UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 8-K

CURRENT REPORT

Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934

Date of report (date of earliest event reported): July 16, 2024

TONIX PHARMACEUTICALS HOLDING CORP.

(Exact name of registrant as specified in its charter)

Nevada	**001-36019**	**26-1434750**
(State or Other Jurisdiction of Incorporation)	**(Commission File Number)**	**(IRS Employer Identification No.)**

26 Main Street, Chatham, New Jersey 07928
(Address of principal executive offices) (Zip Code)

Registrant's telephone number, including area code: (862) 904-8182

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions (see General Instruction A.2. below):

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)
☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)
☐ Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))
☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock	**TNXP**	**The NASDAQ Capital Market**

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 7.01 Regulation FD Disclosure.

Tonix Pharmaceuticals Holding Corp. (the "Company") updated its investor presentation, which is used to conduct meetings with investors, stockholders and analysts and at investor conferences, and which the Company intends to place on its website, which may contain nonpublic information. A copy of the presentation is filed as Exhibit 99.01 hereto and incorporated herein by reference. The Company updated its CD45 product candidate presentation, which it intends to place on its website and which may contain nonpublic information. A copy of the product presentation is filed as Exhibit 99.02 and hereto and incorporated herein by reference.

The information in this Item 7.01 of this Current Report on Form 8-K, including Exhibits 99.01 and 99.02 attached hereto, shall not be deemed "filed" for purposes of Section 18 of the United States Securities Exchange Act of 1934 (the "Exchange Act") or otherwise subject to the liabilities of that section, nor shall they be deemed incorporated by reference in any filing under the United States Securities Act of 1933 or the Exchange Act, except as shall be expressly set forth by specific reference in such a filing.

Item 9.01 Financial Statements and Exhibits.

(d)

Exhibit No.	**Description.**
99.01	Corporate Presentation by the Company for July 2024
99.02	CD45 Product Presentation
104	Cover Page Interactive Data File (embedded within the Inline XBRL document)

SIGNATURE

Pursuant to the requirement of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

TONIX PHARMACEUTICALS HOLDING CORP.

Date: July 16, 2024

By: /s/ Bradley Saenger
Bradley Saenger
Chief Financial Officer

Exhibit 99.01

Cautionary Note on Forward-Looking Statements

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.

© 2024 Tonix Pharmaceuticals Holding Corp.

Who We Are

Tonix is committed to developing and marketing therapeutics to treat pain, neurologic, psychiatric and addiction conditions through our ***central nervous system portfolio*** and within other areas of ***high unmet need***, including immunology, infectious disease, and rare disease

With a Focus on:

Filing a New Drug Application (NDA) with the US Food and Drug Administration (FDA) for Tonmya™ (TNX-102 SL) for the management of Fibromyalgia (FM)

© 2024 Tonix Pharmaceuticals Holding Corp.

Key Clinical Programs

Molecule*	Indication	Phase 1	Phase 2	Phase 3	NDA Submission
Tonmya™ TNX-102 SL Cyclobenzaprine HCl Protectic® Sublingual Tablets	Fibromyalgia	*Statistically Significant Phase 3 Topline Results Reported 4Q'23*			***Submission expected 2H'24***
	Long COVID	*Phase 2 Topline Results Reported 3Q'23*			
	Acute Stress Disorder	*Phase 2 Study** Start Expected 3Q'24*			
TNX-1300 Cocaine Esterase *NIDA Funded*	Cocaine Intoxication	*Phase 2 Study Start Expected 3Q'24*			
TNX-2900 Intranasal Potentiated Oxytocin *FDA Orphan Drug and Rare Pediatric Disease Designation*	Prader-Willi Syndrome	*Phase 2 Ready*			
TNX-1500 Anti-CD40L mAb	Organ Transplant Rejection/ Autoimmune Conditions	*Phase 1 Study Ongoing*	*Clinical Stage Completed*		

*All of Tonix's product candidates are investigational new drugs or biologics and none has been approved for any indication.
**Investigator-initiated study

© 2024 Tonix Pharmaceuticals Holding Corp.

Tonmya™
(TNX-102 SL, Cyclobenzaprine HCl Sublingual Tablets)

A unique, sublingual formulation of cyclobenzaprine designed to optimize delivery and absorption

Tonmya™ is conditionally accepted by the U.S. Food and Drug Administration (FDA) as the tradename for TNX-102 SL for the management of fibromyalgia. Tonmya has not been approved for any indication.

© 2024 Tonix Pharmaceuticals Holding Corp.

TONIX PHARMACEUTICALS

About Fibromyalgia

*Fibromyalgia is a **chronic pain disorder** resulting from amplified sensory and pain signaling within the CNS[1]*

*Fibromyalgia is a **syndrome** comprised of the **symptoms**: chronic widespread pain, **nonrestorative sleep**, and fatigue*

Fibromyalgia is considered a **chronic overlapping pain condition (COPC)**
*- the **only COPC** with any **FDA-approved drugs**[3]*

Fibromyalgia is the prototypic nociplastic syndrome

[1]American Chronic Pain Association (www.theacpa.org, 2019)
[3]CFS/ME = chronic fatigue syndrome/myalgic encephalomyelitis
[3]The three drugs with FDA approval for the treatment of fibromyalgia: Pregabalin (Lyrica®); Duloxetine (Cymbalta®); Milnacipran (Savella®)

© 2024 Tonix Pharmaceuticals Holding Corp.

CNS PORTFOLIO

TONIX PHARMACEUTICALS

Fibromyalgia is a Large, Underserved and Dissatisfied Population

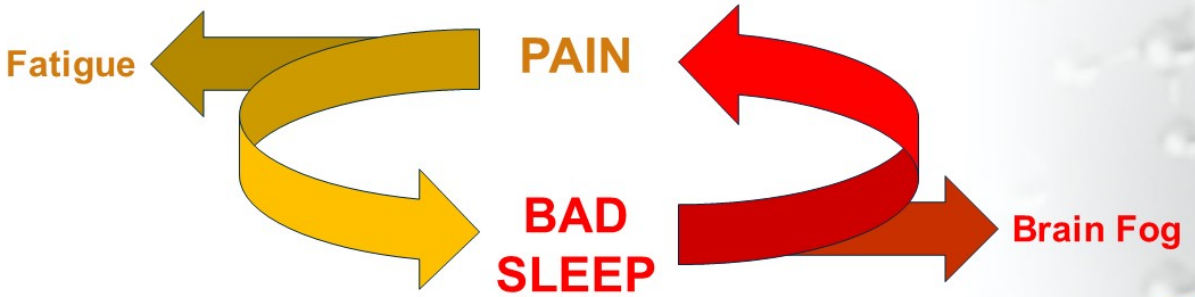
- **~10 million U.S. adults are affected – predominantly women[1,2]**
  - Debilitating and life altering condition
  - Significant economic impact
- **Patients are dissatisfied, despite three FDA approved drugs[3,4]**
  - 85% of patients fail first-line therapy[5]: efficacy variability, tolerability issues especially when used long-term and lack of broad-spectrum activity
  - Typical for patients to rotate between drugs and be on multiple drugs at the same time; 79% of FM patients are on multiple therapies[5]
- **~2.7 million FM patients diagnosed and treated[6]**
  - >22 million prescriptions are issued for the treatment of fibromyalgia (on- and off-label usage) each year[7,8]
- **No new R*x* product since 2009**
- *The treatment objective is to **restore functionality** and **quality of life** by broadly improving symptoms while avoiding significant side effects*

[1]American College of Rheumatology (www.ACRPatientInfo.org accessed May 7, 2019) – prevalence rate of 2-4% for U.S. adult population (~250 million)
[2]Vincent A, et al. *Arthritis Care Res (Hoboken).* 2013 65(5):786-92. doi: 10.1002; diagnosed prevalence rate was 1.1% of adult population or 50% of the prevalent population
[3]Robinson RL, et al. *Pain Med.* 2012 13(10):1366-76. doi: 10.1111; 85% received drug treatment
[4]The three drugs with FDA approval for the treatment of fibromyalgia: Pregabalin (Lyrica); Duloxetine (Cymbalta); Milnacipran (Savella)
[5]EVERSANA primary physician research, May 2024; commissioned by Tonix
[6]EVERSANA analysis of claims database, May 2024; commissioned by Tonix
[7]Product sales derived from IMS MIDAS; IMS NDTI used to factor usage for fibromyalgia; data accessed April 2015.
[8]Market research by Frost & Sullivan, commissioned by Tonix, 2011

© 2024 Tonix Pharmaceuticals Holding Corp.

Poor Sleep and Pain have Bi-directional Reinforcing Effects[1]

- **Poor sleep and pain form a <u>vicious cycle</u> in driving fibromyalgia <u>decompensation</u>**
  - Can't sleep → worse pain / In pain → can't sleep
  - Poor sleep and pain contribute to persistence, chronicity and severity
  - Syndrome includes symptoms of fatigue and brain fog
- **Treating sleep disturbance in fibromyalgia has the potential to break the vicious cycle**
  - Potential to remove an obstacle to recovery
  - Using the right medicine is important – some sedative/hypnotics don't work[1,2]



[1]Moldofsky H, et al. *J Rheumatol*. 1996;23:529–533.
[2]Grönbald M, et al. *Clin Rheumatol*. 1993;12(2):186–191

© 2024 Tonix Pharmaceuticals Holding Corp.

Tonmya™ (TNX-102 SL, Cyclobenzaprine HCl Sublingual Tablets)[1]

- **Non-opioid analgesic designed for long-term daily bedtime use in fibromyalgia patients**
  - Targets non-restorative sleep
  - Potent binding and antagonist activities at four post-synaptic receptors
    - serotonin-5-HT2A
    - α1-adrenergic
    - histaminergic-H1
    - muscarinic-M1
  - No recognized risk for abuse

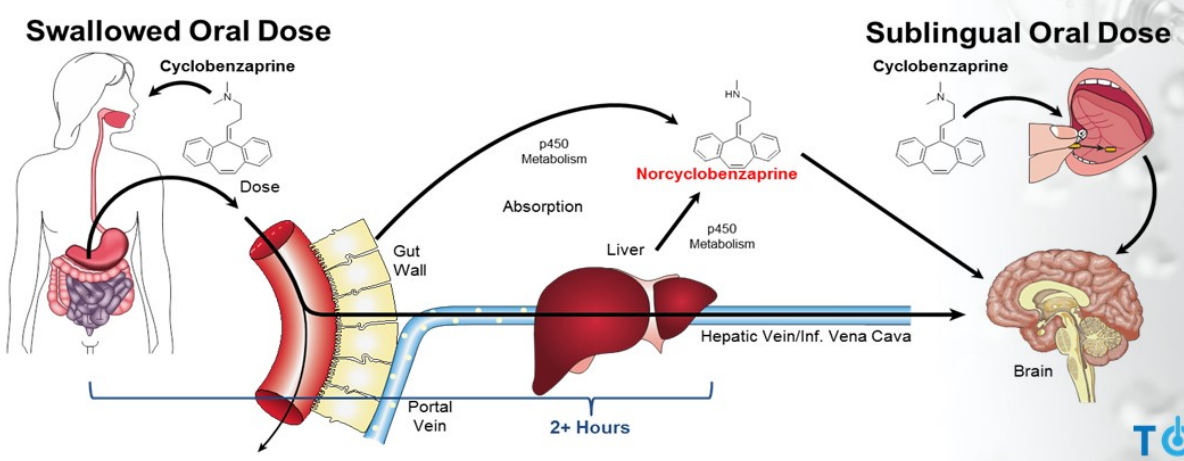
- **Improves sleep quality, does not increase sleep quantity:**
  - Not a traditional hypnotic or sedative

- **Proprietary, sublingual transmucosal formulation of cyclobenzaprine designed to optimize delivery and absorption**
  - Protectic® formulation based on eutectic composition of matter
    - Rapid absorption
    - Decrease in major metabolite by bypassing first-pass hepatic metabolism

© 2024 Tonix Pharmaceuticals Holding Corp.

TNX-102 SL: Sublingual Administration and Transmucosal Delivery

- Advantages of the sublingual route
- Faster absorption provides PK that is ideal for bedtime dosing
- Bypasses "first-pass" hepatic metabolism
- Reduced metabolism of parent CBP to active metabolite norcyclobenzaprine (nCBP)



© 2024 Tonix Pharmaceuticals Holding Corp.

Fibromyalgia Program Status

Tonmya™ (TNX-102 SL)
Cyclobenzaprine Protectic® Sublingual Tablets

Fibromyalgia

Statistically Significant 2nd Phase 3 Topline Results Reported 4Q'23

- **First pivotal Phase 3 study (*RELIEF*) reported – December 2020[1]**
- **Second Phase 3 study (*RALLY*) missed primary endpoint – July 2021**
- **Confirmatory pivotal Phase 3 study (*RESILIENT*) reported – December 2023**
- **Type B CMC and clinical pre-NDA meetings with FDA completed with alignment on requirements for filing and potential approval**

Next Steps:

- **NDA filing expected 2H'24**
- **FDA decision on NDA approval expected 2H'25**

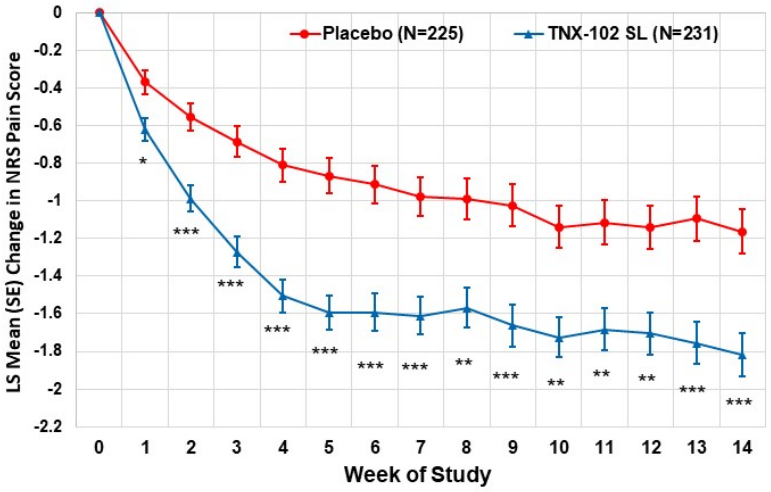
[1]Lederman S, et al. *Arthritis Care Res (Hoboken)*. 2023 Nov;75(11):2359-2368. doi: 10.1002.

© 2024 Tonix Pharmaceuticals Holding Corp.

RESILIENT Primary Outcome Measure
Reduction in Widespread Pain

RESILIENT Study

Weekly Average of Daily Diary NRS Ratings of Average Pain Over Prior 24 Hours



*p<0.01; **p<0.001; ***p<0.0001

Week 14 LS mean (SE) change from baseline for TNX-102 SL -1.82 (0.12) and for placebo -1.16 (0.12); LSMD from placebo -0.65 (0.16); **p=0.00005#**

#Based on Mixed Model Repeated Measures with Multiple Imputation, with fixed categorical effects of treatment, center, study week, and treatment by study week interaction, as well as baseline value and baseline value-by-study week interaction. Abbreviations: LS, least squares; LSMD, least squares mean difference; NRS, numerical rating scale; SE, standard error

© 2024 Tonix Pharmaceuticals Holding Corp.

RESILIENT Summary of Endpoints

RESILIENT Study

CNS PORTFOLIO

Endpoint	P-value	Effect Size (ES)
Primary Endpoint		
Daily Diary Pain ratings	***p* = 0.00005****	ES = 0.38
Key Secondary Endpoints*		
Patient Global Impression of Change (PGIC), responders	*p* = 0.00013**	--
Fibromyalgia Impact Questionnaire – Symptoms domain	*p* = 0.000002**	ES = 0.44
Fibromyalgia Impact Questionnaire – Function domain	*p* = 0.001**	ES = 0.30
PROMIS Sleep Disturbance instrument	*p* = 0.0000001**	ES = 0.50
PROMIS Fatigue instrument	*p* = 0.00009**	ES = 0.37
Diary Sleep Quality ratings	*p* = 0.0007**	ES = 0.32

*In order of statistical serial gate-keeping hierarchy (or, "waterfall") to control overall Type 1 error
**Statistical significance met

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

RESILIENT – Cognitive Dysfunction or "Brain Fog"

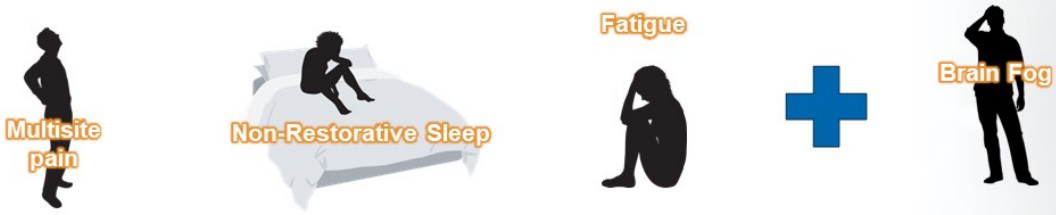
RESILIENT Study

CNS PORTFOLIO

Brain Fog assessed by the FIQ-R[1] item on memory

- Patients rated their level of memory problems
- 11-pt scale going from "Good Memory" to "Very Poor Memory"
- Prespecified endpoint, but not in the "waterfall" with the key secondary endpoints

- TNX-102 SL patients vs PBO change from baseline LS mean (SE) difference of −0.8 (0.23)
- *p* = 0.001 (not corrected for multiple comparisons)
- Cohen's *d* effect size = 0.31



[1]FIQ-R = Fibromyalgia Impact Questionnaire - Revised

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

Tonmya™ Showed Broad-Spectrum Activity and was Well Tolerated

		Lyrica®	Cymbalta® Savella®	Tonmya™
Activity	Pain	**YES**	**YES**	**YES**
	Sleep	**YES**	**-**	**YES**
	Fatigue	**-**	**YES**	**YES**
Systemic Tolerability Issues	Insomnia	**-**	**+**	**-**
	Fatigue	**+**	**-**	**-**
	Weight	**+**	**-**	**-**
	Blood Pressure	**-**	**+**	**-**
	Sexual function	**-**	**+**	**-**
	GI issues	**-**	**+**	**-**

- Tonmya showed activity in all three measures of pain, sleep, and fatigue
- Tonmya is not associated with any of the commonly reported side effects of the FDA-approved medications for fibromyalgia

© 2024 Tonix Pharmaceuticals Holding Corp.

Safety and Tolerability

- **Completion Rate (safety population): TNX-102 SL: 81.0% and Placebo: 79.2%**
- **No new safety signals observed**
- **Only systemic adverse events (AEs) at rate ≥ 3.0% (TNX-102 SL v. Placebo)**
  - COVID-19 (4.3% v. 3.1%), somnolence (3.0% v. 1.3%), and headache (3.0% v. 1.8%)
- **As previously observed TNX-102 SL associated with administration site reactions**
  - Hypoaesthesia oral (23.8% v. 0.4%), product taste abnormal (11.7% v. 0.9%), paraesthesia oral (6.9% v. 0.9%), and tongue discomfort (6.9% v. 0%)
- **No effect on weight or blood pressure (BP)**
  - Weight: Week 14 change from baseline for TNX-102 SL of +0.04 lbs.; and for Placebo of +0.44 lbs.
  - Systolic BP: Week 14 change from baseline for TNX-102 SL of +0.7 mmHg; and for Placebo of +0.5 mmHg
  - Diastolic BP: Week 14 change from baseline for TNX-102 SL of +1.1 mmHg; and for Placebo of +0.2 mmHg
- **No sexual dysfunction AEs and improved female sexual functioning**
  - No reported AEs of any type of sexual dysfunction
  - Improvement in female sexual function using Changes in Sexual Functioning Questionnaire (p=0.010)

© 2024 Tonix Pharmaceuticals Holding Corp.

RESILIENT Safety Summary

RESILIENT Study

CNS PORTFOLIO

Treatment-Emergent Adverse Events (TEAEs) at Rate of ≥ 3% in Either Treatment Group

System Organ Class Preferred Term	TNX-102 SL N=231	Placebo N=226	Total* N=457
Systemic Adverse Events			
COVID-19	10 (4.3%)	7 (3.1%)	17 (3.7%)
Somnolence	7 (3.0%)	3 (1.3%)	10 (2.2%)
Headache	7 (3.0%)	4 (1.8%)	11 (2.4%)
Oral Cavity Adverse Events			
Hypoaesthesia oral	55 (23.8%)	1 (0.4%)	56 (12.3%)
Product taste abnormal	27 (11.7%)	2 (0.9%)	29 (6.3%)
Paraesthesia oral	16 (6.9%)	2 (0.9%)	18 (3.9%)
Tongue discomfort	16 (6.9%)	0 (0.0%)	16 (3.5%)

*Safety Population

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

~50% of U.S. Fibromyalgia Patients are on Medicare: Prescription Coverage in Medicare Stands to Benefit from Changes in IRA

CNS PORTFOLIO

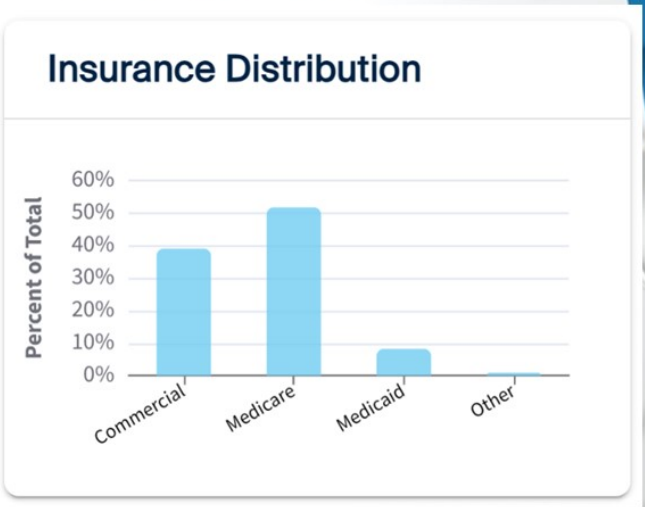
Approximately 50% of fibromyalgia patients are on Medicare

- EVERSANA analysis of claims database consisting of 2.2M patients, for which 1.2M claims were submitted throughout March 2002-March 2023[1]

Beneficial Changes in 2025 to Medicare Part D through Inflation Reduction Act (IRA)[2]

- Medicare prescription payment plan to offer enrollees the option to pay out-of-pocket prescription drug costs in the form of capped monthly installment payments instead of all at once at the pharmacy
- Annual out-of-pocket costs will be capped at $2,000 in year 2025
- Will replace the existing Coverage Gap Discount Program, which sunsets as of January 1, 2025

Fibromyalgia Patients by Coverage[1]



[1] EVERSANA analysis of claims database, May 2024; commissioned by Tonix
[2] Source: Final CY 2025 Part D Redesign Program Instructions Fact Sheet | CMS

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

Prescribers Interviewed are Broadly Dissatisfied with Available Fibromyalgia Medications: Results of Primary Research[1]

Perspectives on FM Therapies from Prescribers Interviewed		
Drug	**Positives**	**Negatives**
Duloxetine *(Cymbalta, generic)*	• Relatively high efficacy (compared to alternatives) • Can be titrated slowly from 20mg to 120mg	• Tolerability issues: worsening depression, insomnia • Seldom used as a monotherapy; often requires adjunct
Pregabalin *(Lyrica, generic)*	• Relatively high efficacy (compared to alternatives) • Can often be safely combined with other medications	• Suboptimal for long-term use (e.g., weight gain) • Schedule V status makes some HCPs more cautious to Rx
Savella *(milnacipran)*	• Offers another option if patient fails Cymbalta or Lyrica	• Subpar efficacy does not counterbalance tolerability issues • High cost and access constraints (~$50/month)
Cyclobenzaprine *(Flexeril, generic; oral formulation, off-label)*	• Active for initiating and sustaining sleep; can be titrated up • Active for pain driven by stiffness and muscle spasms	• Mixed perspectives on pain benefit independent of sleep • Suboptimal long-term results as efficacy wanes

85% of patients (avg) fail first line therapy

79% of FM patients (avg) are on multiple therapies

[1] EVERSANA primary physician research, May 2024; commissioned by Tonix

© 2024 Tonix Pharmaceuticals Holding Corp.

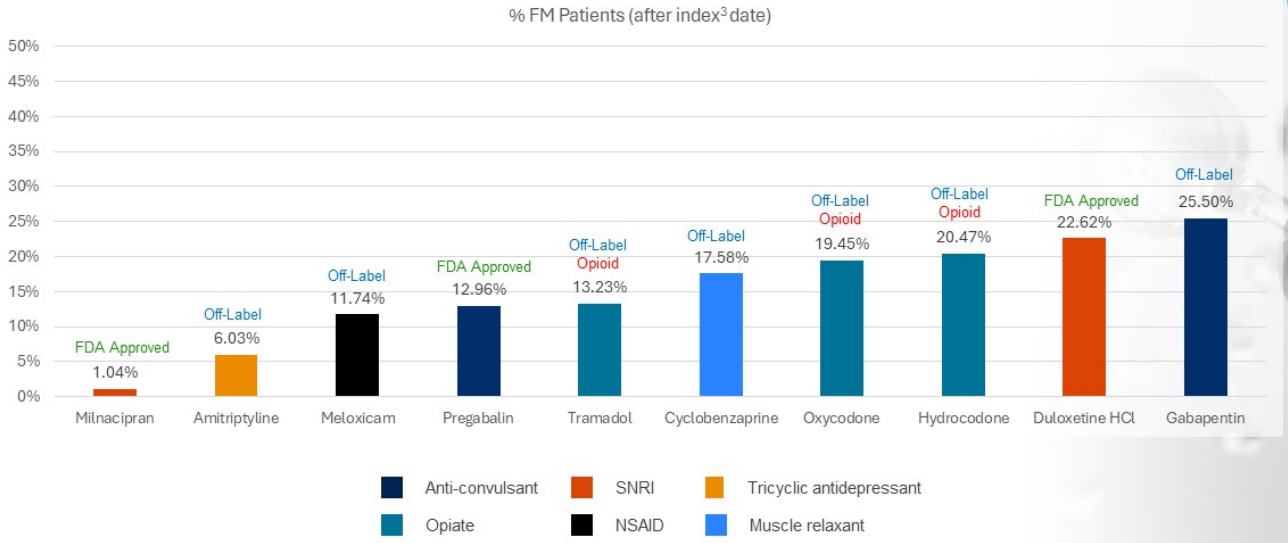
Opportunity for a New, Unique Fibromyalgia Treatment Option: Results of Primary Research from EVERSANA[1,2]

FM Landscape	• Prescribers indicate a **very high unmet need** in FM (ranked ≥4.0 on a 5-point scale) • Prescribers report there is **no standard of care in FM**, employ an **individualized approach** based on symptomology • No new treatments approved since 2009 • Prescribers report minimal promotional activities by any pharmaceutical company • Highly concentrated prescriber base with 50% of patients treated by ~16k physicians
Physician Primary Market Research	• **Physicians reacted positively to Tonmya's efficacy and safety profile (based on Phase 3 Study results)** • Median interest = 4.0 on a 5-point scale • Driving attributes included **strong efficacy, safety and tolerability** • Unique & differentiating efficacy features included improvements in **sleep and fatigue**
Anticipated Use	• **Physicians indicated intended use in 40% of their FM patients** • Majority of respondents indicated Tonmya would be their first choice, if accessible • Physicians surveyed indicated they are well-equipped to deal with access restrictions including prior authorizations and step-edits

[1] EVERSANA primary physician research, May 2024; commissioned by Tonix
[2] EVERSANA analysis of claims database, May 2024; commissioned by Tonix

© 2024 Tonix Pharmaceuticals Holding Corp.

Many Fibromyalgia Patients are Prescribed Off-Label Drugs; ~53% FM Patients Prescribed Opioids Off-Label[1,2]



[1] 2022-2023
[2] EVERSANA analysis of claims database, May 2024; commissioned by Tonix
[3] Index date refers to date when ICD10 code was entered into database

© 2024 Tonix Pharmaceuticals Holding Corp.

Planning for Tonmya™ Launch and Marketing

Several companies that successfully developed CNS drugs have launched them

- Big Pharma wants the commercial launch de-risked before acquisition (*e.g.*, Nurtec®)

Company		Mkt Cap[1]	Product	Indication	FDA Approval	Exit
Axsome	AXSM	$3.5 B	Auvelity®	Depression	8/2022	
Biohaven	BHVN	$3.0 B	Nurtec®	Migraine	2/2020	Sold to PFE for $12 B in Oct 2022
IntraCellular	ITCI	$7.2 B	Caplyta®	Schizophrenia	12/2019	
Supernus	SUPN	$1.4 B	Oxtella-XR®	Seizures	1/2019	
Neurocrine	NBIX	$13.6 B	Ingrezza®	Tardive Dyskinesia	4/2017	
Acadia	ACAD	$2.5 B	Nuplazid®	Parkinson's psychosis	4/2016	

To prepare for the launch of Tonmya, Tonix acquired two marketed Rx drugs: Zembrace® and Tosymra®

- Both are indicated for the acute treatment of migraine

[1] Accessed June 7, 2024

© 2024 Tonix Pharmaceuticals Holding Corp.

Two Marketed Proprietary Migraine Drugs
Non-oral Formulations of Sumatriptan

Zembrace® SymTouch®
(sumatriptan injection) 3 mg[1]

- Each indicated for the ***treatment of acute migraine with or without aura in adults***
- Sumatriptan remains the acute migraine 'gold standard' treatment for many patients and continues to represent the largest segment of the market in terms of unit sales[3]
- Each may provide migraine ***pain relief in as few as 10 minutes*** for some patients[1,2,4,5]
- Patents to 2036 (Zembrace) and 2031 (Tosymra)

Tosymra®
(sumatriptan nasal spray) 10 mg[2]

Acquired from Upsher-Smith Laboratories which has managed care contracts covering ~200 M lives
- Contract includes a transition period during which Tonix expects to secure its own contracts

Tonix Medicines Commercial Subsidiary
- Complete commercialization capability
  - Manage supply chain and contract manufacturer
  - Distribution
  - Trade, Managed Care & Government contracting
- Team of professionals including Sales & Marketing personnel

[1]Zembrace SymTouch [package insert]. Maple Grove, MN: Upsher-Smith Laboratories, LLC: February 2021 - For more information, talk to your provider and read the Patient Information and Instructions for Use. – Important Safety Information is provided in the appendix
[2]Tosymra [package insert]. Maple Grove, MN: Upsher-Smith Laboratories, LLC: Feb 2021. For more information, talk to your provider and read the Patient Information and Instructions for Use. – Important Safety Information is provided in the appendix
[3]Tonix Medicines, Inc.; Data On File, 2023
[4]Mathew NT, et al. Dose ranging efficacy and safety of subcutaneous sumatriptan in the acute treatment of migraine. US Sumatriptan Research Group. Arch Neurol. 1992;49(12):1271-1276.
[5]Wendt J, et al. A randomized, double-blind, placebo-controlled trial of the efficacy and tolerability of a 4-mg dose of subcutaneous sumatriptan for the treatment of acute migraine attacks in adults. Clinical Therapeutics. 2006;28(4):517-526.

Zembrace SymTouch and Tosymra are registered trademarks of Tonix Medicines, Inc. Intravail is a registered trademark of Aegis Therapeutics, LLC, a wholly owned subsidiary of Neurelis, Inc.

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

CNS-Focused Biopharma with Preclinical, Clinical and Commercial Stage Products

Tonmya™ for Fibromyalgia: Preparing New Drug Application (NDA)
- Two Phase 3 trials completed with statistical significance on primary endpoint
- Pre-NDA meetings with FDA completed with alignment on requirements for filing and potential approval
- NDA filing expected 2H'24
- FDA decision on NDA approval expected 2H'25

Marketed Products
- Zembrace® and Tosymra® indicated for the treatment of acute migraine

Pipeline
- Phase 2 biologic cocaine antidote, FDA "Breakthrough Therapy Designation"
- Phase 1 anti-CD40L monoclonal antibody to prevent organ transplant rejection

Strategic Partnerships
- With government institutions, world-class academic & research organizations

Internal Capabilities
- Commercial prescription drug sales
- R&D and clinical-trial scale manufacturing

*Tonmya™ is conditionally accepted by the U.S. Food and Drug Administration (FDA) as the tradename for TNX-102 SL for the management of fibromyalgia

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

Additional Potential Indications for Tonmya™ (TNX-102 SL)

CNS PORTFOLIO

Fibromyalgia-Type Long COVID

- Status: Phase 2
- Phase 2 study (*PREVAIL*) completed
- Topline results reported 3Q 2023

Next Steps: Meet with FDA

Acute Stress Reaction/ Acute Stress Disorder

- Phase 2 ready investigator-initiated study
- Department of Defense funded
- UNC will perform study
- Received IND clearance from FDA

Next Steps: Expect to start Phase 2 in 3Q 2024

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

Additional Programs and Pipeline Strategy

Focusing on government and academic collaborations

- Validates Tonix's scientific expertise and technology
- Reduces internal spend
- Increases number of trials
- Potentially speeds time to market
- Grants, contracts, cost-sharing or "in-kind" arrangements

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

TNX-1500: Next Generation anti-CD40L mAb

Re-engineered to better modulate the binding of FcγR and mitigate risk of thrombosis

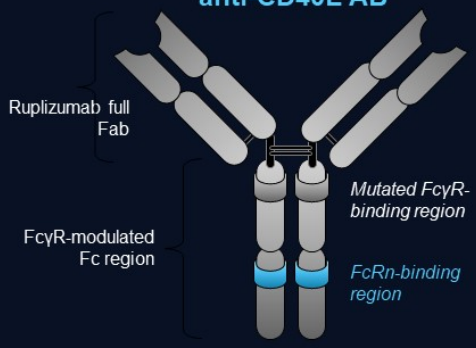
Clinical Stage of Phase 1 study completed

Key Differentiators

Expected to deliver efficacy without compromising safety

- **First Generation:** Development halted due to thromboembolic (TE) complications—blood clots—traced to Fc gamma receptor (FcγR)
- **Second Generation:** Eliminated the FcγR TE complication but potency and half life was reduced, limiting utility
- **Third Generation (TNX-1500):** Re-engineered to better modulate the binding of FcγR.

Selectively Modified anti-CD40L AB



Contains the full ruplizumab Fab and the engineered Fc region that modulates FcγR-binding, while preserving FcRn function

*TNX-1500 has not been approved for any indication.

© 2024 Tonix Pharmaceuticals Holding Corp.

TONIX PHARMACEUTICALS

External Partnerships

Government partners providing direct funding, cost sharing or in-kind support include:

- ***National Institutes of Health (NIH)***
- ***National Institute of Allergy and Infectious Disease (NIAID)***
  - TNX-1800 selected for Project NextGen
- National Institute on Drug Abuse (NIDA)
  - TNX-1300 for cocaine intoxication; Phase 2 study funding
- ***Department of Defense (DoD)***
  - TNX-4200 for the prevention or treatment of infections to improve the medical readiness of military personnel in biological threat environments
  - TNX-102 SL for ASD; investigator-initiated Phase 2 study funding

Academic partners sponsoring clinical trials of Tonix's investigational drug products include:

- Massachusetts General Hospital (MGH)
- University of Washington
- University of North Carolina

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

TNX-801

Live Virus Vaccine

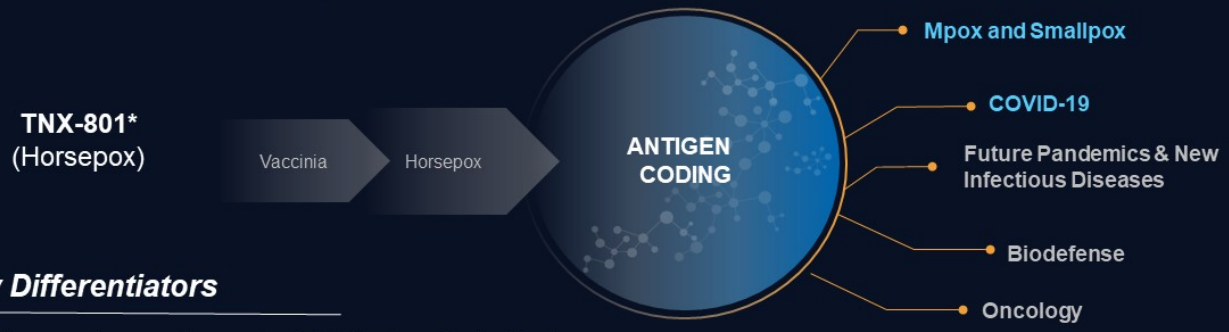
Live virus vaccine platform with multitude of potential applications

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

TNX-801: Recombinant Pox Vaccine (RPV) Platform Using Live Virus Technology

Cloned version of horsepox[1] purified from cell culture



Key Differentiators

Live virus vaccines are the most established vaccine technology

- Prevents forward transmission
- Effective in eliciting durable or long-term immunity

Economical to manufacture at scale

- Low dose because replication amplifies dose *in vivo*
- Single administration

Standard refrigeration for shipping and storage

*TNX-801 is in the pre-IND stage of development and has not been approved for any indication.
[1]Noyce et al., 2018. *PLoS One*. 13(1):e0188453.

© 2024 Tonix Pharmaceuticals Holding Corp.

TONIX PHARMACEUTICALS

TNX-1800: Designed to Express the SARs-CoV-2 Spike Protein

TNX-1800 (recombinant horsepox virus) is a live virus vaccine based on Tonix's TNX-801 that is designed to express the spike protein of the SARS-CoV-2 virus and to elicit a predominant T cell response

- Immunogenic and well tolerated[1]
- Showed promise in protecting animals from challenge with SARS-CoV-2 delivered directly into the lungs[1]

Status: ***National Institute of Allergy and Infectious Diseases (NIAID) will conduct a Phase 1 clinical trial with TNX-1800***

- First vaccine candidate using Tonix's live virus recombinant pox virus (RPV) platform technology to enter clinical trials
- "Project NextGen" is an initiative by the U.S. Department of Health and Human Services (HHS) to advance a pipeline of new, innovative vaccines and therapeutics for COVID-19. NIAID will be conducting clinical trials to evaluate several early-stage vaccine candidates, including TNX-1800
- Phase 1 study is designed to assess safety and immunogenicity in approximately 60 healthy adult volunteers
- Upon completion of the trial, NIAID and Tonix will assess the results and determine the next steps for the development of TNX-1800

[1]Awasthi, M. et al. *Viruses*. 2023. 15(10):2131.
[2]Awasthi, M. et al. *Vaccines (Basel)*. 2023. 11(11):1682.

© 2024 Tonix Pharmaceuticals Holding Corp.

Broad-Spectrum Antiviral Discovery Programs

Host-directed antiviral discovery programs

- **TNX-4200: CD45 targeted therapeutics**
  - Small molecule therapeutics that reduce endogenous levels of CD45, a protein tyrosine phosphatase
  - Reduction in CD45 protects against many viruses including the Ebola virus
- **Cathepsin inhibitors**
  - Small molecule therapeutics that inhibit ***essential cathepsins*** which are required by viruses such as coronaviruses and filoviruses to infect cells
  - Activity as monotherapy and in combination with other antivirals

Virus-directed antivirals discovery program

- **Viral glycan-targeted engineered biologics**
  - Bind to viral densely branched high-mannose (DBH) glycans
  - ***Neutralize circulating virus*** and stop the entry of the progeny virus into cells
  - Antiviral activity against a broad range of RNA viruses
  - Activity as monotherapy and in combination with other antivirals

R&D Center (RDC): Frederick, MD

- Accelerated development of vaccines and antiviral drugs against infectious diseases
- ~48,000 square feet, BSL-2 with some areas designated BSL-3

© 2024 Tonix Pharmaceuticals Holding Corp.

Key Partnerships

TNX-1500: ALLOGRAFT REJECTION

MASSACHUSETTS GENERAL HOSPITAL

HARVARD MEDICAL SCHOOL

TNX-102 SL: ACUTE STRESS DISORDER

U.S. Department of Defense

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

TNX-2900: PRADER-WILLI SYNDROME

InsermTransfert

CHU de Toulouse

Aix*Marseille université

TNX-1300: COCAINE INTOXICATION

NIH National Institute on Drug Abuse

COLUMBIA UNIVERSITY

TNX-1800: COVID-19 VACCINE

NIH National Institutes of Health

NIH National Institute of Allergy and Infectious Diseases

TNX-4200: BROAD=SPECTRUM ANTIVIRAL

U.S. Department of Defense

DTRA Defense Threat Reduction Agency

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

Management Team

Seth Lederman, MD
Co-Founder, CEO & Chairman

TARGENT | Fusilev (levoleucovorin) for injection | vela

Gregory Sullivan, MD
Chief Medical Officer

Columbia University Department of Psychiatry | New York State Psychiatric Institute

Bradley Saenger, CPA
Chief Financial Officer

Shire | VERTEX | Steward | pwc

Jessica Morris
Chief Operating Officer

Deutsche Bank | svb Silicon Valley Bank | American Capital

© 2024 Tonix Pharmaceuticals Holding Corp.

Milestones: Recently Completed and Upcoming

Tonmya™ Milestones

☑ 4th Quarter 2023	Statistically significant topline results of Phase 3 RESILIENT study for Tonmya™ for the management of fibromyalgia
☑ 2nd Quarter 2024	Type B CMC and clinical pre-NDA meetings with FDA for Tonmya™ for fibromyalgia
❑ 2nd Half 2024	Submit NDA to FDA for Tonmya™ for fibromyalgia

Other Key Program Milestones

❑ 3rd Quarter 2024	Initiate Phase 2 study of TNX-102 SL for acute stress disorder
❑ 3rd Quarter 2024	Initiate Phase 2 study of TNX-1300 for the treatment of cocaine intoxication

© 2024 Tonix Pharmaceuticals Holding Corp.

THANK YOU

© 2024 Tonix Pharmaceuticals Holding Corp.

Zembrace® Important Safety Information (1 of 2)

Zembrace SymTouch (Zembrace) can cause serious side effects, including heart attack and other heart problems, which may lead to death. Stop use and get emergency help if you have any signs of a heart attack:

- Discomfort in the center of your chest that lasts for more than a few minutes or goes away and comes back; severe tightness, pain, pressure, or heaviness in your chest, throat, neck, or jaw; pain or discomfort in your arms, back, neck, jaw or stomach; shortness of breath with or without chest discomfort; breaking out in a cold sweat; nausea or vomiting; feeling lightheaded

Zembrace is not for people with risk factors for heart disease (high blood pressure or cholesterol, smoking, overweight, diabetes, family history of heart disease) unless a heart exam shows no problem.

Do not use Zembrace if you have:

- History of heart problems; narrowing of blood vessels to your legs, arms, stomach, or kidney (peripheral vascular disease); uncontrolled high blood pressure; hemiplegic or basilar migraines. If you are not sure if you have these, ask your provider.
- Had a stroke, transient ischemic attacks (TIAs), or problems with blood circulation; severe liver problems; taken any of the following medicines in the last 24 hours: almotriptan, eletriptan, frovatriptan, naratriptan, rizatriptan, ergotamines, dihydroergotamine; are taking certain antidepressants, known as monoamine oxidase (MAO)-A inhibitors or it has been 2 weeks or less since you stopped taking a MAO-A inhibitor. Ask your provider for a list of these medicines if you are not sure.
- An allergy to sumatriptan or any of the components of Zembrace

Tell your provider about all of your medical conditions and medicines you take, including vitamins and supplements.

Zembrace can cause dizziness, weakness, or drowsiness. If so, do not drive a car, use machinery, or do anything where you need to be alert.

© 2024 Tonix Pharmaceuticals Holding Corp.

Zembrace® Important Safety Information (2 of 2)

Zembrace may cause serious side effects including:

- Changes in color or sensation in your fingers and toes; sudden or severe stomach pain, stomach pain after meals, weight loss, nausea or vomiting, constipation or diarrhea, bloody diarrhea, fever; cramping and pain in your legs or hips; feeling of heaviness or tightness in your leg muscles; burning or aching pain in your feet or toes while resting; numbness, tingling, or weakness in your legs; cold feeling or color changes in one or both legs or feet; increased blood pressure including a sudden severe increase even if you have no history of high blood pressure; medication overuse headaches from using migraine medicine for 10 or more days each month. If your headaches get worse, call your provider.
- Serotonin syndrome, a rare but serious problem that can happen in people using Zembrace, especially when used with anti-depressant medicines called SSRIs or SNRIs. Call your provider right away if you have: mental changes such as seeing things that are not there (hallucinations), agitation, or coma; fast heartbeat; changes in blood pressure; high body temperature; tight muscles; or trouble walking.
- Hives (itchy bumps); swelling of your tongue, mouth, or throat
- Seizures even in people who have never had seizures before

The most common side effects of Zembrace include: pain and redness at injection site; tingling or numbness in your fingers or toes; dizziness; warm, hot, burning feeling to your face (flushing); discomfort or stiffness in your neck; feeling weak, drowsy, or tired.

Tell your provider if you have any side effect that bothers you or does not go away. These are not all the possible side effects of Zembrace. For more information, ask your provider.

This is the most important information to know about Zembrace but is not comprehensive. For more information, talk to your provider and read the Patient Information and Instructions for Use. You can also visit www.upsher-smith.com or call 1-888-650-3789. For full Prescribing Information, visit: https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=6e5b104f-2b9e-416e-92fb-ef1bdaea867d

You are encouraged to report adverse effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

Zembrace is a prescription medicine used to treat acute migraine headaches with or without aura in adults who have been diagnosed with migraine.

Zembrace is not used to prevent migraines. It is not known if it is safe and effective in children under 18 years of age.

CNS PORTFOLIO

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

Tosymra® Important Safety Information (1 of 2)

Tosymra® can cause serious side effects, including heart attack and other heart problems, which may lead to death. Stop Tosymra and get emergency medical help if you have any signs of heart attack:

- Discomfort in the center of your chest that lasts for more than a few minutes or goes away and comes back; severe tightness, pain, pressure, or heaviness in your chest, throat, neck, or jaw; pain or discomfort in your arms, back, neck, jaw, or stomach; shortness of breath with or without chest discomfort; breaking out in a cold sweat; nausea or vomiting; feeling lightheaded

Tosymra is not for people with risk factors for heart disease (high blood pressure or cholesterol, smoking, overweight, diabetes, family history of heart disease) unless a heart exam is done and shows no problem.

Do not use Tosymra if you have:

- History of heart problems; narrowing of blood vessels to your legs, arms, stomach, or kidney (peripheral vascular disease); uncontrolled high blood pressure; severe liver problems; hemiplegic or basilar migraines. If you are not sure if you have these, ask your healthcare provider.
- Had a stroke, transient ischemic attacks (TIAs), or problems with blood circulation; taken any of the following medicines in the last 24 hours: almotriptan, eletriptan, frovatriptan, naratriptan, rizatriptan, ergotamines, or dihydroergotamine. Ask your provider if you are not sure if your medicine is listed above
- are taking certain antidepressants, known as monoamine oxidase (MAO)-A inhibitors or it has been 2 weeks or less since you stopped taking a MAO-A inhibitor. Ask your provider for a list of these medicines if you are not sure
- An allergy to sumatriptan or any ingredient in Tosymra

Tell your provider about all of your medical conditions and medicines you take, including vitamins and supplements. Tosymra can cause dizziness, weakness, or drowsiness. If so, do not drive a car, use machinery, or do anything where you need to be alert.

CNS PORTFOLIO

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

Tosymra® Important Safety Information (2 of 2)

Tosymra may cause serious side effects including:

- Changes in color or sensation in your fingers and toes; sudden or severe stomach pain, stomach pain after meals, weight loss, nausea or vomiting, constipation or diarrhea, bloody diarrhea, fever; cramping and pain in your legs or hips, feeling of heaviness or tightness in your leg muscles, burning or aching pain in your feet or toes while resting, numbness, tingling, or weakness in your legs, cold feeling or color changes in one or both legs or feet; increased blood pressure including a sudden severe increase even if you have no history of high blood pressure; medication overuse headaches from using migraine medicine for 10 or more days each month. **If your headaches get worse, call your provider**.
- Serotonin syndrome, a rare but serious problem that can happen in people using Tosymra, especially when used with anti-depressant medicines called SSRIs or SNRIs. **Call your provider right away if you have**: mental changes such as seeing things that are not there (hallucinations), agitation, or coma; fast heartbeat; changes in blood pressure; high body temperature; tight muscles; or trouble walking.
- Seizures even in people who have never had seizures before

The most common side effects of Tosymra include: tingling, dizziness, feeling warm or hot, burning feeling, feeling of heaviness, feeling of pressure, flushing, feeling of tightness, numbness, application site (nasal) reactions, abnormal taste, and throat irritation.

Tell your provider if you have any side effect that bothers you or does not go away. These are not all the possible side effects of Tosymra. For more information, ask your provider.

This is the most important information to know about Tosymra but is not comprehensive. For more information, talk to your provider and read the Patient Information and Instructions for Use. You can also visit www.upsher-smith.com or call 1-888-650-3789. For full Prescribing Information, visit: https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=015a5cf9-f246-48bc-b91e-cd730a53d8aa

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch, or call 1-800-FDA-1088.

Tosymra is a prescription medicine used to treat acute migraine headaches with or without aura in adults.

Tosymra is not used to treat other types of headaches such as hemiplegic or basilar migraines or cluster headaches.

Tosymra is not used to prevent migraines. It is not known if Tosymra is safe and effective in children under 18 years of age.

© 2024 Tonix Pharmaceuticals Holding Corp.

TONIX PHARMACEUTICALS

Exhibit 99.02

Cautionary Note on Forward-Looking Statements

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 PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

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

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

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

INFECTIOUS DISEASE PORTFOLIO

[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

TONIX PHARMACEUTICALS

© 2024 Tonix Pharmaceuticals Holding Corp.

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

© 2024 Tonix Pharmaceuticals Holding Corp.

INFECTIOUS DISEASE PORTFOLIO

TONIX PHARMACEUTICALS

Enhancing Viral Immunity Has the Potential to Protect Against Viral Diseases

Too Little — **Spectrum of Immunity** — Too Much

Immune Suppression — Autoimmunity

Therapeutic Zone

Tone down the immune system to treat:

Rev up the immune system to treat:

Autoimmunity examples:
Humira®
Enbrel®
Rituxan®

Allergy examples:
Dupixent®

Cancer examples:
Keytruda®
Opdivo®

Viral disease examples:
Intron A®
Pegasys®

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

© 2024 Tonix Pharmaceuticals Holding Corp.

INFECTIOUS DISEASE PORTFOLIO

TONIX PHARMACEUTICALS

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]

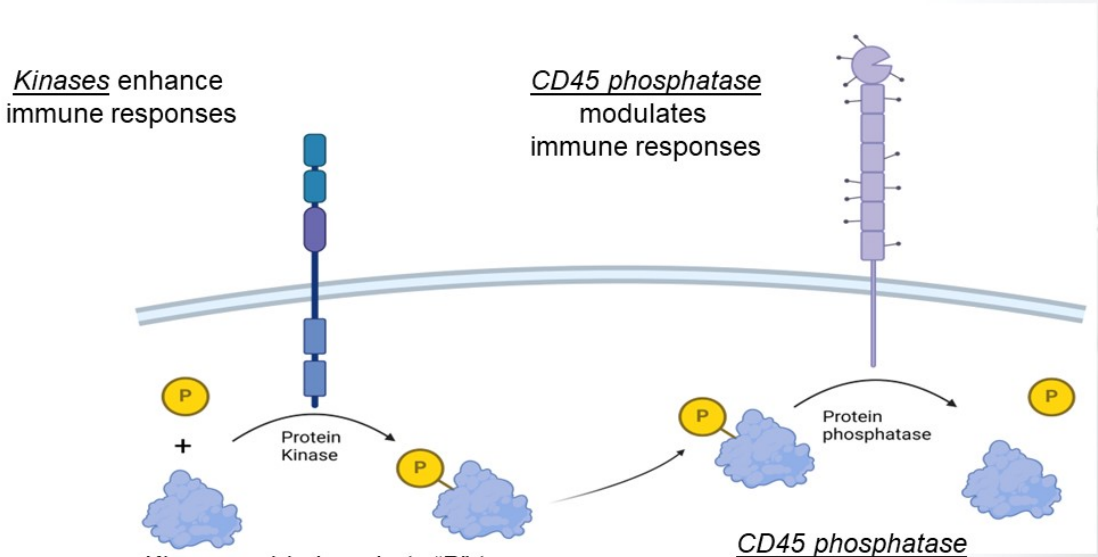
***Goal*: Develop an orally available small molecule that reduces CD45 enzymatic activity**

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.

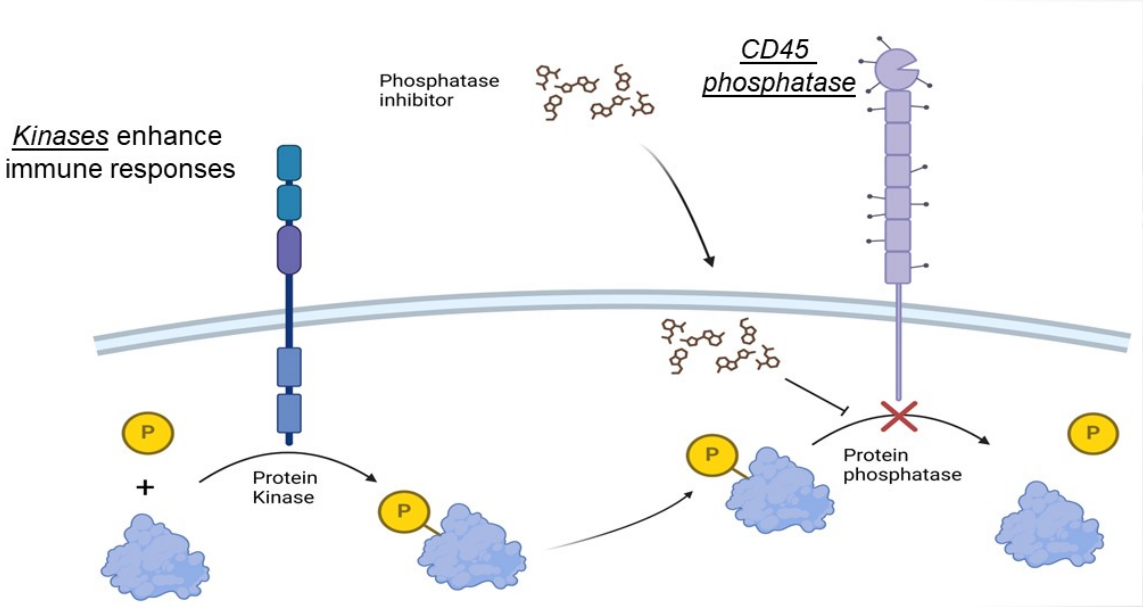
© 2024 Tonix Pharmaceuticals Holding Corp.

Kinases Enhance and Phosphatases Modulate Immune Responses



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
© 2024 Tonix Pharmaceuticals Holding Corp.

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.

© 2024 Tonix Pharmaceuticals Holding Corp.

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

© 2024 Tonix Pharmaceuticals Holding Corp.

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

© 2024 Tonix Pharmaceuticals Holding Corp.

Sina Bavari, PhD – Director of Infectious Disease Reserach

- **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 in Nature 2016 and showed showing that GS-5734 (Remdesivir) works against SARS-CoV and MERS, which led to the testing of Remdesivir/GS-5734 in SARS-CoV-2[3]

[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.

© 2024 Tonix Pharmaceuticals Holding Corp.

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

INFECTIOUS DISEASE PORTFOLIO

TONIX PHARMACEUTICALS

*CDMRP = Congressionally directed medical research program

© 2024 Tonix Pharmaceuticals Holding Corp.

THANK YOU

© 2024 Tonix Pharmaceuticals Holding Corp.