



Corporate Presentation

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.

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

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

Key Clinical Programs

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

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

**Investigator-initiated study



TONIX
PHARMACEUTICALS

**CNS:
KEY DEVELOPMENT
CANDIDATES**



About Fibromyalgia

Fibromyalgia is a **chronic pain disorder** resulting from amplified sensory and pain signaling within the CNS¹

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 drugs²

Fibromyalgia is the prototypic nociplastic syndrome

¹American Chronic Pain Association (www.theacpa.org, 2019)

²The three drugs with FDA approval for the treatment of fibromyalgia: Pregabalin (Lyrica®); Duloxetine (Cymbalta®); Milnacipran (Savella®)



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 therapy⁵: 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 therapies⁵
- **~2.7 million FM patients diagnosed and treated⁶**
 - >22 million prescriptions are issued for the treatment of fibromyalgia (on- and off-label usage) each year^{7,8}
- **No new Rx product since 2009**
- *The treatment objective is to restore functionality and quality of life by broadly improving symptoms while avoiding significant side effects*

¹American College of Rheumatology (www.ACRPatientInfo.org accessed May 7, 2019) – prevalence rate of 2-4% for U.S. adult population (~250 million)

²Vincent 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

³Robinson RL, et al. *Pain Med*. 2012 13(10):1366-76. doi: 10.1111; 85% received drug treatment

⁴The three drugs with FDA approval for the treatment of fibromyalgia: Pregabalin (Lyrica); Duloxetine (Cymbalta); Milnacipran (Savella)

⁵EVERSANA primary physician research, May 2024; commissioned by Tonix

⁶EVERSANA analysis of claims database, May 2024; commissioned by Tonix

⁷Product sales derived from IMS MIDAS; IMS NDTI used to factor usage for fibromyalgia; data accessed April 2015.

⁸Market research by Frost & Sullivan, commissioned by Tonix, 2011

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.

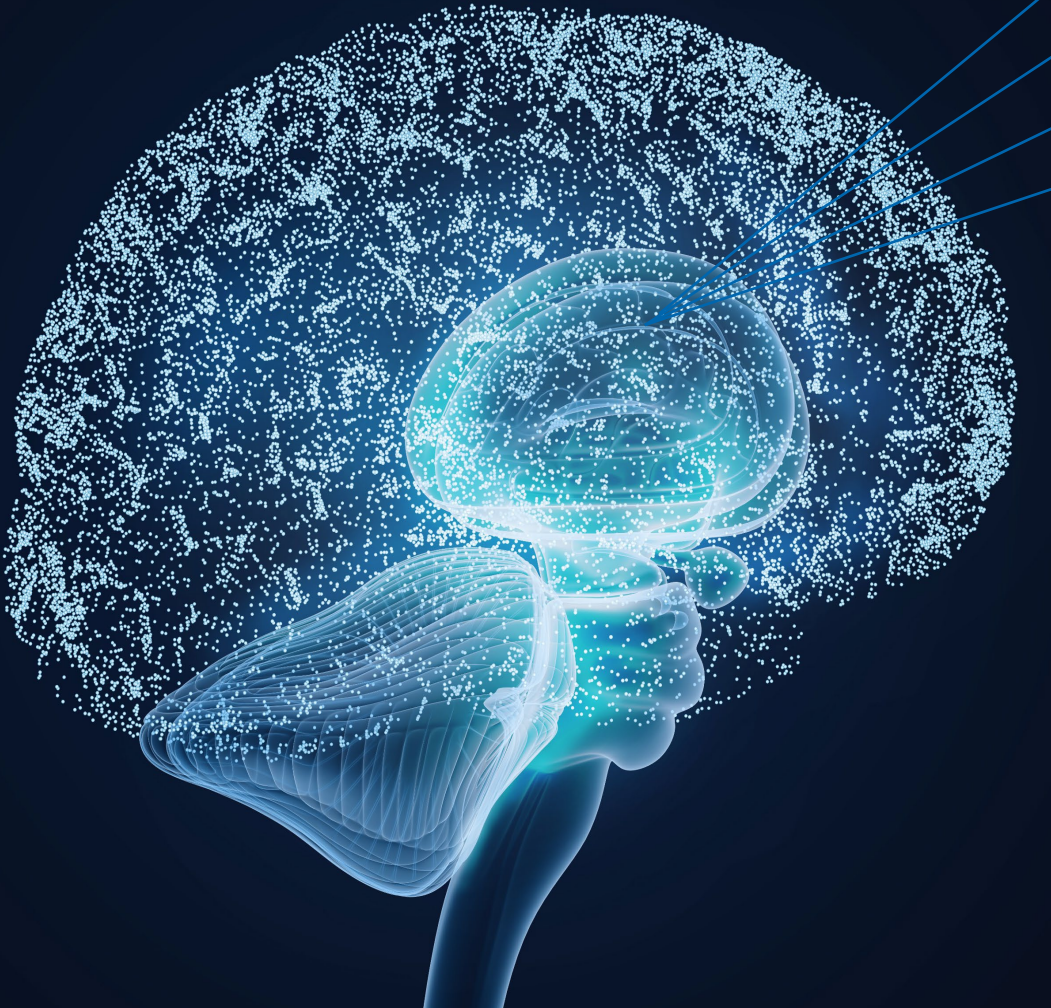
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TONIX
PHARMACEUTICALS

TNX-102 SL: Unique MOA Facilitates Restorative Sleep

Centrally Acting Analgesic

Potent binding and antagonist activities at four key receptors facilitate *restorative sleep*

- 
- *serotonergic-5-HT2A*
 - *adrenergic- α 1*
 - *histaminergic-H1*
 - *muscarinic-M1*

Key Differentiators

Relative to Oral Cyclobenzaprine

- Lower daytime exposure
- Avoids first-pass metabolism
- Reduces risk of pharmacological interference from major metabolite

Relative to Standard of Care

- Potential for better tolerability while maintaining efficacy
- Not scheduled nor with recognized abuse potential

Issued patents expected to provide exclusivity to 2034/2035

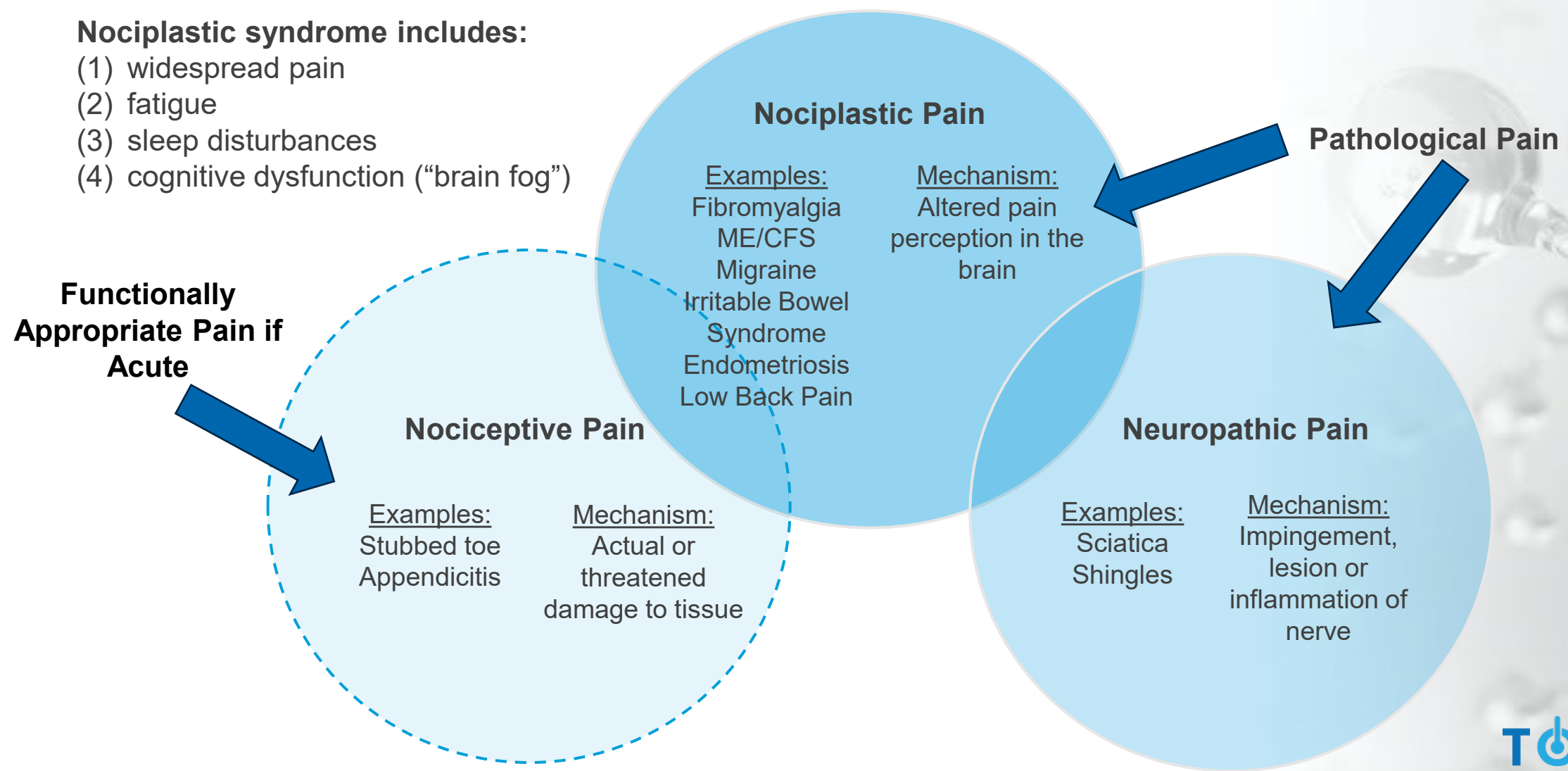
Protectic® formulation based on eutectic composition of matter



The Third Type of Pain: Nociplastic Pain¹

Nociplastic syndrome includes:

- (1) widespread pain
- (2) fatigue
- (3) sleep disturbances
- (4) cognitive dysfunction (“brain fog”)



¹Trouvin AP, et al. *Best Pract Res Clin Rheumatol.* 2019;33(3):101415.

Fibromyalgia is Believed to Result from Chronic Pain or Prior Stress Experiences

The pain system evolved to detect acute pain

- The body's "check engine" light

Chronic pain breaks down the system that determines whether a sensory experience is painful

- Chronic pain results in nociplastic syndromes
- Nociplastic syndrome was formerly known as "Central and Peripheral Sensitization"

Chronic Overlapping Pain Conditions (COPCs) are Nociplastic Syndromes:

- Fibromyalgia
- ME/CFS
- Migraine
- Irritable Bowel Syndrome
- Endometriosis
- Low Back Pain

Stresses that may precede or precipitate FM include:

Chronic nociceptive pain

- e.g., osteoarthritis

Chronic neuropathic pain

- e.g., diabetic neuropathy

Infectious

- e.g., viral illness

Cancer

- e.g., breast cancer

Chemical

- e.g., cancer chemotherapy

Traumatic

- e.g., motor vehicle accident

Physiologic

- e.g., disturbed sleep





Common Chronic Conditions are a Challenge for Pharma

Fibromyalgia is a common chronic disease¹

- Chronic pain syndrome that persists for years or decades

No animal model is recognized for nociplastic syndromes or its component symptoms

- Widespread pain
- Fatigue
- Sleep disturbance
- Cognitive impairment

Nociplastic symptoms are subjective

- Humans need to report symptoms using scales

Clinical trials measuring subjective symptoms are challenging

- Placebo response is typically observed
- Long-term therapy means requires long-term tolerability

¹The U.S. Centers for Disease Control defines chronic diseases as “conditions that last 1 year or more and require ongoing medical attention or limit activities of daily living or both.” www.cdc.gov/chronicdisease/about/index.htm. (accessed Jan 28, 2024)



Common Chronic Conditions are a Challenge for Society

The Opioid Crisis in the U.S. was driven by mistreatment of chronic pain, which was often nociplastic pain

- The epidemic of prescription pain killers was addressed by regulations which limited the availability of opioids
- Many individuals who are opioid dependent have transitioned to illegal street heroin and fentanyl
- Illegal drugs contribute to homelessness

There is an unmet need for non-opioid analgesics that address nociplastic pain

- No new drug for fibromyalgia has been approved since 2009



Current FDA-Approved Fibromyalgia Drugs were Repurposed¹

Human investigation was required to find drugs that improve pain in fibromyalgia

- No current product addresses pain, poor sleep and fatigue

Drug		Lyrica® - Pfizer	Cymbalta® - Lilly Savella® - AbbVie
Initial Indication Sought		Epilepsy	Depression
Class		Gabapentinoid	SNRI
Mechanism		Slow neuron firing	Block NE reuptake
Fibromyalgia Activity	Pain	+	+
	Sleep	+	-
	Fatigue	-	+
Tolerability Issues	Sleep	-	+
	Fatigue	+	-
		Weight gain	Blood Pressure increases
			Sexual function impairment
			GI issues

¹The three drugs with FDA approval for the treatment of fibromyalgia: Pregabalin (Lyrica); Duloxetine (Cymbalta); Milnacipran (Savella)



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 2020¹**
- **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**

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

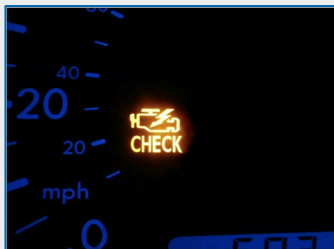
Tonmya™ (TNX-102 SL): Fibromyalgia Cyclobenzaprine Protectic® Sublingual Tablets



PROFILE

Fibromyalgia (FM) is a chronic pain disorder resulting from amplified sensory and pain signaling within the CNS

- Afflicts an estimated 6-12 million adults in the U.S., the majority of whom are women¹
- Symptoms include chronic widespread pain, nonrestorative sleep, fatigue, and cognitive dysfunction
- Patients struggle with daily activities, have impaired quality of life, and frequently are disabled
- Physicians and patients report common dissatisfaction with currently marketed products



When the check engine light malfunctions, the light is on even though the car is not malfunctioning

Patents Issued

DEVELOPMENT PROGRAM

Market Entry: Fibromyalgia

Status: One statistically significant Phase 3 study RELIEF completed, p -value = 0.01²

Second Phase 3 study RALLY missed primary endpoint

Confirmatory Phase 3 study RESILIENT statistically significant, p -value = 0.00005

Positive Type B CMC and clinical pre-NDA meetings with FDA completed

Next Steps: File NDA in 2H'24

Additional Indications: Fibromyalgia-type Long COVID, Acute Stress Disorder (ASD), PTSD, Agitation in Alzheimer's, Alcohol Use Disorder

*TNX-102 SL has not been approved for any indication.

¹American Chronic Pain Association (www.theacpa.org, 2019)

²Lederman S, et al. *Arthritis Care Res (Hoboken)*. 2023 Nov;75(11):2359-2368. doi: 10.1002.

Tonmya™ (TNX-102 SL): Phase 3 *RESILIENT* Study Design

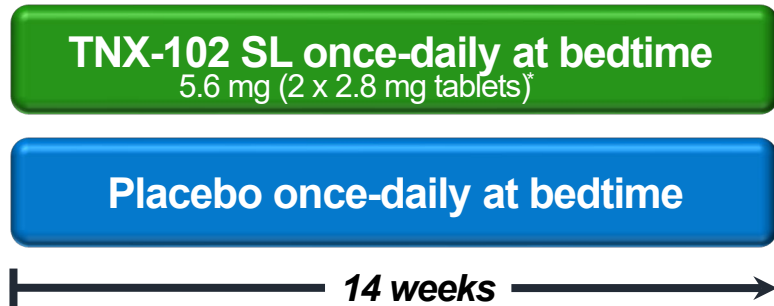


General study characteristics:

- Randomized, double-blind, multicenter, placebo-controlled study in fibromyalgia
- 33 U.S. sites enrolled 457 participants with fibromyalgia as defined by 2016 Revisions to the 2010/2011 FM Diagnostic Criteria¹

Primary Endpoint:

- Change from baseline to Week 14 (TNX-102 SL vs. placebo) in weekly averages of daily diary average pain severity score



ClinicalTrials.gov Identifier: **NCT05273749**

Study Title: A Phase 3 Study to Evaluate the Efficacy and Safety of TNX-102 SL Taken Daily in Patients With Fibromyalgia (RESILIENT)

Trial ID: TNY-CY-F307 ('RESILIENT')

*Two-week run-in at 2.8 mg dose at bedtime followed by 12 weeks at 5.6 mg dose

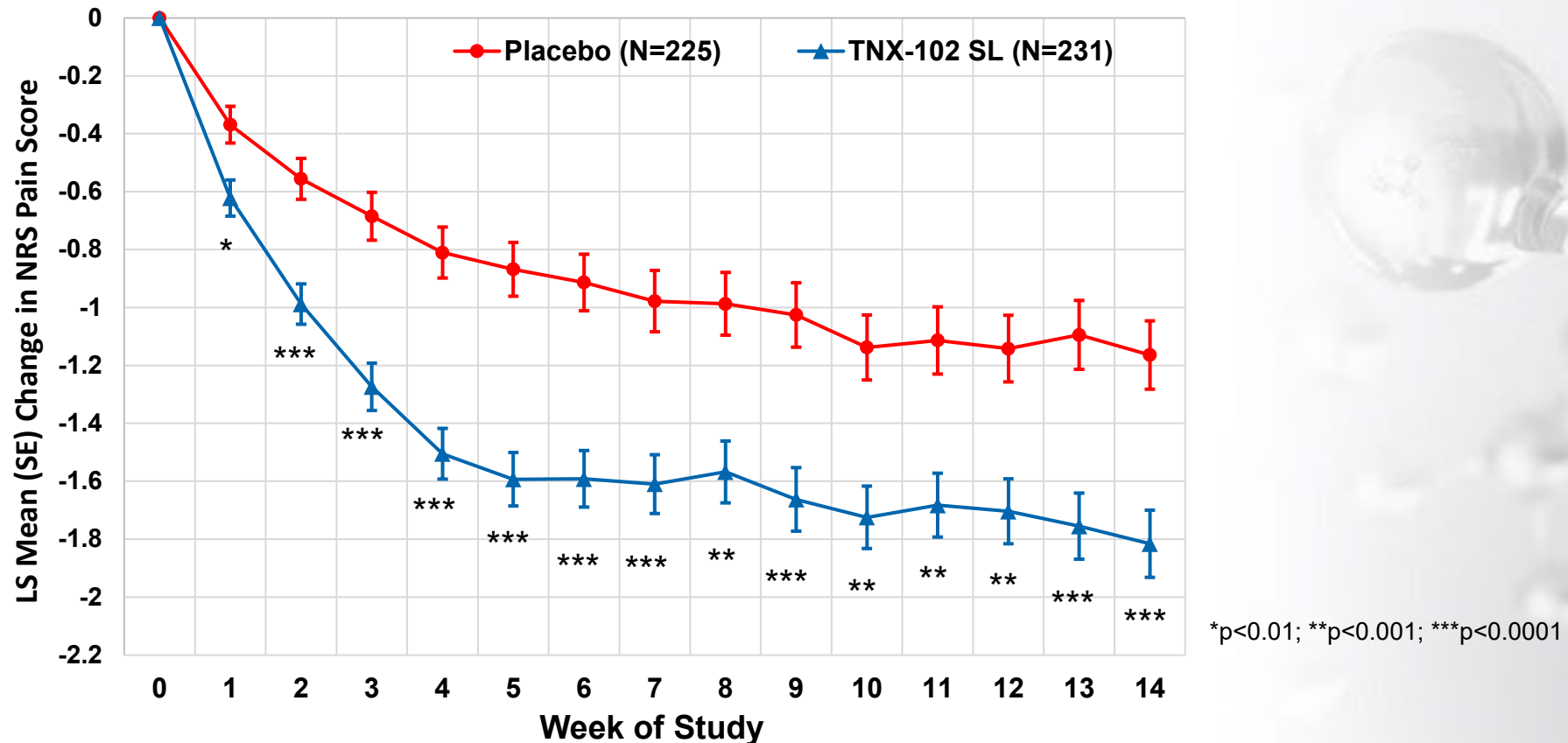
¹Wolfe F, et al. *Semin Arthritis Rheum.* 2016 46(3):319-329. doi: 10.1016

RESILIENT Primary Outcome Measure

Reduction in Widespread Pain



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



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



Summary of Key Pre-Specified Secondary Outcome Measures

<u>Rating Scale</u>	<u>Week 14</u>	<u>Met**</u>
Patient Global Impression of Change (PGIC)	<i>p < 0.001</i>	✓
Fibromyalgia Impact Questionnaire - Symptoms	<i>p < 0.001</i>	✓
Fibromyalgia Impact Questionnaire - Function	<i>p = 0.001</i>	✓
PROMIS Sleep Disturbance	<i>p < 0.001</i>	✓
PROMIS Fatigue	<i>p < 0.001</i>	✓
Weekly average of daily Sleep Quality scores	<i>p < 0.001</i>	✓

*In order of statistical serial gate-keeping hierarchy (or, “waterfall”) to control overall Type 1 error

**Statistical significance met



RESILIENT Pre-Specified Primary Endpoint

Summary¹

- Tonmya™ (TNX-102 SL) demonstrated statistically significant improvement in mean weekly pain scores over placebo at Week 14
- [P-value of 0.00005](#) is highly statistically significant

Additional Findings

- Effect size 0.38
- All pre-specified sensitivity analyses of the primary endpoint show statistical significance ($p \leq 0.001$)
- Rapid onset of action: p -values <0.01 at each weekly time point, including Week 1

¹EULAR 2024. "Targeting Non-Restorative Sleep in Fibromyalgia with Bedtime TNX-102 SL (Sublingual Cyclobenzaprine HCl) Significantly Improves Pain in RESILIENT, a Confirmatory Phase 3 Randomized Clinical Trial." <https://www.tonixpharma.com/wp-content/uploads/2024/06/EULAR-2024-FM-Poster-vFinal.pdf>

RESILIENT Safety Summary



Among participants randomized to Tonmya™ (TNX-102 SL) and to placebo, 81.0% and 79.6%, respectively, completed the study

Tonmya™ (TNX-102 SL) was generally well tolerated with an adverse event (AE) profile comparable to prior fibromyalgia studies

- No new safety signals were observed
- AE-related study discontinuations occurred in 6.1% and 3.6% of patients in the TNX-102 SL and placebo groups, respectively
- Events rated as mild or moderate made up 97.2% of AEs on placebo and 99.1% on TNX-102 SL
- As observed in prior studies with TNX-102 SL, oral administration site AEs were higher in TNX-102 SL than placebo, 42.9% and 10.2%, respectively
 - Most common oral AEs were oral hypoaesthesia, product taste abnormal, oral paraesthesia, and tongue discomfort (see table on next slide)
 - Nearly all of these common oral AEs were temporally related to dosing and lasted <60 minutes
- Serious Adverse Events (SAEs)
 - Three placebo participants experienced an SAE:
 - 1. Pneumonia, 2. Muscular weakness, and 3. Hypertension/Angina/Coronary Artery Disease
 - Two TNX-102 SL participants experienced an SAE
 - 1. Renal carcinoma deemed not related to study drug
 - 2. Acute pancreatitis with onset 14 days after completion of treatment phase, deemed 'possibly related'* to study drug
 - Outcome: 'Recovered/Resolved'
 - *Note: participant was non-compliant with end of treatment study visits, and the last dose before onset of SAE was not known at the time that relationship with study drug was assessed by Investigator and Sponsor

Treatment-Emergent Adverse Events (TEAEs) at Rate of $\geq 3\%$ 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

Changes in Sexual Functioning Questionnaire short form (CSFQ-14) was a safety measure in the study

- In females, CSFQ-14 total score improved (indicating better sexual functioning) to a greater extent in the TNX-102 SL group compared with placebo, $p=0.010$
- Orgasm/Completion and Desire/Frequency were improved
- Potential tolerability advantage over pharmacotherapeutics with potent serotonin reuptake inhibition



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



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

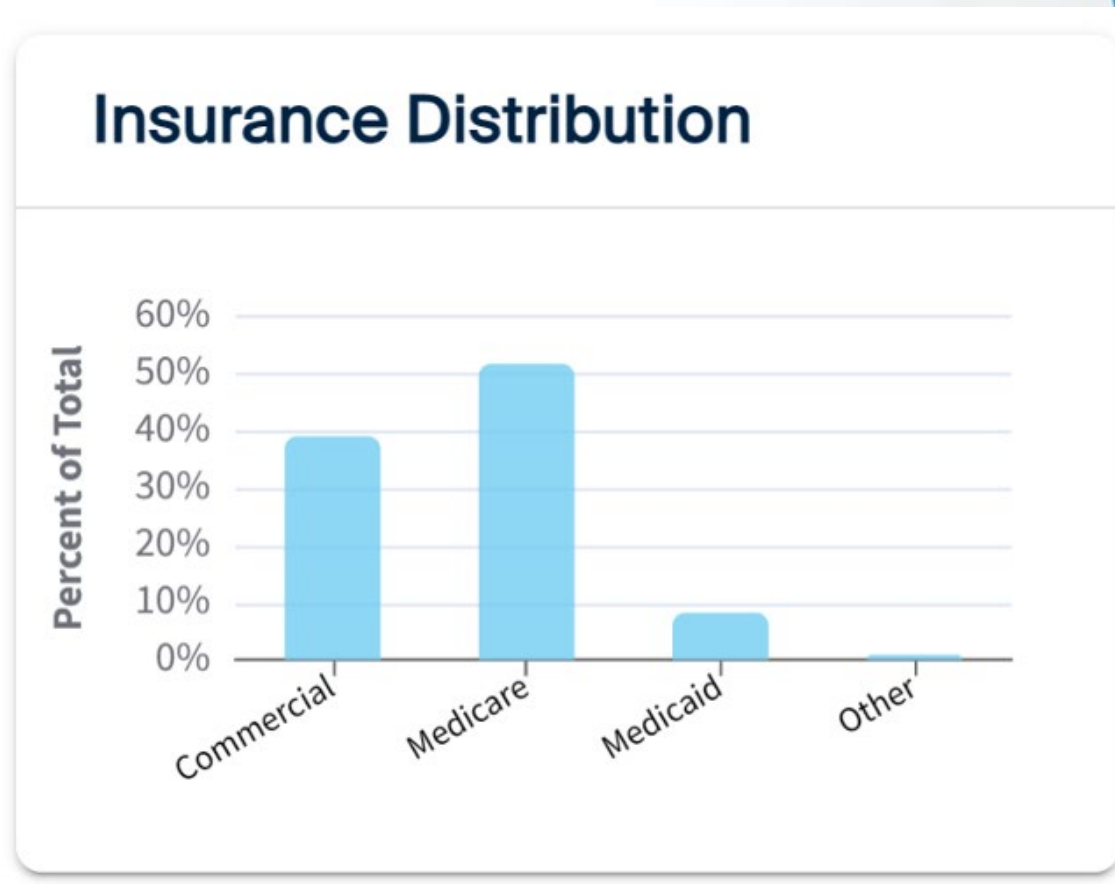
Approximately 50% of fibromyalgia patients are on Medicare

- EVERSANA analysis of claims database consisting of 2.2M patients, for which 1.2M claims were submitted throughout March 2002-March 2023¹

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 Coverage¹



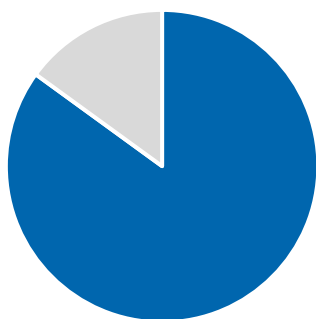
¹ EVERSANA analysis of claims database, May 2024; commissioned by Tonix

² Source: [Final CY 2025 Part D Redesign Program Instructions Fact Sheet | CMS](#)

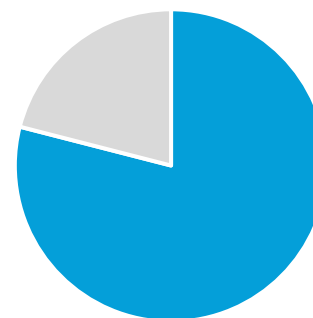


Prescribers Interviewed are Broadly Dissatisfied with Available Fibromyalgia Medications: Results of Primary Research¹

Perspectives on FM Therapies from Prescribers Interviewed		
Drug	Positives	Negatives
Duloxetine <i>(Cymbalta, generic)</i>	<ul style="list-style-type: none"> Relatively high efficacy (compared to alternatives) Can be titrated slowly from 20mg to 120mg 	<ul style="list-style-type: none"> Tolerability issues: worsening depression, insomnia Seldom used as a monotherapy; often requires adjunct
Pregabalin <i>(Lyrica, generic)</i>	<ul style="list-style-type: none"> Relatively high efficacy (compared to alternatives) Can often be safely combined with other medications 	<ul style="list-style-type: none"> Suboptimal for long-term use (e.g., weight gain) Schedule V status makes some HCPs more cautious to Rx
Savella <i>(milnacipran)</i>	<ul style="list-style-type: none"> Offers another option if patient fails Cymbalta or Lyrica 	<ul style="list-style-type: none"> Subpar efficacy does not counterbalance tolerability issues High cost and access constraints (~\$50/month)
Cyclobenzaprine <i>(Flexeril, generic; oral formulation, off-label)</i>	<ul style="list-style-type: none"> Active for initiating and sustaining sleep; can be titrated up Active for pain driven by stiffness and muscle spasms 	<ul style="list-style-type: none"> 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

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

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

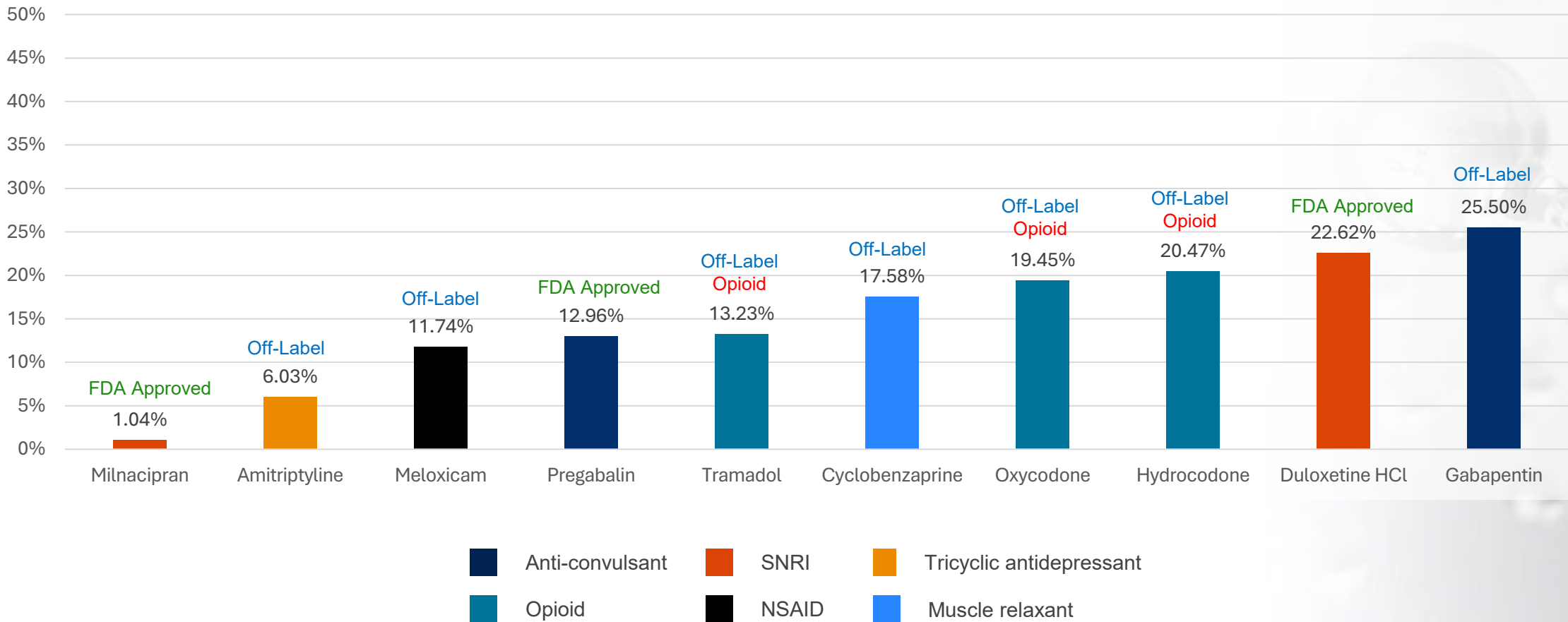
¹ EVERSANA primary physician research, May 2024; commissioned by Tonix

² EVERSANA analysis of claims database, May 2024; commissioned by Tonix

Many Fibromyalgia Patients are Prescribed Off-Label Drugs; ~53% FM Patients Prescribed Opioids Off-Label^{1,2}



% FM Patients (after index³ date)



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



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

¹Accessed June 7, 2024



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

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

Role of Infections in Triggering Fibromyalgia or Chronic fatigue (CFS)-Like Illnesses

- Symptoms of Long COVID, like multi-site pain, fatigue and insomnia, are the hallmarks of chronic pain syndromes like fibromyalgia and myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS).
- In August 2022, the HHS released the *National Research Action Plan on Long COVID*¹ which endorses the connection between Long COVID and chronic fatigue syndrome.

Infection initiates an autoreactive process, which affects several functions, including brain and energy metabolism²⁻⁷

- Infections can trigger any of these conditions in approximately 10% of exposed individuals
- The initial location of the infection determines the subsequent pain syndrome
- Any type of infectious diarrhea will trigger irritable bowel syndrome (IBS) in 10% to 20% of those exposed



¹Department of Health and Human Services, Office of the Assistant Secretary for Health. 2022. National Research Action Plan on Long COVID, 200 Independence Ave SW, Washington, DC 20201.

²Blomberg J, et al. Front Immunol. 2018;9:229. Published 2018 Feb 15.

³Warren JW, et al. Urology. 2008;71(6):1085-1090.

⁴Buskila D, et al. Autoimmun Rev. 2008;8(1):41-43.

⁵Hickie I, et al. BMJ. 2006;333(7568):575.

⁶Parry SD, et al. Am J Gastroenterol. 2003;98(9):1970-1975.

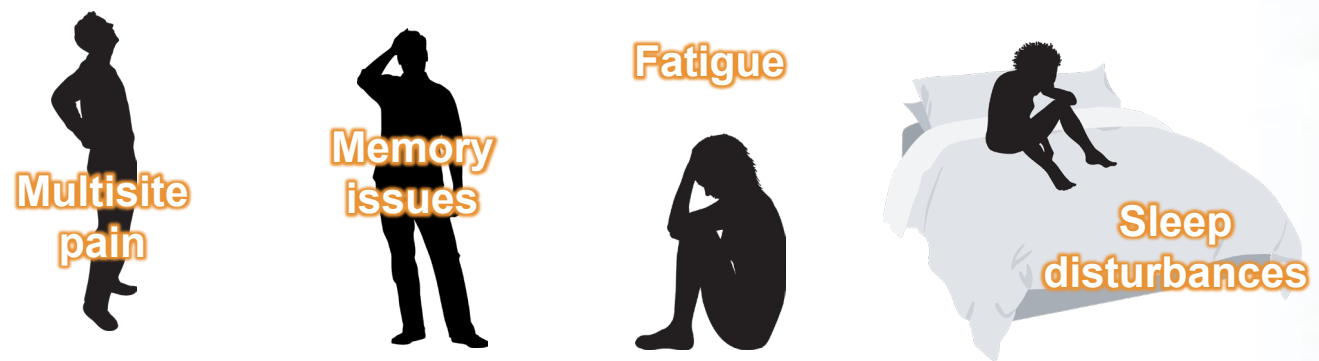
⁷Halvorson HA, et al. Am J Gastroenterol. 2006;101(8):1894-1942.





About Fibromyalgia-Type Long COVID

Long COVID is broadly defined as signs, symptoms, and conditions that continue or develop after acute COVID-19 infection¹



Many Long-COVID symptoms overlap with core symptoms of fibromyalgia and are hallmarks of other chronic pain syndromes like myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS)

19%

Long COVID occurs in approximately 19% of recovered COVID-19 patients²

40%

As many as 40% of Long COVID patients experience multi-site pain^{3,4}

¹CDC - <https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html#:~:text=Some%20people%20who%20have%20been,after%20acute%20COVID%2D19%20infection.>

²CDC Press Release, June 22, 2022 - https://www.cdc.gov/nchs/pressroom/nchs_press_releases/2022/20220622.htm

³Harris, H, et al. Tonix data on file. 2022

⁴TriNetX Analytics

TNX-102 SL for Fibromyalgia-Type Long COVID: Phase 2 PREVAIL Study Design



Study characteristics:

- Randomized, double-blind, placebo-controlled study of TNX-102 SL in fibromyalgia-type Long COVID
- U.S. sites only, **completed enrollment of 63 patients**

Primary Endpoint:

- Daily diary pain severity score change from baseline to Week 14 (TNX-102 SL vs. placebo)
 - Weekly averages of the daily numerical rating scale scores

TNX-102 SL once-daily at bedtime
5.6 mg (2 x 2.8 mg tablets)*

*Two week run in at 2.8 mg dose at bedtime, followed by 12 weeks at 5.6 mg dose

Placebo once-daily at bedtime

ClinicalTrials.gov Identifier: NCT05472090
“A Phase 2 Study to Evaluate the Efficacy and Safety of TNX-102 SL in Patients With Multi-Site Pain Associated With Post-Acute Sequelae of SARS-CoV-2 Infection (PREVAIL)”

14 weeks

Next Steps: *End of Phase 2 Meeting with FDA*



TNX-102 SL: Phase 2 PREVAIL Topline Results¹

Did not meet the primary endpoint of multi-site pain reduction at Week 14

However, findings fulfill the objectives of proof-of-concept study, supporting the decision to advance the program based on a proposed primary endpoint using the PROMIS Fatigue scale

- TNX-102 SL showed robust effect size in improving fatigue and consistent activity across secondary measures of sleep quality, cognitive function, disability and Patient Global Impression of Change (PGIC)
- Was generally well tolerated with an adverse event (AE) profile comparable to prior studies with TNX-102 SL:
 - AE-related discontinuations were similar in drug and placebo arms
 - No new safety signals were observed

Fatigue is the signature symptom of Long COVID and has been identified as the dominant symptom contributing to disability²

- We observed numerical improvement in the PROMIS fatigue score (in RELIEF $p=0.007$ MMRM and in RALLY $p=0.007$ MMRM) in both prior Phase 3 studies of TNX-102 SL in fibromyalgia,
- We believe the results of PREVAIL, together with extensive data from studies in other chronic conditions³⁻⁵, makes PROMIS Fatigue a solid candidate for the primary endpoint of future Long COVID registrational studies

¹Tonix Press Release, September 5, 2023 - <https://bit.ly/3Z6FQHQ>

²Walker S, et al. *BMJ Open* 2023;13:e069217. doi:10.1136/bmjopen-2022-069217

³Cook, K.F., et al. 2016. *Journal of Clinical Epidemiology*, 73, 89- 102

⁴Cella, D., et al. 2016. *Journal of Clinical Epidemiology*, 73, 128-134

⁵Lai, J.S., et al. 2011. *Archives of Physical Medicine and Rehabilitation*, 92(10 Supplement), S20-S27.



Acute Stress Reaction (ASR) / Acute Stress Disorder (ASD)

ASR/ASD are acute stress conditions resulting from trauma which can affect both civilian and military populations.

Large unmet need:

- According to National Center for PTSD, about 60% of men and 50% of women in the US are exposed least one traumatic experience in their lives¹
- In the US alone, one-third of emergency department visits (40-50 million patients per year) are for evaluation after trauma exposures²

Current standard of care:

- No medications are currently available at or near the point of care to treat patients suffering from acute traumatic events and support long-term health

¹National Center for PTSD. How Common is PTSD in Adults? https://www.ptsd.va.gov/understand/common/common_adults.asp

²Wisco et al. *J Clin Psychiatry*. 2014.75(12):1338-46



TNX-102 SL for ASR/ASD: Program Status

Status: Expect to start Phase 2 in 3Q 2024; received IND clearance from FDA

Phase 2 Trial Funded by DoD grant to University of North Carolina (UNC)

- UNC Institute for Trauma Recovery awarded a \$3M grant from the Department of Defense (DoD)
- OASIS trial will build upon infrastructure developed through the UNC-led, \$40M AURORA initiative
 - AURORA study is a major national research initiative to improve the understanding, prevention, and recovery of individuals who have experienced a traumatic event
 - Supported in part by funding from the National Institutes of Health (NIH) and the health care arm of Google’s parent company Alphabet
- Opportunity to investigate the correlation between motor vehicle collisions and the emergence of ASD and PTSD
- Supported by multiple clinical trials:
 - Phase 2 trial in military-related PTSD (AtEase or NCT02277704)
 - Phase 3 trial in military-related PTSD (HONOR or NCT03062540)
 - Phase 3 trial in primarily civilian PTSD (RECOVERY or NCT03841773)
- In each of these studies, early and sustained improvements in sleep were associated with TNX-102 SL treatment by the PROMIS sleep disturbance (SD) scale and the Clinician Administered PTSD Scale (CAPS-5) “sleep disturbance” item.

Together these studies provide preliminary evidence that TNX-102 SL is well-tolerated and may promote recovery from PTSD via a pharmacodynamic facilitation of sleep-dependent emotional memory processing



TNX-102 SL for ASR/ASD: Phase 2 OASIS Study Design

General study characteristics:

- Randomized, double-blind, placebo-controlled study in Acute Stress Reaction (ASR) / Acute Stress Disorder (ASD)
- The proposed Optimizing Acute Stress reaction Interventions with TNX-102 SL (OASIS) trial will examine the safety and efficacy of TNX-102 SL to reduce adverse posttraumatic neuropsychiatric sequelae among patients presenting to the emergency department after a motor vehicle collision (MVC)
- The trial will enroll approximately 180 individuals who acutely experienced trauma at study sites across the US
- Participants will be randomized in the emergency department to receive a two-week course of either TNX-102 SL or placebo
- Investigator-initiated IND

Objective:

- Investigate the potential of Tonix's TNX-102 SL (cyclobenzaprine HCl sublingual tablets) to reduce the frequency and severity of the adverse effects of traumatic exposure, including acute stress reaction (ASR), acute stress disorder (ASD), and posttraumatic stress disorder (PTSD).
- ASR refers to the body's immediate response to trauma, whereas ASD is the short-term effects of trauma (within 1 month), and PTSD is the long-term effects of trauma (beyond 1 month)

TNX-102 SL once-daily at bedtime
5.6 mg (2 x 2.8 mg tablets)*

Placebo once-daily at bedtime



*First dose of TNX-102 SL 5.6 mg versus placebo taken in the emergency department, and then daily at bedtime to finish 2 weeks of treatment

A Phase 2 Study to Evaluate the Efficacy and Safety of TNX-102 SL Taken Daily in Patients With ASR/ ASD (OASIS)

- Primary outcome measure: Acute Stress Disorder Scale (ASDS) assessed at 7 and 21 days post MVC
- Posttraumatic stress symptom severity assessed at 6 and 12 weeks post MVC using the PTSD Checklist for DSM-5 (PCL-5)
- Standardized survey instruments of sleep disturbances, anxiety and depression symptoms, general physical and mental health, and clinical global improvement also employed
- Detailed and brief neurocognitive assessments are performed from baseline to 12 weeks after MVC at specific timepoints throughout study participation period



Tonmya™ (TNX-102 SL): Patents and Patent Applications

- **U.S. Composition:***
 - A 75:25 cyclobenzaprine HCl - mannitol eutectic (dependent claims add a basifying agent).
 - 5 US Patents (Expire November 2034)
 - 1 Pending US Application (Would expire November 2034)
 - A composition of a cyclobenzaprine HCl and a basifying agent suitable for sublingual absorption.
 - 1 Pending US Application (Would expire June 2033)
- **U.S. Methods of Use* (Specific Indications):**
 - Fibromyalgia
 - Pain, Sleep Disturbance, Fatigue
 - 1 Pending US Application (Would expire December 2041)
 - Early Onset Response
 - 1 Pending US Provisional Application (Would expire December 2044)
 - Depressive Symptoms
 - 1 Pending US Application (Would expire March 2032)
 - Sexual Dysfunction
 - 1 Pending US Application (Would expire October 2041)
 - PASC
 - 1 Pending US Application (Would expire June 2043)
 - PTSD
 - 1 US Patent (Expires November 2030)
 - Agitation (Dementia)
 - 1 US Patent (Expires December 2038)
 - 1 Pending US Application (Would expire December 2038)
 - Alcohol Use Disorder
 - 1 Pending US Application (Would expire November 2041)
- **Foreign Filings**
 - Corresponding foreign patents have been filed and some have issued:
 - Composition (25 patents, 3 allowed applications, 16 pending applications)
 - Methods of Use (9 patents, 54 pending applications)

*US Patents: Issued: US Patent Nos. 9,636,408; 9,956,188; 10,117,936; 10,864,175; 11,839,594; 9,918,948; 11,826,321. Pending: US Patent Application Nos. 13/918,692; 18/385,468; 13/412,571; 18/265,525; 63/612,352; 18/382,262; 18/037,815; 17/226,058; 18/212,500.



TONIX MEDICINES: MARKETED PRODUCTS





Tonix Medicines: Commercial-Stage Specialty Pharma Subsidiary

- **Tonix Medicines is a wholly-owned subsidiary of Tonix (NASDAQ: TNXP)**
 - Currently marketing two products indicated for the treatment of acute migraine: Zembrace[®] SymTouch[®] and Tosymra[®]
 - Nascent commercial organization
- **Tonix Medicines is preparing to launch Tonmya[™] (TNX-102 SL) for fibromyalgia**
 - Fibromyalgia care is relatively concentrated to specialized providers
 - We believe prescribing physicians can be targeted effectively by a specialty sales force
 - Evolving landscape in commercial markets favors distribution channels such as specialty pharmacies



Two Marketed Proprietary Migraine Drugs Non-oral Formulations of Sumatriptan

Zembrace® SymTouch® (sumatriptan injection) 3 mg¹



- 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 sales³
- 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 mg²



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

¹Zembrace 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

²Tosymra [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

³Tonix Medicines, Inc.; Data On File, 2023

⁴Mathew 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.

⁵Wendt 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.



Zembrace and Tosymra Bypass the GI Tract

Bypassing gastrointestinal (GI) tract is *potential advantage for treating acute migraine*

- GI absorption may be inconsistent in migraineurs due to gastric stasis (also called “gastroparesis”)¹⁻⁴
- Nausea and vomiting are symptoms of migraine⁵ which can complicate oral treatment

Existing Subcutaneous injectable products

- Imitrex® SQ Injection (sumatriptan succinate)-6mg and 4mg preparations
- DHE 45 (dihydroergotamine mesylate) SQ Injection

Existing intranasal products

- Imitrex® nasal spray (sumatriptan)
- Migranal® (dihydroergotamine) nasal spray – developed by Novartis, sold by Bausch Health
- Zavzpret® (zavegepant) nasal spray, FDA approved in March, 2023⁵ is the first intranasal gepant-marketed by Pfizer
- Zomig® nasal spray (zolmitriptan)
- Onzetra® Xsail® (sumatriptan nasal powder) marketed by Currax
- Trudhesa® (dihydroergotamine) nasal spray

¹Zembrace SymTouch [package insert]. Maple Grove, MN: Upsher-Smith Laboratories, LLC: February 2021.

²Mathew 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.

³Landy, S. et al. Efficacy and safety of DFN-11 (sumatriptan injection, 3 mg) in adults with episodic migraine: a multicenter, randomized, double-blind, placebo-controlled study. *J Headache Pain*. 19, 69 (2018).

⁴Brand-Schieber E, Munjal S, Kumar R, et al. Human factors validation study of 3 mg sumatriptan autoinjector, for migraine patients. *Med Devices (Auckl)*. 2016;9:131-137.

⁵Pfizer Press Release March 10, 2023. – <https://www.pfizer.com/news/press-release/press-release-detail/pfizers-zavzprettm-zavegepant-migraine-nasal-spray>

Pipeline

Programs and Strategy for Partnerships

Pipeline Development 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

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

Key Partnerships

TNX-1500: ALLOGRAFT REJECTION



TNX-102 SL: ACUTE STRESS DISORDER



TNX-2900: PRADER-WILLI SYNDROME



TNX-1300: COCAINE INTOXICATION



TNX-1800: COVID-19 VACCINE



TNX-4200: BROAD-SPECTRUM ANTIVIRAL



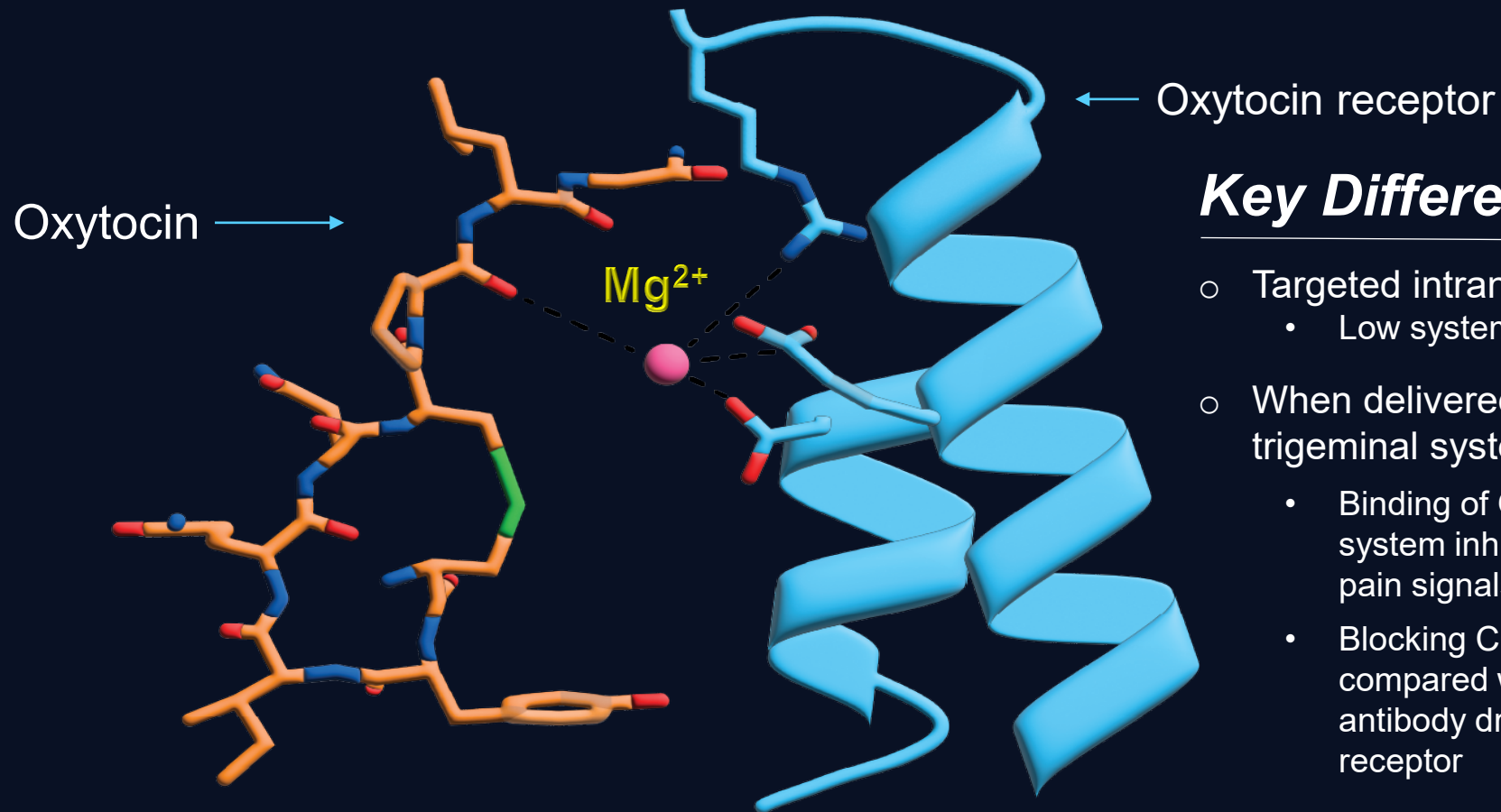
TNX-2900

Intranasal Potentiated Oxytocin with Magnesium

A novel, non-CGRP antagonist approach to treatment

TNX-2900: Novel Formulation of Intranasal Oxytocin (OT) Potentiated with Magnesium

Magnesium is known to potentiate the binding of OT to its receptor^{1,2}



Key Differentiators

- Targeted intranasal delivery
 - Low systemic exposure
- When delivered via the nasal route, concentrates in trigeminal system
 - Binding of OT to receptors on neurons in trigeminal system inhibits release of CGRP and transmission of pain signals
 - Blocking CGRP release is a distinct mechanism compared with CGRP antagonist and anti-CGRP antibody drugs, which block the binding of CGRP to its receptor

¹Antoni et al., 1989. *Biochem J.* 257(2):611-4

²Meyerowitz et al., 2022. *Nat Struct Mol Biol.* (3):274-281

*TNX-2900 has not been approved for any indication.



About Prader-Willi Syndrome

*Prader-Willi Syndrome (PWS) is the most common genetic cause of life-threatening childhood obesity. PWS causes unhealthy behaviors around food¹⁻⁴, consequences such as **obesity, type 2 diabetes, and cardiovascular disease**¹⁻⁵, and creates significant caretaker burden¹⁻⁴*

10-20 Rare genetic disease that afflicts 10-20 thousand individuals in the US
thousand individuals

Current standard of care:

- Human growth hormone treatment is FDA-approved for growth failure in PWS children

Large unmet need:

- Currently no cure, and no treatment for PWS-related hyperphagia
- Consequences can be life threatening - obesity and cardiovascular disease are leading cause of death

****TNX-2900 has been granted FDA Orphan Drug and Rare Pediatric Disease Designations, and received IND clearance by FDA for Phase 2 Trial***

¹Miller et al., 2011. *Am J Med Genet A*. 155A(5):1040-1049

²Butler et al., 2017. *Genet Med*. 19(6):635-642

³Butler MG. NORD. Updated 2018. Accessed May 25, 2022. <https://rarediseases.org/rare-diseases/prader-willi-syndrome/>

⁴Prader-Willi Syndrome Association USA. Accessed May 25, 2022. <https://www.pwsausa.org/what-is-prader-willi-syndrome/>

⁵Muscogiuri et al., 2021. *J Endocrinol Invest*. 44(10):2057-2070



TNX-1300

Cocaine Esterase

Fast acting antidote for life threatening cocaine intoxication

TNX-1300: Recombinant Protein Rapidly Degrades Cocaine in the Bloodstream

Drops plasma exposure by 90% in 2 minutes



Key Differentiators

- Rapidly metabolizes cocaine within matter of minutes
- No other product currently on the market for this indication



About Cocaine Intoxication

Over 5 million Americans reported current cocaine use in 2020, which is almost 2% of the population¹. In 2021, more than 24,900 individuals in the US died from drug overdose deaths involving cocaine²

500k Over 500,000 emergency department visits for cocaine, annually^{3,4}

Current standard of care:

- Patients are currently managed only by supportive care for the adverse effects of cocaine intoxication on the cardiovascular and central nervous systems

Large unmet need:

- No other product currently on the market for this indication
- TNX-1300 could significantly reduce the time and resources required for other detox services
- Potentially reduces the risk of morbidity and mortality

¹Substance Abuse and Mental Health Services Administration. (2021). Results from the 2020 National Survey on Drug Use and Health: Detailed Tables: Prevalence Estimates, Standard Errors, and Sample Sizes.

²Centers for Disease Control and Prevention (CDC) - <https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm>

³Substance Mental Health Services Administration, Drug Abuse Warning Network, 2011: National Estimates of Drug-Related Emergency Department Visits. HHS Publication No. (SMA) 13-4760, DAWN Series D-39. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2013.

⁴ Drug Abuse Warning Network, 2011: Selected Tables of National Estimates of Drug-Related Emergency Department Visits. Rockville, MD: Center for Behavioral Health Statistics and Quality, SAMHSA, 2013.



TONIX
PHARMACEUTICALS

IMMUNOLOGY: KEY CANDIDATES

TNX-1500

Anti-CD40L Monoclonal Antibody

Next Generation mAb preserves efficacy without risk of thrombosis

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

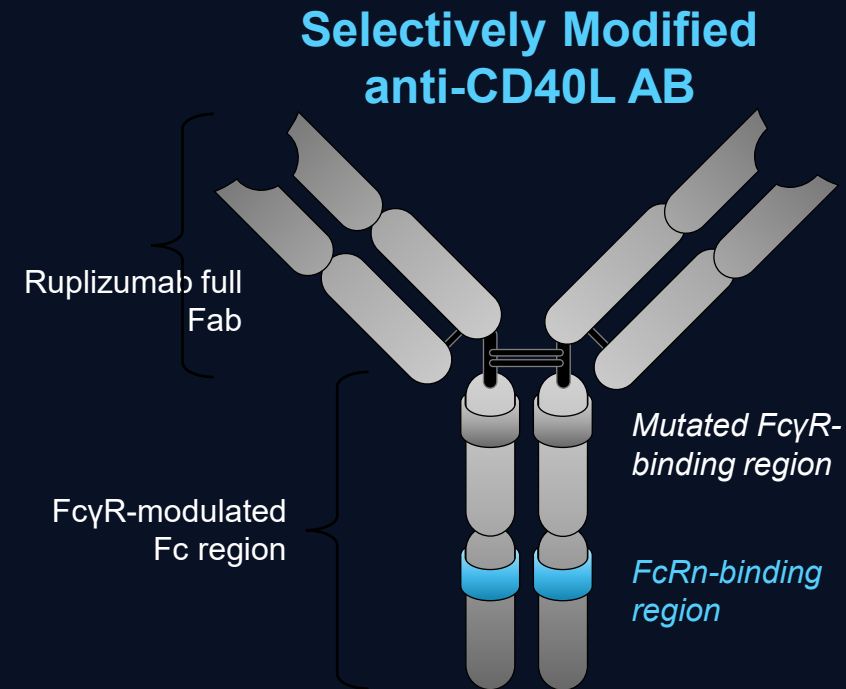
Key Differentiators

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.



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



TNX-1500 Strategy and Status

1 Proposed Initial Indication: Prevention of Allograft Rejection
Status: Clinical stage Phase 1 complete
Collaborations ongoing with Mass General Hospital on heart and kidney transplantation in non-human primates

- Collaboration with Boston Children’s on bone marrow transplantation in non-human primates

Next Steps: Initiate Phase 2 study in Kidney Transplant Recipients

2 Second Indication: Hematopoietic Cell Transplant (Bone Marrow Transplant)

- Potential to reduce GvHD

3 Third Indication (and beyond): Autoimmune Diseases (e.g., Multiple Sclerosis, Sjögren’s Syndrome, Systemic Lupus Erythematosus)

- These indications require large studies, but represent large target markets

Currently exploring strategic partnerships and out-licensing opportunities



TNX-1500 Preclinical Data and Publications

Non-human Primate Kidney Allo-Transplantation

- TNX-1500 monotherapy consistently prevents kidney transplant rejection with no thrombosis observed
- April 2023 Publication: Lassiter, G., et al. (2023). TNX-1500, an Fc-modified Anti-CD154 Antibody, Prolongs Nonhuman Primate Renal Allograft Survival. *American Journal of Transplantation*. www.sciencedirect.com/science/article/pii/S1600613523003714

Non-human Primate Heart Heterotopic Allo-Transplantation

- TNX-1500 monotherapy consistently prevents heart transplant rejection. Similar activity to chimeric hu5c8² during treatment phase in prior studies
- April 2023 Publication: Miura, S., et al. (2023) TNX-1500, an Fc-modified Anti-CD154 Antibody, Prolongs Nonhuman Primate Cardiac Allograft Survival. *American Journal of Transplantation*. www.sciencedirect.com/science/article/pii/S1600613523003969

Non-Human Primate Kidney Xenograft Transplantation

- TNX-1500 therapy is part of a regiment to prevent rejection in kidney xenograft transplants
 - Anand, R.P., Layer, J.V., Heja, D. et al. (2023). Design and testing of a humanized porcine donor for xenotransplantation. *Nature*. <https://www.nature.com/articles/s41586-023-06594-4>
 - Kozlov, M. (2023). Monkey survives two years after gene-edited pig-kidney transplant. *Nature*. <https://www.nature.com/articles/d41586-023-03176-2>
 - Mohiuddin, M. (2023). Pig-to-primate organ transplants require genetic modifications of donor. *Nature*. <https://www.nature.com/articles/d41586-023-02817-w>



α-CD40L Headlines

- Mass General Hospital just transplanted a genetically engineered pig kidney into a living human¹
 - Boston Globe, March 21, 2024
 - Patient’s death announced May 11, 2024²
- The patient was being treated with anti-CD40L mAb tegoprubart from Eledon¹
- **The preclinical work was performed with TNX-1500³**

¹ Massachusetts General Hospital press release. March 21, 2024. “World’s First Genetically Edited Pig Kidney Transplant into Living Recipient Performed at Massachusetts General Hospital.” www.massgeneral.org/news/press-release/worlds-first-genetically-edited-pig-kidney-transplant-into-living-recipient (accessed March 29, 2024)

² Stoico, N. *Boston Globe*. May 11, 2023. “Mass Man who received first kidney transplant from genetically engineered pig has died, family says”.

³ Anand, R.P., et al *Nature*. 622, 393–401 (2023). <https://doi.org/10.1038/s41586-023-06594-4>

The Boston Globe

In a first, Mass. General surgeons transplant a pig kidney into a man

The patient is doing well, but many unknowns remain

By [Felice J. Freyer](#) Globe Staff, Updated March 21, 2024, 7:40 p.m.



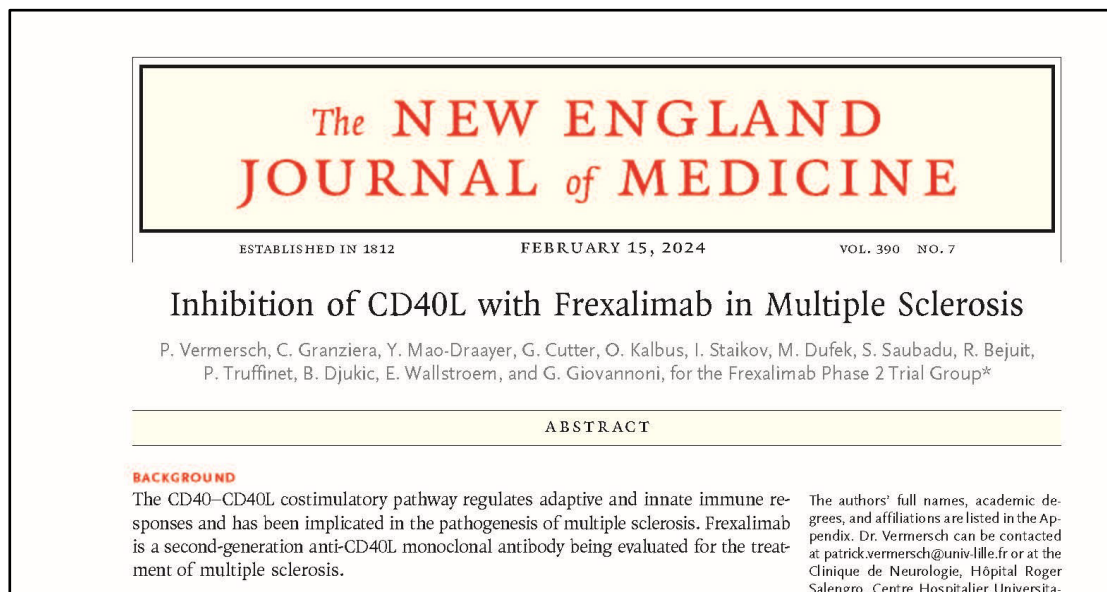
Dr. Leonardo V. Riella, medical director of kidney transplantation, center, broke down as he thanked his colleagues. Dr. Tatsuo Kawai, director of the Legorreta Center for Clinical Transplant Tolerance, left, and Dr. Winfred Williams, associate chief of the Division of Nephrology, also spoke at a news conference on Thursday. DAVID L. RYAN/GLOBE STAFF

Seventy years after surgeons at Brigham & Women’s Hospital performed the world’s first kidney transplant, doctors at its sister hospital, Massachusetts General, announced an



Anti-CD40L Headlines

- Sanofi recently published their Phase 2 data on their frexalimab in multiple sclerosis in the *New England Journal of Medicine*¹
 - Sanofi projects its Fc-modified humanized anti-CD40L mAb frexalimab will exceed €5 B per year in peak sales²
- Like frexalimab, TNX-1500 is Fc-modified to reduce/eliminate the risk of thrombosis seen with “first generation” anti-CD40L mAbs.



¹ Vermersch P, et al. N Engl J Med. 2024 Feb 15;390(7):589-600. doi: 10.1056/NEJMoa2309439. PMID: 38354138.

² Dunn, A. Endpoints. December 7, 2023. “Sanofi CEO Paul Hudson pitches 12 blockbusters in a bid to convince investors on boosting R&D spend”. <https://endpts.com/sanofi-rd-day-ceo-paul-hudson-touts-12-blockbusters-ups-rdspend/>

TNX-1700

Recombinant Trefoil Factor Family Member 2 (rTFF2-HSA)
Fusion Protein

Targeting the toxic tumor micro-environment

TNX-1700: Fighting Cancer by Targeting the Tumor Micro-Environment

Suppresses myeloid-derived suppressor cells (MDSCs) and activates anti-cancer CD8+ T cells



Key Differentiators

- Different MOA than checkpoint inhibitors
- **Potential synergy with anti-PD-1 or anti-PD-L1 monoclonal antibodies**

Preclinical Evidence

- mTNX-1700 (mTFF2-MSA fusion protein) and anti-PD-1 monotherapy each was able to evoke anti-tumor immunity in the MC38 model of colorectal cancer¹
- mTNX-1700 augmented the anti-tumor efficacy of anti-PD-1 therapy in both the MC38 and the CT26.wt models¹

*TNX-1700 is in the pre-IND stage of development and has not been approved for any indication.

¹Daugherty, B. et al. March 6, 2023 Keystone Poster, <https://bit.ly/48nIRHM>



About Gastric and Colorectal Cancer

Gastric and colorectal cancer are both leading cancers in the US. Colorectal cancer is the 3rd leading cause of cancer-related deaths in both men and women.¹

>1.3M People living with colorectal cancer in the US²

>125k People living with gastric cancer in the US³

Current standard of care:

- PD-1 blockade
 - However, gastric and colorectal cancer are relatively unresponsive

Large unmet need:

- Gastric and colorectal cancer have a relative 5-year survival rate of 35.7% and 65%, respectively
 - Despite advances in the field, patients are still in need of life saving treatment

¹American Cancer Society, accessed September 2023 - <https://www.cancer.org/cancer/types/colon-rectal-cancer/about/key-statistics.html>
²NIH, accessed September 2023 - <https://seer.cancer.gov/statfacts/html/colorect.html>
³NIH, accessed September 2023 - <https://seer.cancer.gov/statfacts/html/stomach.html> © 2024 Tonix Pharmaceuticals Holding Corp.



TONIX
PHARMACEUTICALS

INFECTIOUS DISEASE: KEY CANDIDATES



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



Tonix Awarded \$34M Contract from DoD

Defense Threat Reduction Agency (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 is to develop small molecule, broad-spectrum antiviral agents for the prevention or treatment of infections to improve the medical readiness of military personnel in biological threat environments
- Tonix's focus is to develop an orally available CD45 antagonist with broad-spectrum efficacy against a range of viral families through preclinical evaluation
 - Program is expected to establish physicochemical properties, pharmacokinetics, and safety attributes to support an IND submission and to fund a first-in-human Phase 1 clinical study

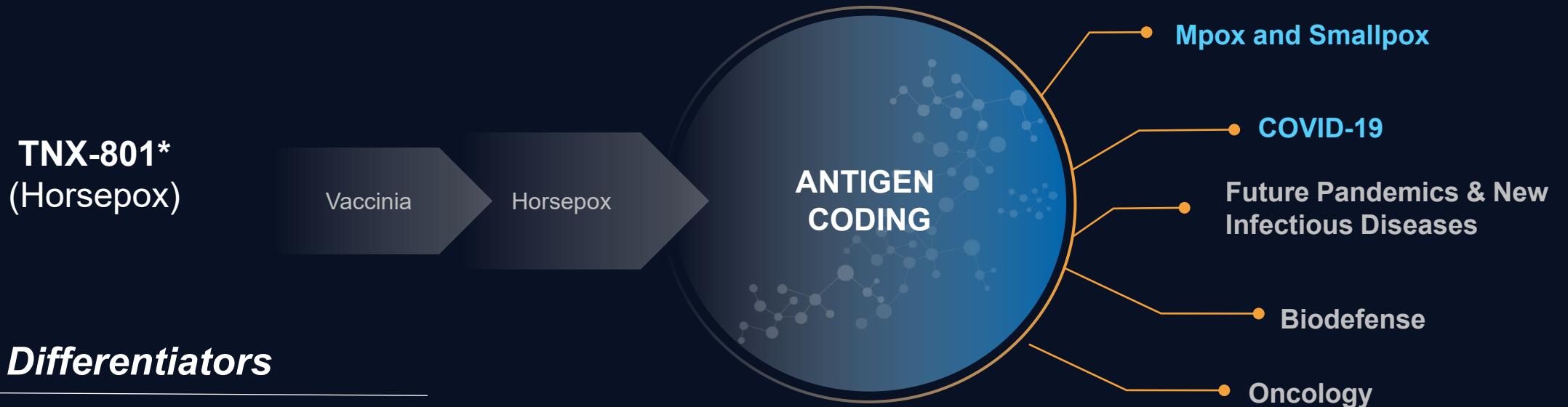
TNX-801

Live Virus Vaccine

Live virus vaccine platform with multitude of potential applications

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

Cloned version of horsepox¹ 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



Smallpox and Monkeypox

- Smallpox has been eradicated, but fears of malicious reintroduction persist¹⁻²
 - Russia and North Korea have capabilities to weaponize smallpox
 - The U.S. population is largely vaccine-naïve (under ~60 years old almost 100% naïve except for immigrants from Russia, China, etc.)
- Mpox in Africa was suppressed by vaccination with live virus vaccines to protect against smallpox
 - The cessation of vaccination against smallpox has resulted in outbreaks of mpox in Africa
- Mpox (Clade 2) spread rapidly around the world in MSM³ population since May 2022¹⁻²
 - >30,000 cases in the U.S. – now endemic in the U.S.
 - >90,000 cases worldwide in countries who did not previously have mpox
 - Clade 2 has <1% fatality rate
- Mpox (Clade 1) is experiencing an outbreak in Democratic Republic of the Congo and Nigeria⁴
 - Clade 1 has ~11% fatality rate, is more infectious and kills mostly children

¹ U.S. National Academy of Sciences. March 28, 2024. “Consensus Study Report: Future State of Smallpox Medical Countermeasures.” <https://nap.nationalacademies.org/catalog/27652/future-state-of-smallpox-medical-countermeasures>

² Bipartisan Commission on Biodefense. (2024). *Box the Pox: Reducing the Risk of Smallpox and Other Orthopoxviruses*. Bipartisan Commission on Biodefense: Washington, DC. <https://biodefensecommission.org/reports/box-the-pox-reducing-the-risk-of-smallpox-and-other-orthopoxviruses/>

³ Men who have sex with men

⁴ Emanuel, G. *NPR*. March 27, 2024. “Why the mpox outbreak in the Democratic Republic of Congo is worrying disease docs.” URL: www.npr.org/sections/goatsandsoda/2024/03/27/1239276957/mpox-outbreak-democratic-republic-of-congo-deadlier-strain



Monkeypox Outbreak Recent Headlines

- Outbreak in the Congo
 - NPR, April 2, 2024¹

The screenshot shows the NPR logo at the top left, followed by the text "Public's Radio's 89.5". Below this is the section name "Goats and Soda" and the sub-section "GOATS AND SODA". The main headline reads "Major mpox outbreak in the Democratic Republic of Congo is a worry to disease docs". Below the headline, it says "UPDATED APRIL 2, 2024 · 6:54 AM ET", "HEARD ON MORNING EDITION", and "By Gabrielle Emanuel".

- U.S. Bipartisan Commission on Biodefense (2024)²:
 - “The shift of Mpox in Africa to the more lethal and sexually transmitted Clade I dictates that further clade shifts could create a more serious global health challenge even without nefarious actions by state/non-state actors). This, in turn, would create further potential risk of depletion of the SNS [U.S. Strategic National Stockpile] if the United States deployed vaccine globally. Though 42 USC 247d-6b(a)(2) requires annual threat-based reviews of the contents of the SNS, the statute does not currently require this review to consider the threat of all orthopoxviruses that smallpox vaccines, antivirals, and therapeutics could treat.”

¹ Emanuel, G. *NPR*. March 27, 2024. “Why the mpox outbreak in the Democratic Republic of Congo is worrying disease docs.” URL: www.npr.org/sections/goatsandsoda/2024/03/27/1239276957/mpox-outbreak-democratic-republic-of-congo-deadlier-strain

² Bipartisan Commission on Biodefense. (2024). *Box the Pox: Reducing the Risk of Smallpox and Other Orthopoxviruses*. Bipartisan Commission on Biodefense: Washington, DC. <https://biodefensecommission.org/reports/box-the-pox-reducing-the-risk-of-smallpox-and-other-orthopoxviruses/>



Monkeypox Headlines

- Multiple recent statements by U.S. Agencies warning about smallpox and monkeypox¹⁻⁶
- U.S. National Academy of Sciences Consensus Report (March, 2024)⁶
 - *“Additionally, safer, single-dose vaccines and a diverse set of therapeutic options against smallpox would improve the U.S. readiness and response posture for immediate containment and long-term protection in a smallpox emergency.*
 - *“Smallpox vaccines that have improved safety across different population subgroups and are available as a single dose would support faster and more effective response to contain smallpox and other orthopoxvirus outbreaks. The development of novel smallpox vaccines using multi-vaccine platforms (i.e., use common vaccine vectors, manufacturing ingredients, and processes) would improve the capacity for rapid vaccine production in response to a smallpox event and reduce the need for stockpiling in the SNS at current levels.*
 - *“Given the lack of commercially available orthopoxvirus diagnostics, vaccines, and therapeutics, planning for logistics and supply chain management considerations is critical. Efforts could give consideration to developing plans to increase the number of smallpox vaccine and therapeutics manufacturers as well as optimizing current manufacturing capacities should they be needed in the shorter term.”*

¹ Office of Science and Technology Policy (OSTP). American Pandemic Preparedness: Transforming Our Capabilities. September 2021
² National Biodefense Science Board (NBSB). Prioritization of Product Attribute Categories to Maximize Access for Next Generation COVID-19 Vaccines and Therapeutics. August 2023
³ Office of Science and Technology Policy (OSTP). American Pandemic Preparedness: Transforming Our Capabilities. September 2021
⁴ National Biodefense Science Board (NBSB). Prioritization of Product Attribute Categories to Maximize Access for Next Generation COVID-19 Vaccines and Therapeutics. August 2023
⁵ BARDA Strategic Plan 2022-2026.
⁶ U.S. National Academy of Sciences. March 28, 2024. “Consensus Study Report: Future State of Smallpox Medical Countermeasures.” <https://nap.nationalacademies.org/catalog/27652/future-state-of-smallpox-medical-countermeasures>



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 tolerated¹
- Showed promise in protecting animals from challenge with SARS-CoV-2 delivered directly into the lungs¹

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

*TNX-1800 is in the pre-IND stage of development and has not been approved for any indication

¹Awasthi, M. et al. *Viruses*. 2023. 15(10):2131.

²Awasthi, M. et al. *Vaccines (Basel)*. 2023. 11(11):1682.



TONIX
PHARMACEUTICALS

**TEAM,
NETWORK, &
UPCOMING
MILESTONES**

Management Team



Seth Lederman, MD
Co-Founder, CEO & Chairman



Gregory Sullivan, MD
Chief Medical Officer



Bradley Saenger, CPA
Chief Financial Officer



Jessica Morris
Chief Operating Officer



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



THANK YOU





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.



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-ef1bd8aea867d>

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.



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.



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.