

# **VIROFIGHT:**

## **General purpose virus-neutralizing engulfing shells with modular target specificity**

# Project Partners and teams



Technische Universität München

- **Prof. Dr. Hendrik Dietz, Professor for Biophysics, Physics Department (Coordinator)**
- Prof. Dr. Ulrike Protzer, Institute Director, Institute of Virology, School of Medicine



AARHUS  
UNIVERSITY

- Prof. Dr. Jorgen Kjems, Director, Interdisciplinary Nanoscience Center (iNANO)



Universität Regensburg

- Prof. Dr. Ralf Wagner, Head of Molecular Microbiology (Virology)



NATIONAL INSTITUTE  
OF CHEMISTRY

- Dr. Roman Jerala, Head of department, Synthetic biology and immunology



- Dr. Claudia Speiser, Senior Consultant, ARTTIC

# Project facts

- Project Duration: 01.06.2020-31.05.2024
- Coordinator: Prof. Dr. Hendrik Dietz,  
Professor for Biophysics,  
Physics Department  
Technical University Munich
- Project funding: 3.88mio €

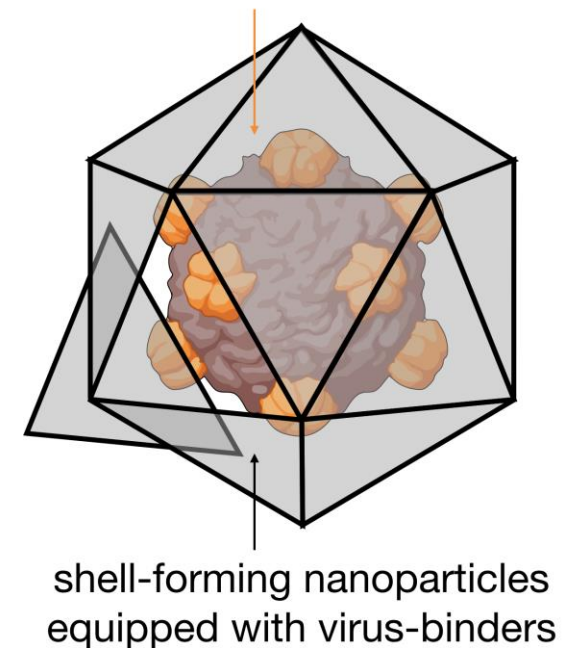
# VIROFIGHT MISSION

- **The mission of this project is to develop and test a prototypical drug platform with the principal capacity to neutralize *any given virus.***

# VIROFIGHT CONCEPT

- **Current antivirals target virus-specific proteins or enzymes by small molecules.**
- **We plan to *engulf whole viruses* with synthetic nano-shells to neutralize the pathogen.**
- **Enables avidity effects, occlude large portions of the viral surface, modularity, ...**

**VIROFIGHT** neutralized virus



# VIROFIGHT OPPORTUNITY

- Test targets:
  - Virus-like particles with various env proteins
  - lentiviral pseudo-type, hepatitis B, adeno virus
- In principle, no need for detailed molecular knowledge about the target viral pathogen.
- Hence, our concept offers a route to fight newly emerging viral diseases or disease variants.
- In our grant we proposed a “blind” experiment to test this idea.
  - **Adapt for SARS-CoV2**

# VIROFIGHT KEY TECHNOLOGIES

- **DNA / protein nanotech:** Fabrication of fully addressable synthetic virus-sized nano-shells and attaching the virus-binders to them
- **Aptamers, peptides:** Identification of molecular binders against user-defined targets through *in vitro* selection processes to obtain specificity to any given target virus
- **Real viruses and virus-like particles** as test targets



# VIROFIGHT OBJECTIVES

- 1. Create** discrete, size-adaptable nano-shells that can *fully engulf and neutralize entire virus particles*, with variants for spherical and filamentous viruses (WP1)
- 2. Create** a set of molecular building blocks that can *polymerize into virus-neutralizing shells on the surface of viruses* (WP2)
- 3. Establish** a generic molecular selection pipeline against purified virus-like particles, purified viruses and viruses in serum yielding chemically modified DNA and RNA aptamers (WP3)
- 4. Test** the neutralizing effectiveness against virus-like particles & lentivirus pseudo-type particles as models for a variety of aggressive viral pathogens, and HIV, hepatitis B and adeno viruses as models for real enveloped and non-enveloped viruses (WP4)

# VIROFIGHT MILESTONES

## 1. Selection pipeline against viral proteins is established

- **AU, M18**; biophysical methods proving successful selection of molecular binders against given molecular targets.

## 2. Delivery of virus-binding shells in physiological buffer for performing virus neutralization assays

- **TUM, M24**; Biophysical methods proving successful construction of shells and survival in physiological buffer (e.g. cryo EM images acquired after 24h incubation in suitable buffer).

## 3. Self-assembling coiled-coil modules

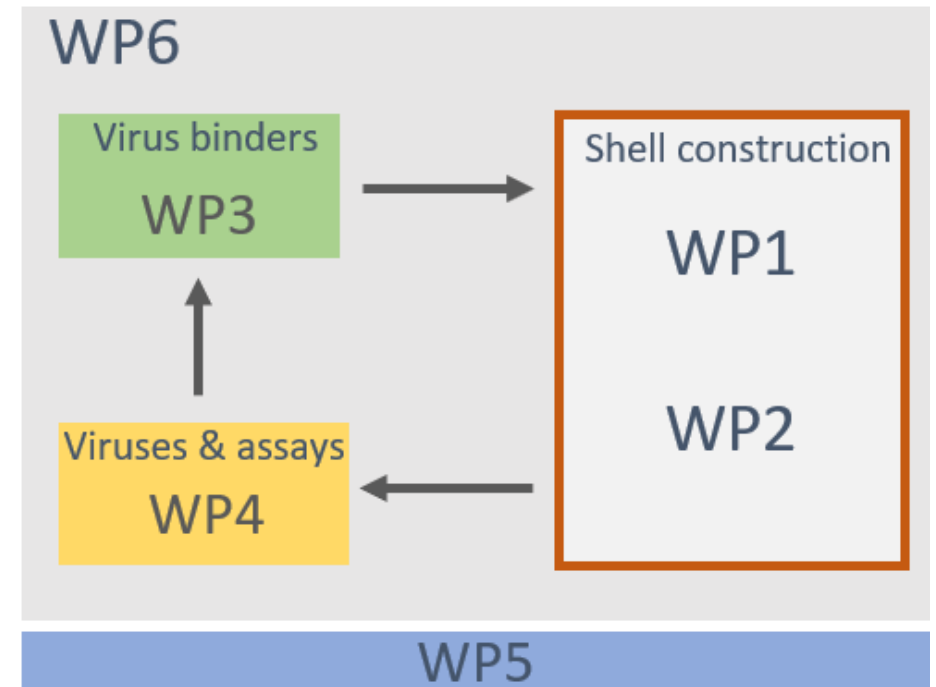
- **NIC, M24**; Biophysical methods proving successful self-assembly of these molecular constructs (SAXS, cryo EM, EMSA etc).

## 4. Viral neutralization capacity is shown

- **UREG, M48**; Cell-based neutralization assays showing significant inhibition versus control (e.g. measuring the number of infected cells via reporter fluorescence gene intensity using flow cytometry). Goal is at least 80% suppression over control.

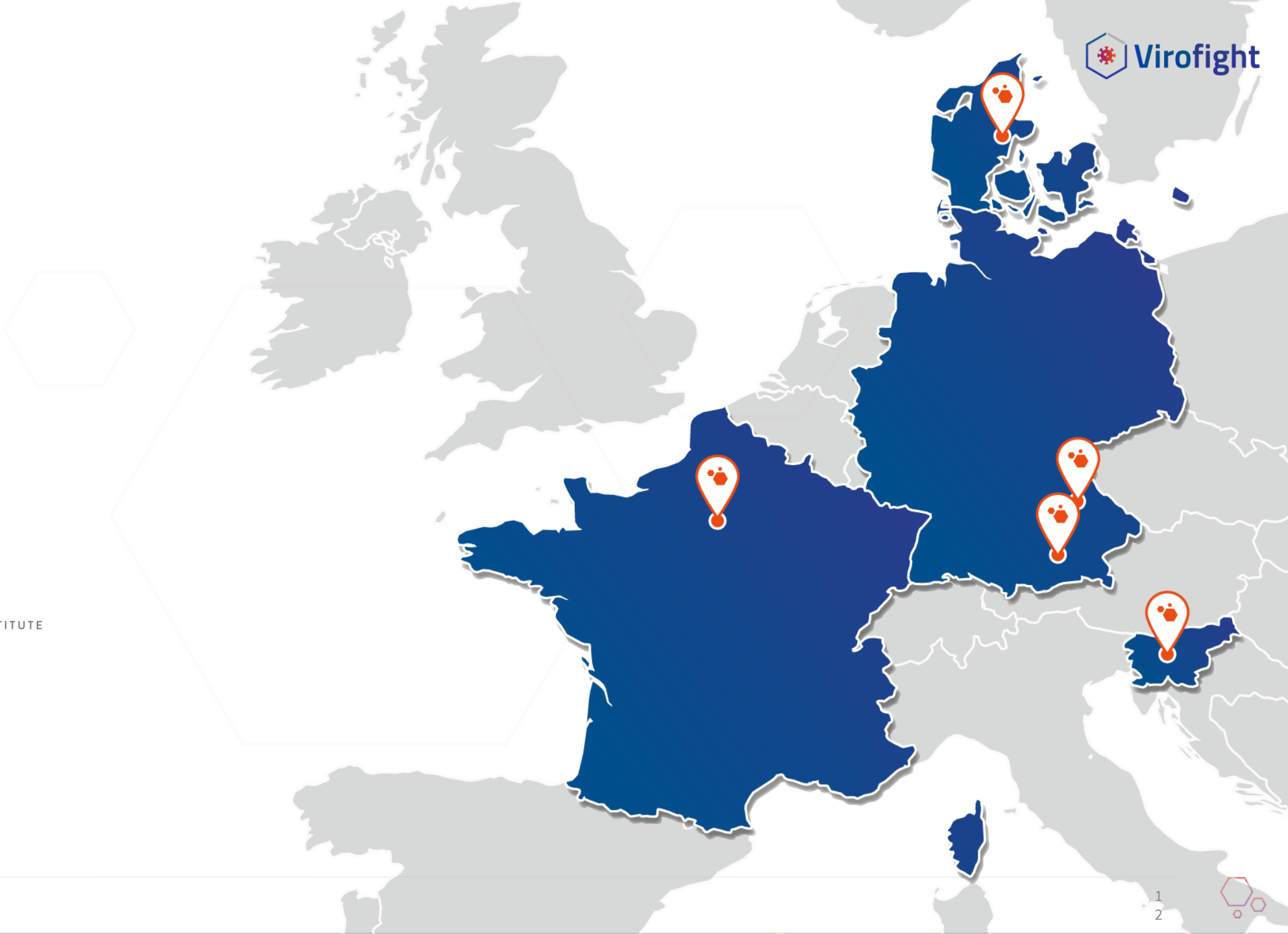
# VIROFIGHT implementation

- Four interlinked scientific work-packages for iterative progress.
- WP5: dissemination, exploitation, communication
- WP6: project management





# Partners



## Contact information

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