TONIX PHARMACEUTICALS

Broad-spectrum Host-directed Therapeutics: CD45 Inhibitor as Antiviral

July 2024

NASDAQ: TNXP

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Certain statements in this presentation regarding strategic plans, expectations and objectives for future operations or results are “forward-looking statements” as defined by the Private Securities Litigation Reform Act of 1995. These statements may be identified by the use of forward-looking words such as “anticipate,” “believe,” “forecast,” “estimate” and “intend,” among others. These forward-looking statements are based on Tonix’s current expectations and actual results could differ materially. There are a number of factors that could cause actual events to differ materially from those indicated by such forward-looking statements. These factors include, but are not limited to, the risks related to failure to obtain FDA clearances or approvals and noncompliance with FDA regulations; risks related to the failure to successfully market any of our products; risks related to the timing and progress of clinical development of our product candidates; our need for additional financing; uncertainties of patent protection and litigation; uncertainties of government or third party payor reimbursement; limited research and development efforts and dependence upon third parties; and substantial competition. As with any pharmaceutical under development, there are significant risks in the development, regulatory approval and commercialization of new products. The forward-looking statements in this presentation are made as of the date of this presentation, even if subsequently made available by Tonix on its website or otherwise. Tonix does not undertake an obligation to update or revise any forward-looking statement, except as required by law. Investors should read the risk factors set forth in the Annual Report on Form 10-K for the year ended December 31, 2023, as filed with the Securities and Exchange Commission (the “SEC”) on April 1, 2024, and periodic reports and current reports filed with the SEC on or after the date thereof. All of Tonix's forward-looking statements are expressly qualified by all such risk factors and other cautionary statements.

Tonix Awarded $34M Contract from DTRA/DoD

U.S. Department of Defense

DTRA contract is expected to advance development of Tonix's broad-spectrum oral antiviral program (TNX-4200) for medical countermeasures

- Other Transaction Agreement (OTA) with a potential for up to ***$34 million over five years***

Objective: Develop an orally available small molecule that reduces CD45 enzymatic activity, with broad-spectrum protection against a range of viral families through the completion of Phase 1 clinical evaluation

INFECTIOUS DISEASE PORTFOLIO

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DoD Moves Beyond "One Drug, One Bug" Approach[1,2]

- The US Department of Defense (DoD) is moving beyond the traditional "one drug, one bug" approach to antivirals, and embracing the "one drug, multiple bugs" approach to protect against viral illness in warfighters
- The Defense Threat Reduction Agency (DTRA) is a division of the DoD that supports research to protect the warfighter
    - DoD/DTRA collaborate with commercial partners to translate fundamental discoveries into products

[1]Vergun, D. DOD News. January 10, 2023. DoD aims to shield warfighters from novel biological agents. https://www.defense.gov/News/News-Stories/Article/Article/3261095/dod-aims-to-shield-warfighters-from-novel-biological-agents

[2]US Department of Defense, Chemical and Biological Defense Program, "Approach for Research, Development and Acquisition of Medical Countermeasure and Test Products, Dec. 2022. https://media.defense.gov/2023/Jan/10/2003142624/-1/-1/0/APPROACH-RDA-MCM-TEST-PRODUCTS.PDF

Broad-spectrum Host Directed Antiviral Drug Development vs Virus-specific Approaches

Conventional Approach

"One drug, one bug"

Broad Spectrum Antivirals[1]

"One drug, multiple bugs"

Single Virus Family		Broad Spectrum			
Virus-Targeted[2]		Virus-Targeted		Host-Targeted	
Drug	**Virus**	**Drug**	**Virus**	**Drug**	**Virus**
Biktarvy® tenofovir/ emtricitabine	HIV	Veklury® Remdesivir	COVID SARS-CoV-2	Intron-A® Pegasys® interferon-alpha	Hep-C
Sovaldi® Sofosbuvir	Hep-C	Paxlovid® nirmatrelvir /ritonavir	COVID SARS-CoV-2		
Valtrex® Valacyclovir	Herpes simplex and varicella	Ribavirin	Hep-C, RSV		
Arestvy® Tecovirimat	Smallpox	Tembexa® brincidofovir	Smallpox		
Tamiflu® oseltamivir	Influenza				

Host-targeted broad-spectrum antivirals is a new and emerging category

[1]Bekerman E, and Einav, S. *Science*. 2015 348(6232):282-3. doi: 10.1126/science.aaa3778.
[2]Examples: not a complete list

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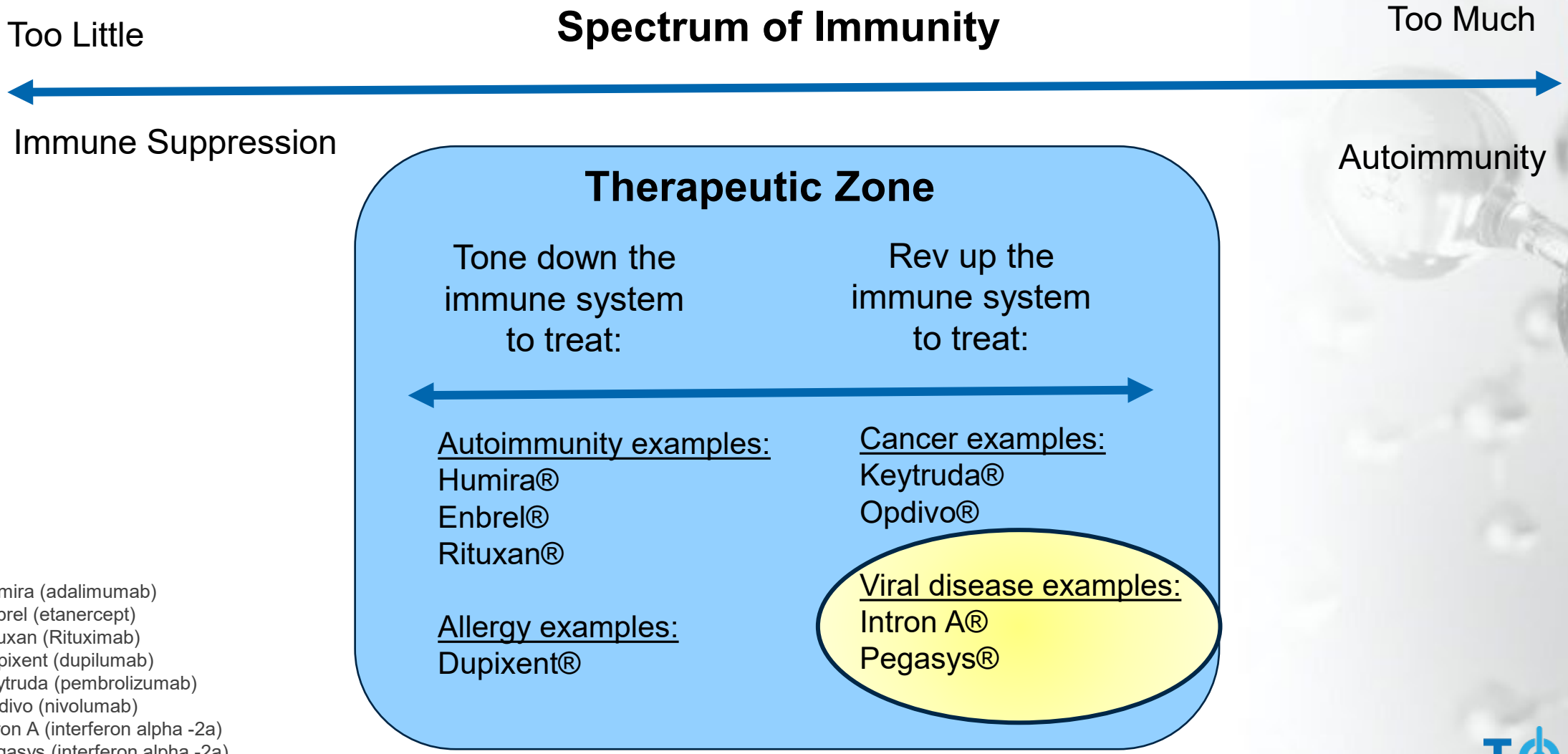
Enhancing Viral Immunity Has the Potential to Protect Against Viral Diseases



Humira (adalimumab)
Enbrel (etanercept)
Rituxan (Rituximab)
Dupixent (dupilumab)
Keytruda (pembrolizumab)
Opdivo (nivolumab)
Intron A (interferon alpha -2a)
Pegasys (interferon alpha -2a)

Enhancing Viral Immunity by Inhibiting CD45 Phosphatase

- CD45 is a transmembrane protein tyrosine phosphatase (PTPase) expressed on most hematopoietic cells, including T lymphocytes
- CD45 regulates receptor signaling pathways, particularly T cell activation
  - It dephosphorylates the negative regulatory tyrosine kinases (e.g., *lck* and *src*)
- Decreased levels of CD45 enhance antiviral[1] and antibacterial immunity in animals[2]
- Oral small-molecule inhibitors of CD45 have the potential to enhance antiviral immunity[3-5]

***Goal*: Develop an orally available small molecule that reduces CD45 enzymatic activity**

CD45 modulating host-directed antivirals would be an entirely new class of medicines

[1]Panchal RG, et al., *Cell Host Microbe*. 2009 6(2):162-73. doi: 10.1016/j.chom.2009.07.003. PMID: 19683682.
[2]Panchal RG, et al. *J Biol Chem.* 2009 284(19):12874-85. doi: 10.1074/jbc.M809633200
[3]Miski M, et al. *Bioorg Med Chem Lett*. 1995 5(14):1519-22. doi: 10.1016/0960-894X(95)00250-W.
[4]Hamaguchi T, et al. *Bioorg Med Chem Lett*. 2000 10(23):2657-60. doi: 10.1016/s0960-894x(00)00539-4. PMID: 11128645.
[5]Carr G, et al. *Methods*. 2014. 65(2):229-38, doi: 10.1016/j.ymeth.2013.09.007.

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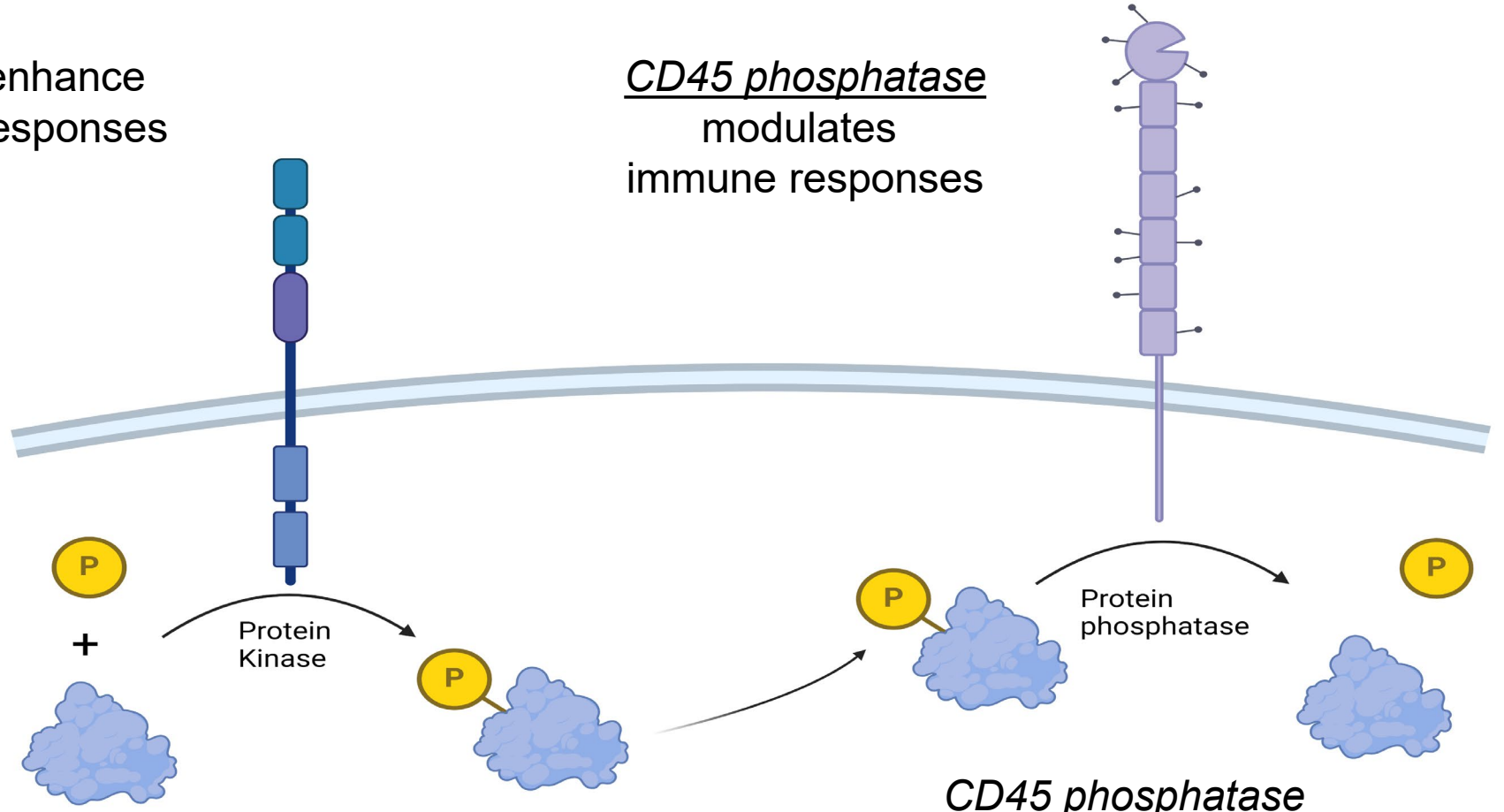
Kinases Enhance and Phosphatases Modulate Immune Responses

Kinases enhance immune responses

CD45 phosphatase modulates immune responses

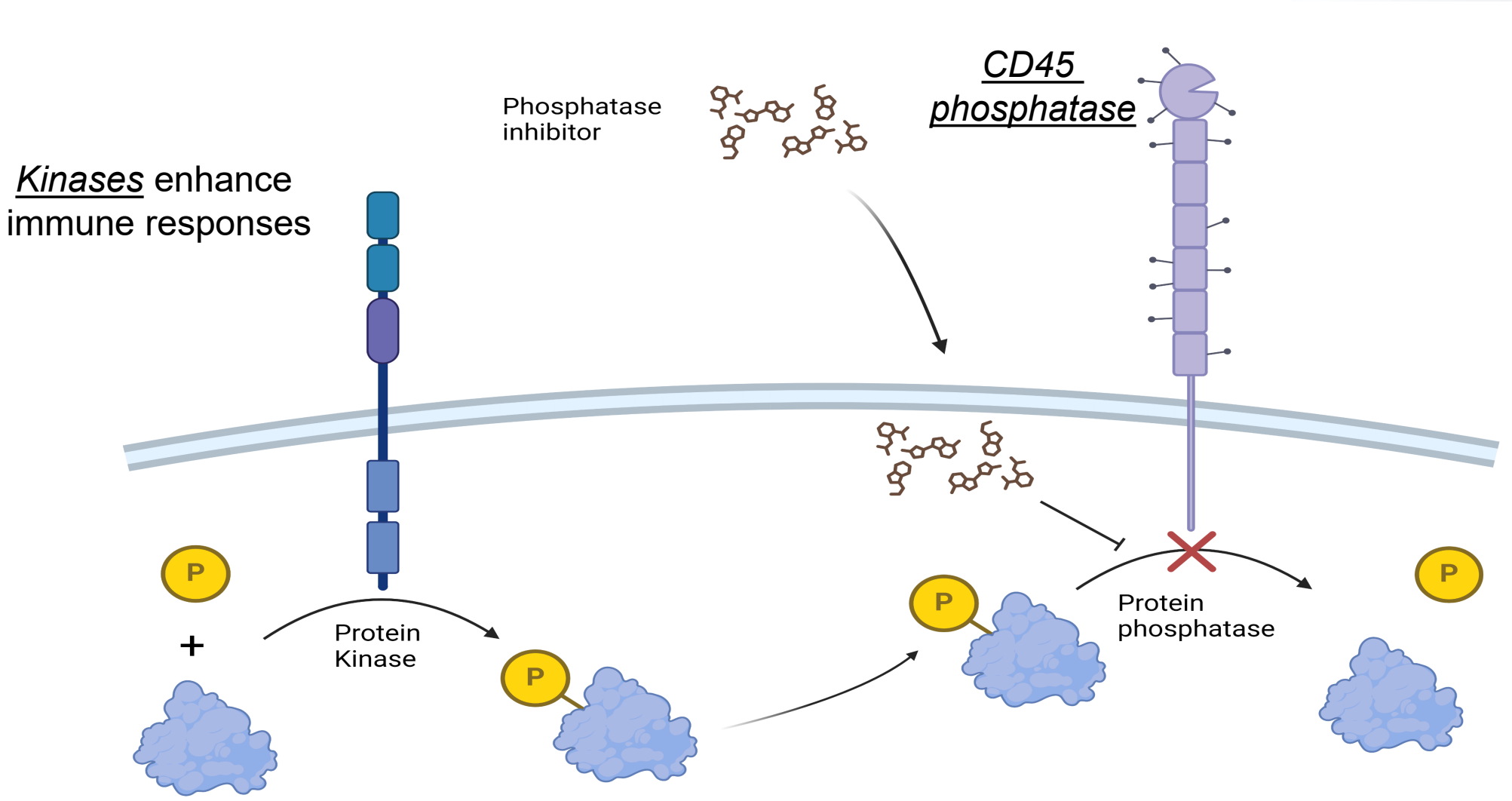


Kinases add phosphate “P” to signaling molecules

CD45 phosphatase removes phosphate “P” From signaling molecules

Panchal RG, *et al.,* .J Biol Chem. 2009 May 8;284(19):12874-85. doi: 10.1074/jbc.M809633200. Epub 2009 Mar 6.PMID: 19269962

Phosphatase Inhibitors Decrease Enzymatic Activity of CD45 and Potentially Enhance Viral Immunity



Panchal RG, et al. *J Biol Chem.* 2009 284(19):12874-85. doi: 10.1074/jbc.M809633200.

TNX-4200: Orally Available CD45 Antagonists

- Tonix is exploiting regenerative AI and computational biology to identify ***modulators of CD45 expression and inhibitors of CD45 function*** to develop candidate broad-spectrum antiviral drugs[1]

Goal: broad spectrum antivirals

CD45 modulating host-directed antivirals would be an entirely new class of medicines

- Drugs that strengthen the body's immunity and protect against viral illness are called "host-directed" antivirals[2,3]

[1]Panchal RG, et al. *J Biol Chem.* 2009 284(19):12874-85. doi: 10.1074/jbc.M809633200
[2]Radoshitzky SR, *et al.,* PLoS Pathog. 2016 Mar 31;12(3):e1005466. doi: 10.1371/journal.ppat.1005466. eCollection 2016 PMID: 27031835
[3]Loureiro ME, *et al.,* PLoS Pathog. 2018 Jul 12;14(7):e1007125. doi: 10.1371/journal.ppat.1007125. eCollection 2018 Jul.PMID: 30001425

Tonix Research and Development Center (RDC)

- Located in Frederick, MD (close to Fort Detrick/ USAMRIID)
- 48,000 square foot facility; main building is BSL-2 with some areas designated BSL-3
- Supports expanding infectious disease pipeline by accelerating internal discovery and development of vaccines and antiviral drugs
- At full capacity, the RDC can employ 80-100 scientists and technical support staff

Sina Bavari, PhD – Director of Infectious Disease Research

- **Sina Bavari, PhD, Tonix's Executive Director of Infectious Disease R&D**
  - Formerly served as head of science at the United States Army Medical Research Institute of Infectious Diseases (USAMRIID)

- **At DoD/USAMRIID, his laboratory found that a small decrease in the expression or function of CD45 protects animals from multiple pathogens such as anthrax and Ebola virus[1,2]**
  - CD45 is a lymphocyte transmembrane receptor phosphatase

- **Dr. Bavari's lab also discovered Remdesivir (GS-5734) in collaboration with Gilead and CDC**
  - That work was published in Nature 2016 and showed that GS-5734 (Remdesivir) works against SARS-CoV and MERS[3], which led to the testing of Remdesivir/GS-5734 in SARS-CoV-2

[1]Panchal RG, et al., *Cell Host Microbe*. 2009 6(2):162-73. doi: 10.1016/j.chom.2009.07.003. PMID: 19683682.
[2]Panchal RG, et al. *J Biol Chem.* 2009 284(19):12874-85. doi: 10.1074/jbc.M809633200
[3]Warren TK, et al. *Nature*. 2016 531(7594):381-5. doi: 10.1038/nature17180.

Other Programs at Tonix: Non-dilutive Funding

- **Tonix has other broad spectrum antiviral programs ongoing**
  - Cathepsin inhibitors
  - Protein-engineered lectins

- **Other Government Support**
  - Tonix's TNX-1800 vaccine was selected by the National Institutes of Health (NIH), the National Institute of Allergic and Infectious Diseases (NIAID) for Project NextGen, an in-kind award in which NIAID will study Tonix's COVID-19 vaccine platform in a Phase 1 study
  - The DoD CDMRP* has also provided $3 M of funding to support a University of North Carolina (UNC) study of Tonix's TNX-102 SL drug to treat Acute Stress Disorder (ASD) and prevent PTSD after motor vehicle collisions
  - The National Institute of Drug Abuse (NIDA) has awarded $5.2 M in a grant to support Tonix's Phase 2 development of TNX-1300, a cocaine antidote

*CDMRP = Congressionally directed medical research program

THANK YOU