April 6, 2023

Tonix Pharmaceuticals Presents Data from its Vaccine Development Program at the World Vaccine Congress

Preclinical data demonstrate the efficacy of TNX-801 vaccination against mpox virus challenge in a non-human primate model

Phase 1 trial with TNX-801 for the prevention of mpox and smallpox is expected to start in the second half of 2023

CHATHAM, N.J., April 06, 2023 (GLOBE NEWSWIRE) -- Tonix Pharmaceuticals Holding Corp. (Nasdaq: TNXP) (Tonix or the Company), a clinical-stage biopharmaceutical company, presented data from its live virus vaccine platform development program in two oral presentations at the World Vaccine Congress being held in Washington D.C., April 3-6, 2023. Copies of the Company's presentations are available under the Scientific Presentations tab of the Tonix website atwww.tonixpharma.com.

"Tonix's live virus vaccine technology is designed to help protect against emerging infectious diseases by providing durable protection, and can be widely deployed without the need for sterile injection or ultra-cold shipping and storage," said Seth Lederman, M.D., Chief Executive Officer of Tonix Pharmaceuticals. "Our lead vaccine candidate, TNX-801, is a live virus vaccine in development to protect against monkeypox ('mpox') and smallpox. We believe TNX-801 is closer in genetic structure and properties to the smallpox vaccines used in the U.S. and Europe before 1900 than the modern vaccinia smallpox vaccines. Relative to modern vaccinia vaccines, TNX-801 has reduced virulence in animals, and we believe it has the potential for widespread use to protect against mpox and smallpox."

The presentation, titled, "*TNX-801: A Live Attenuated Orthopoxvirus (Horsepox) Vaccine for Mpox and Smallpox*," describes the history of live virus vaccines and the rationale for the development of the Company's Recombinant Pox Virus (RPV) platform. The presentation demonstrates that non-human primates vaccinated with TNX-801 were fully protected with sterilizing immunity from a lethal challenge.

The presentation, titled, "*The Development of Horsepox virus as a vaccine platform: Evaluation of TNX-1800 as a SARS-CoV-2 Vaccine*," describes TNX-1800, a live virus vaccine based on the horsepox viral vector platform, which was developed to protect against COVID-19. The presentation shows that in animal testing, TNX-1800 protected upper and lower airways after challenge with SARS-CoV-2, suggesting an ability to block forward transmission. TNX-1800 is an example of the ability of Tonix's adaptable vaccine platform to protect against emerging threats and future pandemics.

About TNX-801

TNX-801 is a live virus vaccine based on horsepox[2,3]. Tonix is developing TNX-801 for percutaneous administration as a vaccine to protect against mpox and smallpox. Tonix's TNX-801 is based on the sequence of the 1976 natural isolate Mongolian horsepox clone MNR-763.[2] Molecular analysis of DNA sequences suggests that TNX-801 is closer than modern smallpox vaccines to the vaccine discovered and disseminated by Dr. Edward Jenner in 1798[4-6]. For example, recent studies[7,8] have shown approximately 99.7% colinear identity between TNX-801 and the circa 1860 U.S. smallpox vaccine VK05.[9] The small plaque size in culture of TNX-801 appears identical to the U.S. Centers for Disease Control publication of the natural isolate[10]. Relative to vaccinia, horsepox has substantially decreased virulence in mice[2]. Dr. Edward Jenner invented vaccination in 1798 and the procedure was called "vaccination" because 'cow' is 'vacca' in Latin and the inoculum material was initially obtained from lesions on the udders of cows affected by a mild disease known as cowpox. However, Dr. Jenner suspected that cowpox originated from horses[6]. Subsequently, Dr. Jenner and others immunized against smallpox using material directly obtained from horses. The use of vaccines from horses was sometimes called 'equination' from the Latin 'equus' which means 'horse'[11]. Equination and vaccination were practiced side-by-side in Europe[11,12].

About the Recombinant Pox Virus (RPV) Platform

Horsepox virus and vaccines based on its use as a vector are live replicating viruses that elicit strong immune responses. Live replicating orthopoxviruses, like vaccinia or horsepox, can be engineered to express foreign genes and have been exploited as platforms for vaccine development because they possess; (1) large packaging capacity for exogenous DNA inserts, (2) precise virus-specific control of exogenous gene insert expression, (3) lack of persistence or genomic integration in the host, (4) strong immunogenicity as a vaccine, (5) ability to rapidly generate vector/insert constructs, (6) manufacturable at scale, and (7) ability to provide direct antigen presentation. Horsepox-based vaccines are designed to be single dose, vial-sparing vaccines, that can be manufactured using conventional cell culture systems, with the potential for mass scale production and packaging in multi-dose vials. Tonix's TNX-801 and RPV vaccine candidates are administered percutaneously using a two-pronged, or "bifurcated" needle. The major cutaneous reaction or "take" to vaccinia vaccine was described by Dr. Edward Jenner in 1796 and has been used since then as a biomarker for protective immunity to smallpox, including in the World Health Organization's (WHO) accelerated smallpox eradication program that successfully eradicated smallpox in the 1960's. The "take" is a measure of functional T cell immunity validated by the eradication of smallpox, a respiratory-transmitted disease caused by variola.

About Mpox and Smallpox

Mpox[13] and smallpox[14] are diseases in humans caused by the mpox and smallpox (or variola) viruses, respectively. Mpox and variola are closely related orthopox viruses. Vaccination against smallpox with live virus vaccines based on horsepox or vaccinia protects against mpox. After routine smallpox vaccination was stopped in about 1970, mpox has become a growing problem in Africa. Since May of 2022, approximately 30,000 cases have been identified in the United States[15,16]. There are two distinct clades of the mpox virus: the central African (Congo Basin) clade, and the west African clade which is associated with the recent outbreak. Historically, the Congo Basin clade has caused more severe disease than

the west African clade. In recent times, the case fatality ratio for the virus is about 3–6%[17]. In November 2022, the WHO began using a new preferred term “mpox” as a synonym for monkeypox[18]. Smallpox is considered eradicated, but there are concerns about malicious reintroduction.

Tonix Pharmaceuticals Holding Corp.[1]

Tonix is a clinical-stage biopharmaceutical company focused on discovering, licensing, acquiring and developing therapeutics to treat and prevent human disease and alleviate suffering. Tonix’s portfolio is composed of central nervous system (CNS), rare disease, immunology and infectious disease product candidates. Tonix’s CNS portfolio includes both small molecules and biologics to treat pain, neurologic, psychiatric and addiction conditions. Tonix’s lead CNS candidate, TNX-102 SL (cyclobenzaprine HCl sublingual tablet), is in mid-Phase 3 development for the management of fibromyalgia with interim data expected in the second quarter of 2023. TNX-102 SL is also being developed to treat Long COVID, a chronic post-acute COVID-19 condition. Enrollment in a Phase 2 study has been completed, and topline results are expected in the third quarter of 2023. TNX-1900 (intranasal potentiated oxytocin), in development for chronic migraine, is currently enrolling with interim data expected in the fourth quarter of 2023. TNX-601 ER (tianeptine hemioxalate extended-release tablets), a once-daily formulation being developed as a treatment for major depressive disorder (MDD), is also currently enrolling with interim data expected in the fourth quarter of 2023. TNX-1300 (cocaine esterase) is a biologic designed to treat cocaine intoxication and has been granted Breakthrough Therapy designation by the FDA. A Phase 2 study of TNX-1300 is expected to be initiated in the second quarter of 2023. Tonix’s rare disease portfolio includes TNX-2900 (intranasal potentiated oxytocin) for the treatment of Prader-Willi syndrome. TNX-2900 has been granted Orphan Drug designation by the FDA. Tonix’s immunology portfolio includes biologics to address organ transplant rejection, autoimmunity and cancer, including TNX-1500, which is a humanized monoclonal antibody targeting CD40-ligand (CD40L or CD154) being developed for the prevention of allograft and xenograft rejection and for the treatment of autoimmune diseases. A Phase 1 study of TNX-1500 is expected to be initiated in the second quarter of 2023. Tonix’s infectious disease pipeline includes TNX-801, a vaccine in development to prevent smallpox and mpox, for which a Phase 1 study is expected to be initiated in the second half of 2023. TNX-801 also serves as the live virus vaccine platform or recombinant pox vaccine platform for other infectious diseases. The infectious disease portfolio also includes TNX-3900 and TNX-4000, classes of broad-spectrum small molecule oral antivirals.

This press release and further information about Tonix can be found at www.tonixpharma.com.

[1]*All of Tonix’s product candidates are investigational new drugs or biologics and have not been approved for any indication.*

[2]*Noyce RS, et al. (2018) PLoS One. 13(1):e0188453*

[3]*Tulman ER, et al. (2006) J Virol. 80(18):9244-58.PMID:16940536*

[4]*Schrick L et al. (2017) N Engl J Med. 377:1491.*

[5]*Qin et al. (2015) J. Virol. 89:1809.*

[6]*Jenner E. “An Inquiry Into the Causes and Effects of the Variolae Vaccinae: A Disease Discovered in Some of the Western Counties of England, Particularly Gloucestershire, and*

Known by the Name of the Cow Pox." London: Sampson Low, 1798.
[7]*Brinkmann A et al, Genome Biology (2020) 21:286 https://doi.org/10.1186/s13059-020-02202-0*
[8]*Duggan A et al. Genome Biology (2020) 21:175 https://doi.org/10.1186/s13059-020-02079-z*
[9]*Tonix press release. Dec 4, 2020 https://ir.tonixpharma.com/news-events/press-releases/detail/1236/vaccine-genome-researchers-report-99-7-colinear-identity*
[10]*Trindale GS et al. (2016) Viruses (12).Pii: E328. PMID:27973399*
[11]*Esparza E, et al (2017) Vaccine. 35(52):7222-7230.*
[12]*Esparza J et al. (2020) Vaccine.; 38(30):4773-4779.*
[13]*www.cdc.gov/poxvirus/monkeypox/about.html*
[14]*www.cdc.gov/smallpox/research/*
[15]*Mandavilli, A. The New York Times. May 26, 2020. "Who is protected against monkeypox"*
[16]www.cdc.gov/poxvirus/monkeypox/response/2022/us-map.html - Accessed Feb 8, 2023
[17]https://www.who.int/news-room/fact-sheets/detail/monkeypox#:~:text=There%20are%20two%20distinct%20genetic,thought%20to Accessed Feb 8, 2023
[18]https://www.who.int/news/item/28-11-2022-who-recommends-new-name-for-monkeypox-disease - Accessed Feb 8, 2023

Forward Looking Statements

Certain statements in this press release are forward-looking within the meaning of 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," "expect," 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, risks related to the failure to obtain FDA clearances or approvals and noncompliance with FDA regulations; delays and uncertainties caused by the global COVID-19 pandemic; 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. Tonix does not undertake an obligation to update or revise any forward-looking statement. Investors should read the risk factors set forth in the Annual Report on Form 10-K for the year ended December 31, 2022, as filed with the Securities and Exchange Commission (the "SEC") on March 13, 2023, and periodic 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. The information set forth herein speaks only as of the date thereof.

Contacts

Jessica Morris (corporate)
Tonix Pharmaceuticals

investor.relations@tonixpharma.com
(862) 904-8182

Olipriya Das, Ph.D. (media)
Russo Partners
Olipriya.Das@russopartnersllc.com
(646) 942-5588

Peter Vozzo (investors)
ICR Westwicke
peter.vozzo@westwicke.com
(443) 213-0505

Source: Tonix Pharmaceuticals Holding Corp.