



# Transforming the Possible in Neuroscience

2Q 2021 Financial Results & Business Update

August 2021



## Forward-Looking Statements

This presentation contains forward-looking statements that are based on management's beliefs and assumptions and on information currently available to management. In some cases, you can identify forward-looking statements by the following words: "may," "will," "could," "would," "should," "expect," "intend," "plan," "anticipate," "believe," "estimate," "predict," "project," "potential," "continue," "ongoing" or the negative of these terms or other comparable terminology, although not all forward-looking statements contain these words. These statements involve risks, uncertainties and other factors that may cause actual results, levels of activity, performance or achievements to be materially different from the information expressed or implied by these forward-looking statements. Although we believe that we have a reasonable basis for each forward-looking statement contained in this presentation, we caution you that these statements are based on a combination of facts and factors currently known by us and our projections of the future, about which we cannot be certain.

Forward-looking statements in this presentation include, but are not limited to: statements about the potential attributes and benefits of our product candidates, including with respect to receptor subtype selectivity, activity, side effect and tolerability profile and relevant indications; the format and timing of our product development activities and clinical trials, including the advancement of CVL-231 into a comprehensive Phase 2 program in schizophrenia, plans to evaluate the potential of this mechanism in other populations, including dementia-related psychosis, the timing and status of our Phase 1 trial of darigabat in acute anxiety and other statements regarding the design of clinical trials and the timing of initiation, completion and data readouts for clinical trials; the timing and outcome of IND submissions and other regulatory interactions; the ability to compete with other companies currently marketing or engaged in the development of treatments for relevant indications; the size and growth potential of the markets for product candidates and ability to serve those markets; the rate and degree of market acceptance of product candidates, if approved; the potential effects of the business combination; the amount and timing of payments we may receive pursuant to the tavapadon financing transaction; the sufficiency of our financial resources, including to fund the tavapadon Phase 3 development program through NDA submission; receipt of proceeds from our warrant redemption; and our cash runway.

We cannot assure you that the forward-looking statements in this presentation will prove to be accurate. Furthermore, if the forward-looking statements prove to be inaccurate, the inaccuracy may be material. Actual performance and results may differ materially from those projected or suggested in the forward-looking statements due to various risks and uncertainties, including, among others: that we may not realize the expected benefits of the financing transaction; that clinical trial results may not be favorable; uncertainties inherent in the product development process (including with respect to the timing of results and whether such results will be predictive of future results); the impact of COVID-19 on the timing, progress and results of ongoing or planned clinical trials; other impacts of COVID-19, including operational disruptions or delays or to our ability to raise additional capital; whether and when, if at all, our product candidates will receive approval from the FDA or other regulatory authorities, and for which, if any, indications; competition from other biotechnology companies; uncertainties regarding intellectual property protection; and other risks identified in our SEC filings, including those under the heading "Risk Factors" in our Quarterly Report on Form 10-Q filed with the SEC on May 17, 2021 and our subsequent SEC filings.

In light of the significant uncertainties in these forward-looking statements, you should not regard these statements as a representation or warranty by us or any other person that we will achieve our objectives and plans in any specified time frame, or at all. The forward-looking statements in this presentation represent our views as of the date of this presentation. We anticipate that subsequent events and developments will cause our views to change. However, while we may elect to update these forward-looking statements at some point in the future, we have no current intention of doing so except to the extent required by applicable law. You should, therefore, not rely on these forward-looking statements as representing our views as of any date subsequent to the date of this presentation.

# Agenda

Introduction



**Matthew Calistri**  
*Vice President, Corporate Strategy and Investor Relations*

Overview



**Tony Coles, M.D.**  
*Chairperson & Chief Executive Officer*

Lead Program Updates



**Raymond Sanchez, M.D.**  
*Chief Medical Officer*

Early Pipeline Updates



**John Renger, Ph.D.**  
*Chief Scientific Officer*

Q2 Financial Performance



**Kathy Yi**  
*Chief Financial Officer*

Q&A

*All*

# Business & Pipeline Updates

## Pipeline

- Announced **clinically meaningful and statistically significant** topline results from Phase 1b trial for **CVL-231** in schizophrenia
- **Initiated screening** in Phase 2a trial in dementia-related apathy for **CVL-871**
- Submitted IND for **CVL-354 (KORA)**, in development for MDD and substance use disorder; expect to **initiate Phase 1 in 3Q 2021**
- **Darigabat** Phase 1 acute anxiety data now expected **1H 2022**
- Upcoming R&D Event scheduled for **October 7, 2021**

## Capital

- Raised **\$328 million net proceeds** from follow-on offering in July 2021
- Announced redemption of outstanding public warrants
- Cash balance of **\$327 million\*** as of 6/30/2021
- Cash runway projected into **2024**

# Company Highlights



Pursuing a targeted approach to neuroscience that combines a differentiated understanding of neurocircuitry with advanced chemistry to develop novel therapies for CNS diseases



Broad portfolio of 11 assets targeting large markets with significant unmet need, including schizophrenia, epilepsy and Parkinson's Disease



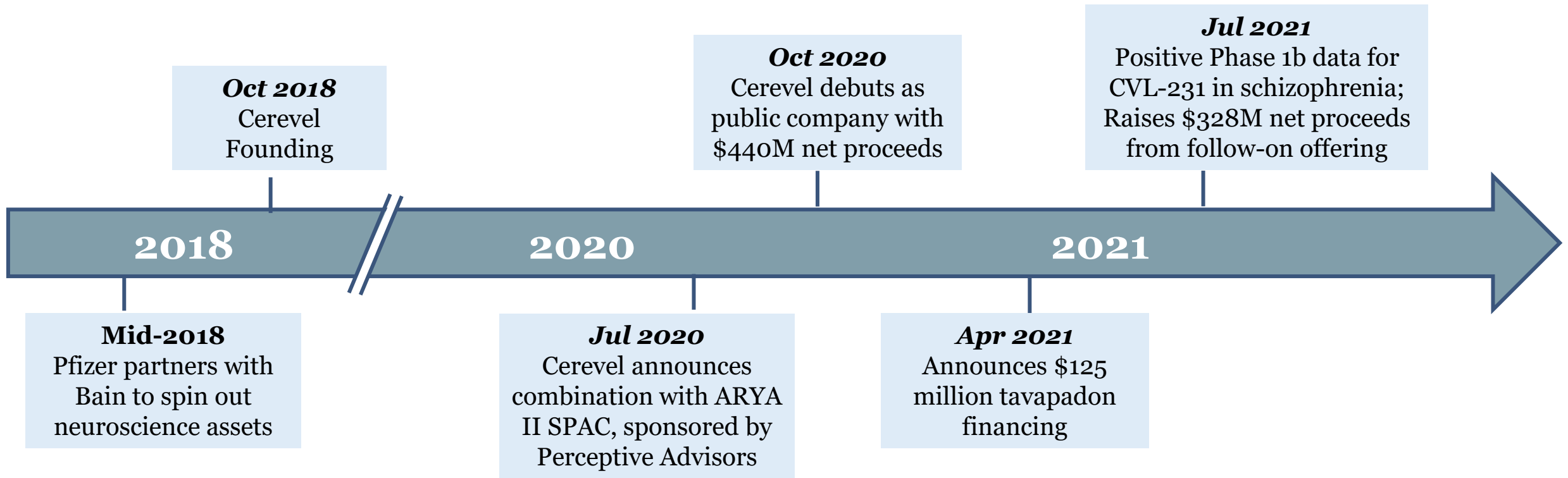
Progressing towards multiple near and medium-term catalysts, with at least 7 data readouts and multiple INDs expected by the end of 2023



Leveraging a seasoned management team with extensive expertise in neuroscience and a strong track record of over 20 prior drug approvals and commercialization



# History of Innovative Dealmaking



# Led by a Seasoned Life Sciences Management Team



**Tony Coles, M.D.**  
*Chairperson &  
Chief Executive Officer*



**Kathy Yi**  
*Chief Financial Officer*



**John Renger, Ph.D.**  
*Chief Scientific Officer*



**Kathleen Tregoning**  
*Chief Corporate  
Affairs Officer*



**Abraham Ceesay**  
*President*



**Raymond Sanchez, M.D.**  
*Chief Medical Officer*



**Kenneth DiPietro**  
*Chief Human  
Resources Officer*



**Scott Akamine**  
*Chief Legal Officer*

## Strong Track Record of Approvals



**Abilify MyCite**  
(aripiprazole tablets with sensor)  
2, 5, 10, 15, 20, 30 mg

**Abilify Maintena**  
(aripiprazole) for extended release injectable suspension

**Belsomra**  
(suvorexant) IV  
5, 10, 15, 20 mg tablets

**JYNARQUE**  
(tolvaptan) tablets

**Nexavar**  
(sorafenib) tablets

**Samsca**  
(tolvaptan)

**Kyprolis**  
(carfilzomib) for injection

**REXULTI**  
brexpiprazole

**ADHANSIAXR**  
(methylphenidate HCl) extended-release capsules

**BLINCYTO**  
(blinatumomab) for injection



Bristol-Myers Squibb



# Cerevel's Targeted Approach to CNS Disease

Leveraging Expertise in Neurocircuitry

Pipeline Uniquely Based on

Differentiated Understanding of Neurocircuitry

Targeted Receptor Subtype Selectivity

Receptor Binding/Modulation

Optimized Receptor Pharmacology

Highly Selective Small Molecules in Clinical Studies  
*Created using Pfizer world-class chemistry*

Robust Data Packages



# Deep Pipeline: Multiple Value Inflections Near & Long-Term

## 11 Assets

5  
Clinical Assets

Tavapadon

Darigabat

CVL-231

CVL-871

CVL-936

4  
Pre-Clinical Assets

CVL-354 (KORA)

CVL-047 (PDE4)

M4 Agonist\*

LRRK2\*

2  
Undisclosed Assets

## Patient Populations

Early Parkinson's

Late Parkinson's

Epilepsy

Anxiety

Schizophrenia

Dementia-Related  
Apathy

Substance Use Disorder

## 8 Trials

3 Phase 3 Trials

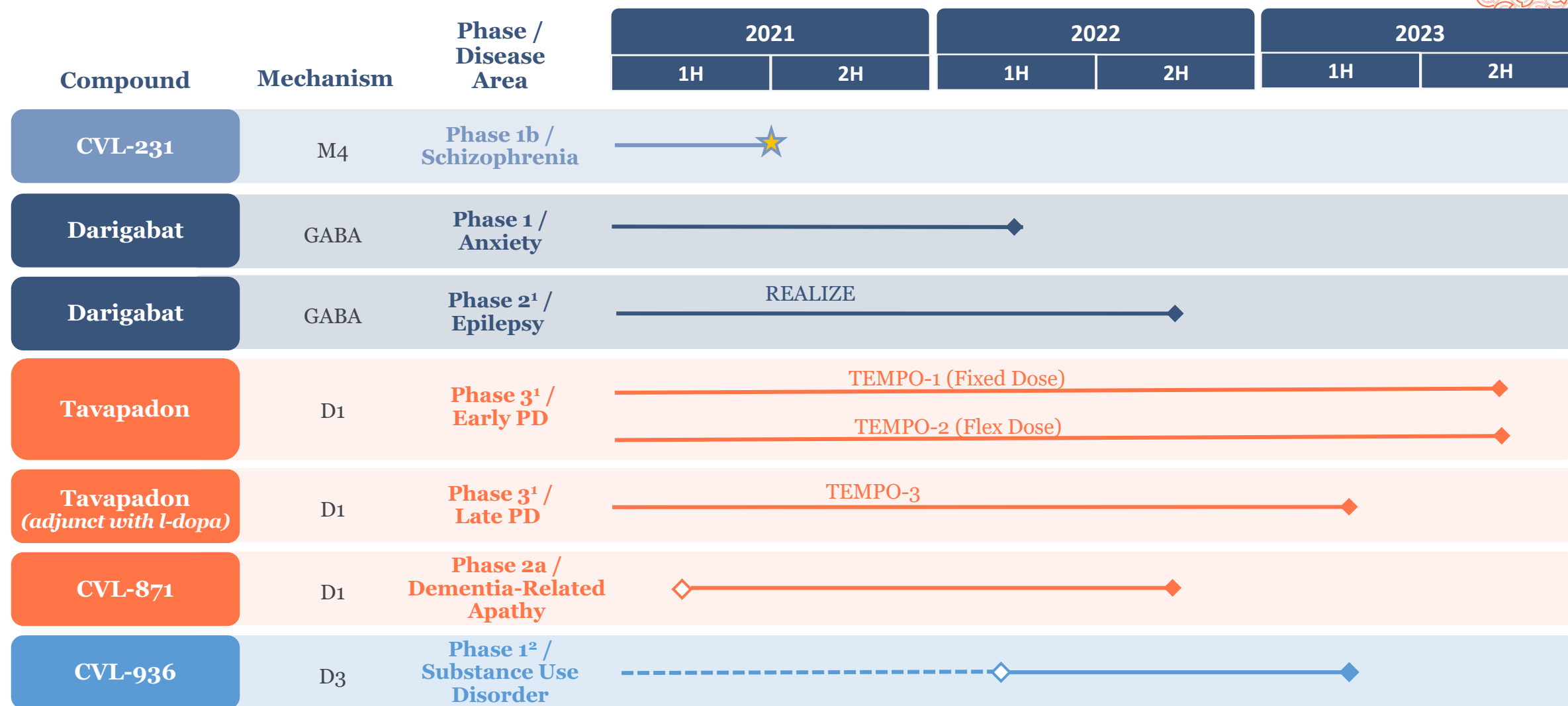
2 Phase 2 Trials

1 Phase 1b Trial  
Completed

2 Phase 1 Trials

+2 Open Label Extensions

# Multiple Milestones Expected Over Next Three Years

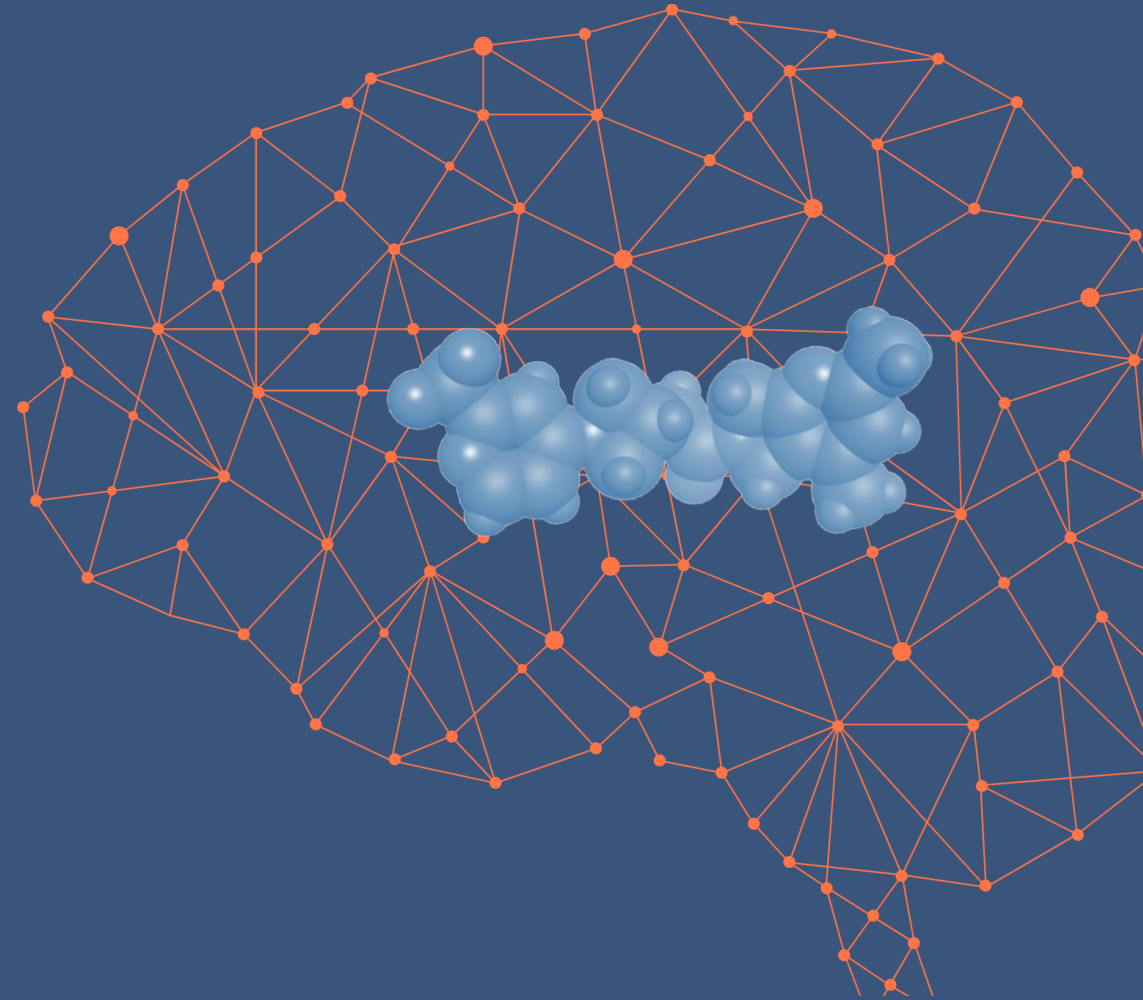


◇ Estimated Trial Initiation

◆ Estimated Topline Data

## ■ M4 PAM (CVL-231) in Schizophrenia

*Selectively targeting the M4 muscarinic receptor with the goal of treating psychosis-related symptoms with improved side effect profile*



# Cerevel's M4 PAM is a Potential Next Generation Antipsychotic

## M4 PAM (CVL-231)

Potential New Standard of Care

## Opportunity for Innovation in Schizophrenia

Current Standard of Care Uses Same Mechanism of Action (MOA) as Therapies from the 1950s

**First-in-Class Therapy with Novel MOA**

M4 Selective

Targeted Muscarinic Activity

Improved Tolerability

Large Market

~20M

Patients Worldwide

~\$7B

G7 Revenues in 2018

~3.5%

Growth per year

Significant Need for New Treatment Option

Side Effect and Tolerability Issues

Limited Compliance

60%

High Relapse Rates

77%

90%

at 1 year

at 2 years

Progression and worsening of disease

High Discontinuation

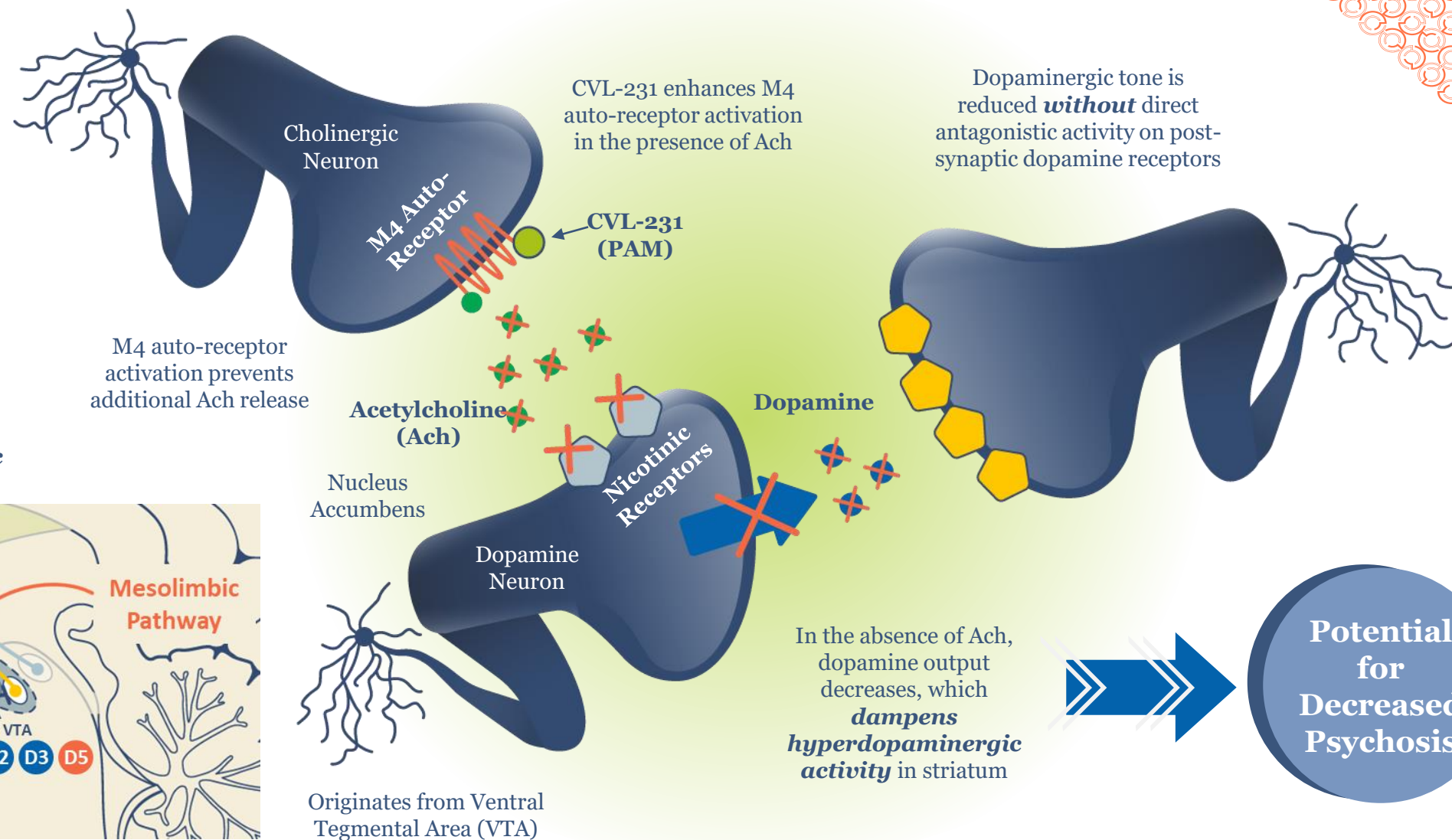
74%

Within 18 months



Debilitating side effects of atypicals often lead to discontinuation and relapse, driving a vicious cycle of disease progression

# M4 Receptor Activation Reduces Dopamine in the Striatum



# Cerevel's Selective M4 Modulation: A Compelling and Novel Approach to Drive Antipsychosis

## Receptor Selectivity Offers Potential Improvement over Non-Selective Compounds

Xanomeline (M1/M4 agonist) data showed targeting muscarinic receptor may improve psychosis

*But development limited by GI and CV side effects*

Karuna's KarXT addresses tolerability issues by adding trospium to Xanomeline to offset side effects

*Combination approach with non-selective peripheral antagonist*

Knock-out mouse data suggests M4 receptors drive the antipsychotic activity of Xanomeline

*M1 receptors believed to contribute to GI side effects, potential cognitive benefit undetermined*

## CVL-231's Differentiated Approach

Target	<ul style="list-style-type: none"><li>Highly selective for M4 receptor</li></ul>
Antipsychotic effect	<ul style="list-style-type: none"><li>19.5 pt improvement in PANSS total score at Week 6</li></ul>
Tolerability	<ul style="list-style-type: none"><li>No GI-related dropouts</li><li>Not associated with EPS, akathisia, or weight gain</li></ul>
Dosing	<ul style="list-style-type: none"><li>Once-daily</li></ul>
Titration	<ul style="list-style-type: none"><li>None</li></ul>

CVL-231:  
Selective Potentially Once-daily M4 PAM

>600X  
more selective for  
M4 over M1, 3 and 5

~360X  
more selective  
than for M2



# Phase 1b in Schizophrenia: Topline Results

- **Clinically meaningful improvements in PANSS Total Score:**
  - 30 mg QD: -19.5 pts at week 6
  - 20 mg BID: -17.9 pts at week 6
- **Statistically significant difference in PANSS Total Score versus placebo\*:**
  - 30 mg QD: -12.7 pts (p=0.023) at week 6
  - 20 mg BID: -11.1 pts (p=0.047) at week 6
- **Clinically meaningful improvements in both PANSS Positive and PANSS Negative subscales**
- **Generally well-tolerated:**
  - Discontinuation rates similar between treatment and placebo (22% for each arm including placebo)
  - Not associated with extrapyramidal side effects, akathisia, or weight gain
  - Gastrointestinal (GI) side effects were infrequent and were similar between treatment and placebo
  - Serious adverse events included COVID-19, accidental overdose (cocaine), and exacerbation of schizophrenia (one instance of each); none considered related to study medication

# CVL-231 Phase 1b Trial Design

## Part A: Safety Assessment

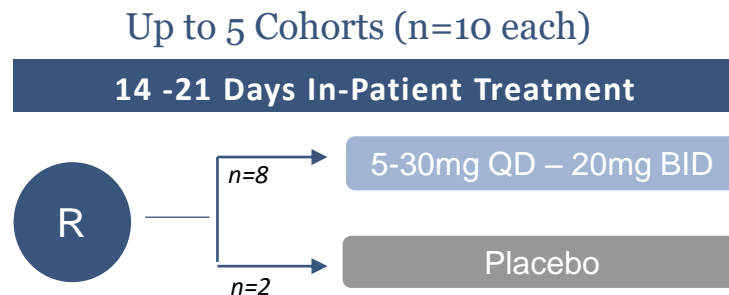
Multiple Ascending Dose

### Primary Objective

- Safety & tolerability

### Secondary Objective

- PK



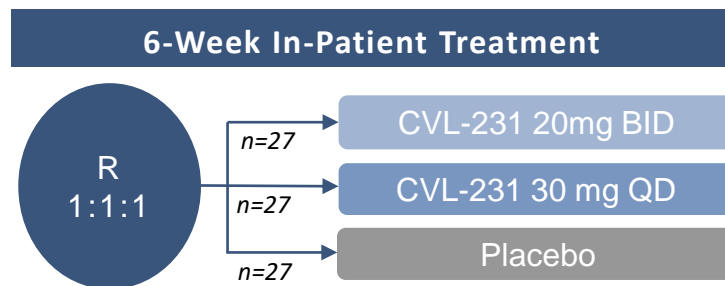
### Target Patient Population

- Male and female subjects, ages 18 to 50 years
- CGI-S  $\leq 4$  (normal to moderately ill) at screening and Day-1
- PANSS total score of  $\leq 80$  at the time of screening and Day-1

## Part B: Pharmacodynamics

### Exploratory PD Assessment

- Positive and Negative Syndrome Scale (PANSS)\*
  - PANSS Positive Score
  - PANSS Negative Score
- Clinical Global Impression – Severity Scale (CGI-S)\*
- Brief Assessment of Cognition in Schizophrenia (BACS) symbol coding test\*



### Target Patient Population

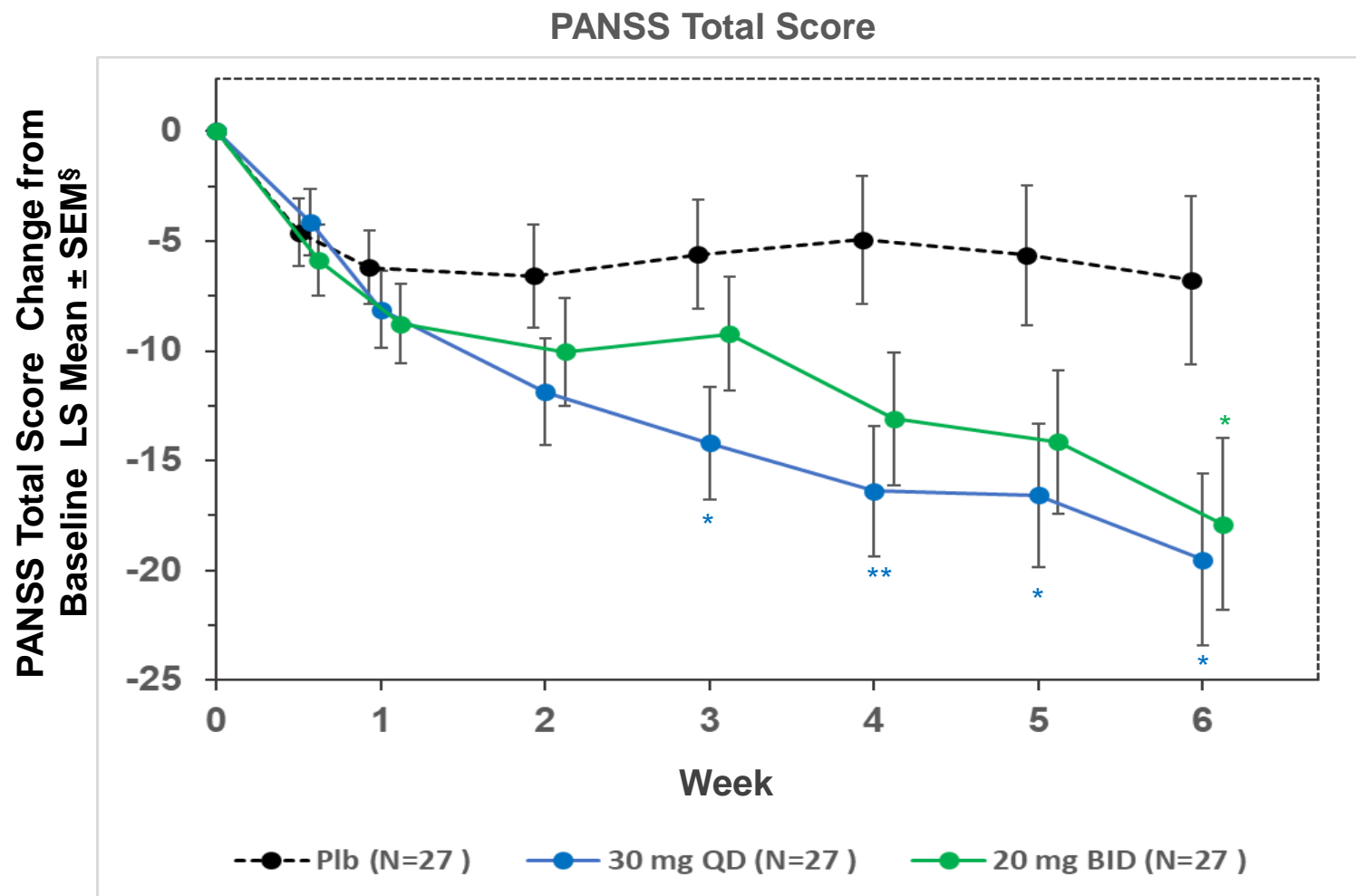
- Male and female subjects, ages 18 to 55 years
- PANSS total score of  $\geq 80$  at screening and Day -1
- CGI-S  $\geq 4$  (moderately to severely ill) at screening and Day -1
- History of relapse and/or exacerbation of symptoms when not receiving antipsychotic treatment, excluding the current episode
- Experiencing an acute exacerbation or relapse of symptoms, with onset less than 2 months prior to screening
- Population was enriched for key positive symptoms



# Phase 1b in Schizophrenia: Pharmacodynamic Results\*

Week 6 (Day 42)	Placebo N=27	CVL-231 30 mg QD N= 27	CVL-231 20 mg BID N= 27	Combined CVL-231 N=54
PANSS Total Score				
LS Mean Change from Baseline	-6.8	-19.5	-17.9	-18.7
Difference vs Placebo (p-value) <sup>†</sup>		-12.7 <sup>†</sup> p = 0.023	-11.1 <sup>†</sup> p = 0.047	-11.9 <sup>†</sup> p = 0.014
PANSS Positive Score				
LS Mean Change from Baseline	-2.5	-6.8	-4.9	-5.8
Difference vs Placebo (p-value)		-4.3 p = 0.016	-2.4 p = 0.166	-3.3 p = 0.028
PANSS Negative Score at Baseline				
LS Mean Change from Baseline	0.1	-3.0	-3.6	-3.3
Difference vs Placebo (p-value)		-3.1 p = 0.009	-3.7 p = 0.002	-3.4 p = 0.001

# Phase 1b: Key Pharmacodynamic Endpoint – PANSS Total Score



- **30 mg QD:** 12.7 Point improvement versus placebo at Week 6 (19.5 of 30 mg QD vs 6.8 placebo) with  $P=0.023$
- **20 mg BID:** 11.1 Point improvement versus placebo at Week 6 (17.9 of 20 mg BID vs 6.8 placebo) with  $P=0.047$
- **Combined CVL 231:** 11.9 Point improvement versus placebo at Week 6 (18.7 of CVL231 vs 6.8 placebo) with  $P=0.014$

\*  $P<0.05$  vs Placebo    \*\*  $P<0.01$  vs Placebo

# Dementia-Related Psychosis (DRP): Potential Opportunity for CVL-231 Beyond Schizophrenia

## DRP Overview and Unmet Needs<sup>1-7</sup>

- Psychosis incidence ranges from 10-75% of Alzheimer's patients and varies by stage of disease
  - Upwards of 1M moderate to severe Alzheimer's patients in the G7 experience symptoms of psychosis
- Co-morbidities including agitation, aggression and depression
- Often leads to long-term care / nursing home admissions

## Standard of Care

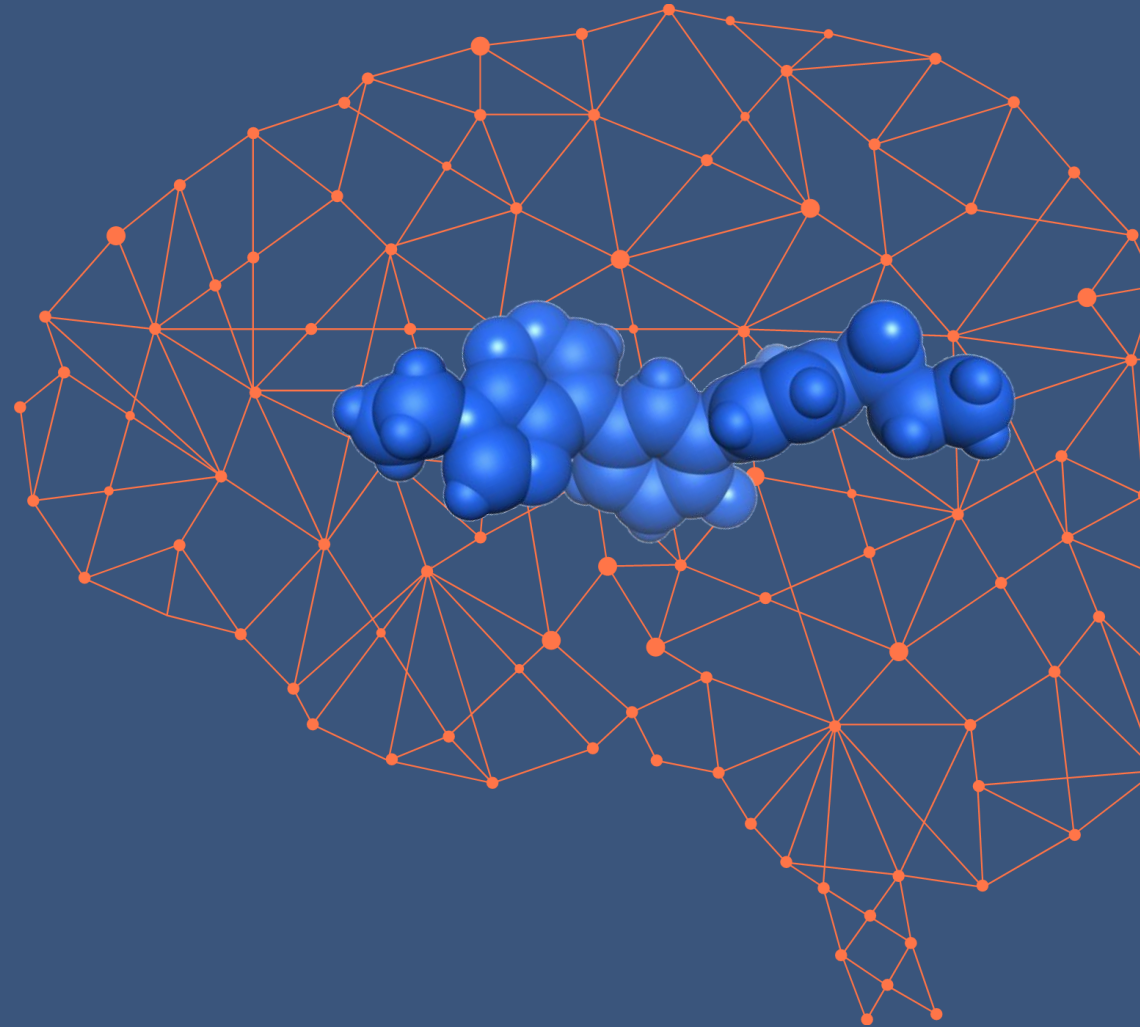
- None established
- Off-label use of atypical antipsychotics: tolerability issues heightened in this population; contribute to cognitive decline

## Next Steps for CVL-231

- CVL-231 side effects / tolerability observed to date are appropriate for further clinical evaluation in elderly patients
- Upcoming clinical pharmacology study in the elderly

## ■ Darigabat (GABA<sub>A</sub> PAM)

Selectively targeting the  $\alpha$ -2/3/5 subunits of the GABA<sub>A</sub> receptor with the goal of enhancing anti-convulsant and anxiolytic effects without dose-limiting sedation



# Darigabat has Potential for Benzo-like Activity, Improved Side Effects and Chronic Dosing

## Darigabat

Potential to become first-line and adjunct therapy

**Targeted GABA  $\alpha$  2/3/5 Receptor Selectivity**

Benzo-like Activity

Improved Tolerability

Potential for Reduced Abuse Liability

## Opportunity for New Treatment Option in Epilepsy

HCPs and patients are dissatisfied due to insufficient activity, side effects and poor tolerability

Large Market

▶ ~65M Patients Worldwide

>\$6B G7 Revenues in 2018

~6% per year Branded AED<sup>1</sup> Market Growth through 2025

Benzos are highly efficacious, but...

▶ Poor Tolerability

Desensitization & Loss of Efficacy

Potential for Abuse

Withdrawal



Potential as chronic therapy with improved side effect profile and tolerability may expand use vs. traditional benzodiazepines

# Selective GABA<sub>A</sub> Receptor PAM: Potential for Lower Seizure Rates, Reduced Side Effects

## GABA $\alpha$ -2/3/5 Can Differentially Address Symptoms

GABA subtype predicted effects:	$\alpha$ 1	Darigabat		
		$\alpha$ 2	$\alpha$ 3	$\alpha$ 5
Anti-convulsant	✓✓	✓✓		
Anxiolysis		✓✓	✓✓	
Analgesia		✓✓	✓	✓✓
Muscle Relaxation		✓✓	✓✓	
Sedation	✓✓			
Cognitive Impairment	✓✓	?	?	✓
Addiction	✓✓	✓		

Benzodiazepine  
side effects

## Role for Targeted GABA $\alpha$ 2/3/5 Receptor Selectivity

- >10 benzodiazepines (BZDs - broad-spectrum GABA modulators) widely prescribed for anxiety, seizures and other indications
- Significant need for better-tolerated, less sedating and less addictive GABA modulators
- BZD Rx's increased >95% from 2003-2015



To our knowledge, darigabat is the only GABA  $\alpha$ -2/3/5 selective PAM in clinical trials for epilepsy

# Darigabat Data Showed a Favorable Side Effect Profile Relative to Benzodiazepines

## Multiple doses of darigabat

Phase 1 MAD Study – only mild AEs and limited somnolence up to 42.5 mg BID

Able to achieve >80% receptor occupancy without significant somnolence observed

Benzodiazepines achieve 10% to 15% receptor occupancy with significant somnolence observed

No evidence of withdrawal effects

## Phase 1 MAD Study (Protocol: B7431011)

	Reaction	Week 1 (Titration)	Week 2 (Maintenance)	Week 3 (Maintenance)	Follow-up
Placebo	No Reaction	4 / 4	4 / 4	3 / 4	4 / 4
	Dizziness	-	-	1 / 4	-
	Somnolence	-	-	-	-
25 mg BID (~80% RO <sup>(1)</sup> )	No Reaction	5 / 8	7 / 8	8 / 8	8 / 8
	Dizziness	2 / 8	1 / 8	-	-
	Somnolence	3 / 8	-	-	-
42.5 mg BID (>80% RO <sup>(1)</sup> )	No Reaction	4 / 7	6 / 7	6 / 7	6 / 7
	Dizziness	3 / 7	1 / 7	1 / 7	1 / 7
	Somnolence	-	-	-	-

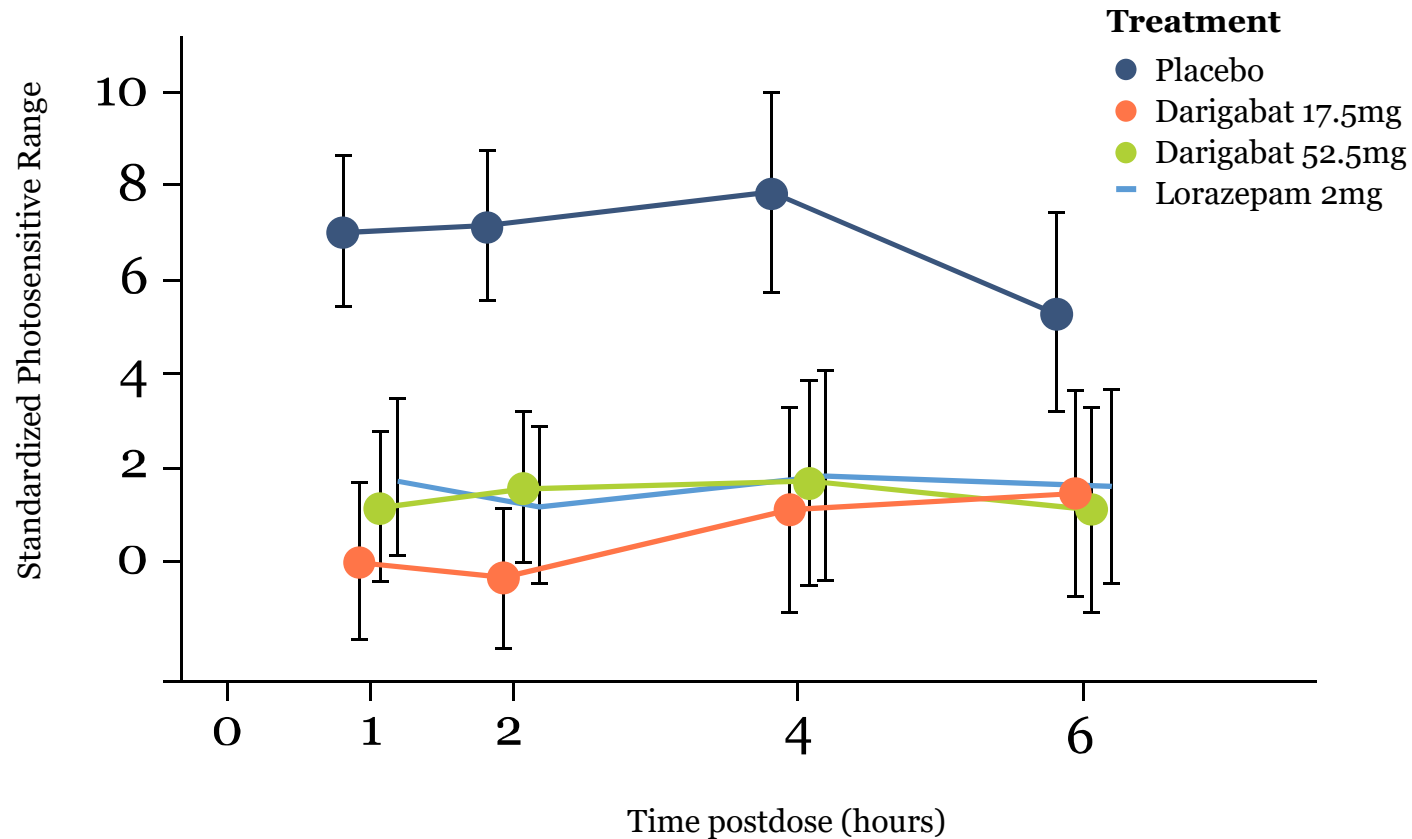


No somnolence observed following titration through doses of 42.5 mg BID



# Darigabat Phase 2 Data Showed Benzo-like Anticonvulsant Activity in Photosensitive Epilepsy<sup>(1)</sup>

## Darigabat in Single-Dose Photosensitive Epilepsy Study



## Darigabat Results

Anticonvulsant activity comparable to lorazepam

Improved sedation and AE profile compared to benzos

Complete suppression in 6 of 7 subjects

Majority of AEDs developed for epilepsy that showed positive published photoepilepsy results were approved<sup>(2)</sup>



# Darigabat REALIZE Trial: Data Expected 2H 2022

## REALIZE Phase 2 Trial In Focal Epilepsy

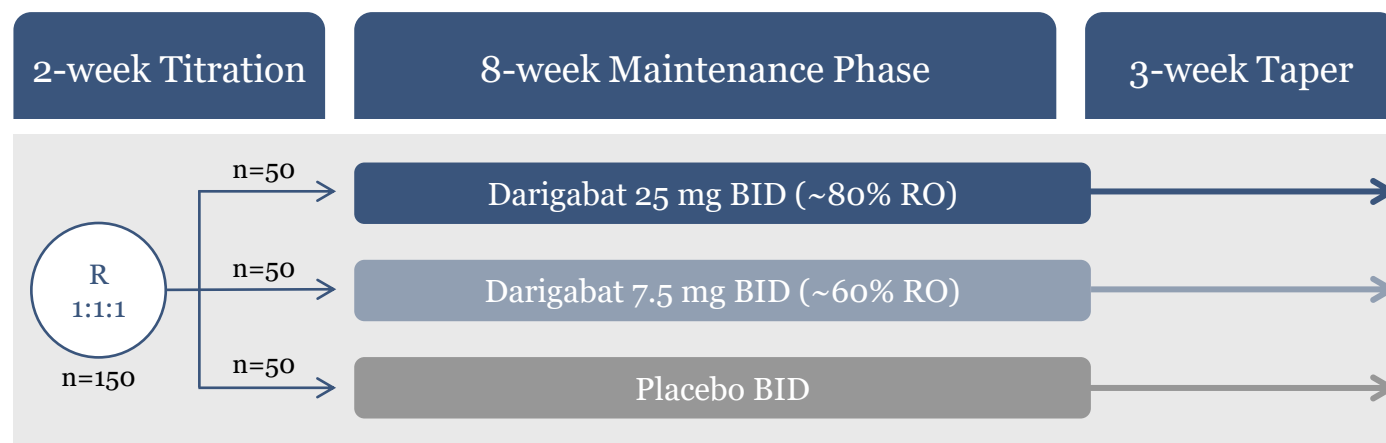
*Targeting ~60 sites in 3 countries*

### Inclusion criteria

- Adults (18-75) with drug-resistant focal onset seizures
- History of 4+ seizures per month for at least 3 months
- 1-3 stable background AEDs allowed

### Primary endpoint

- Reduction in focal onset seizure frequency



*Patients able to join 57-week open-label extension trial (REALIZE OLE) after completion of 8-week maintenance phase*



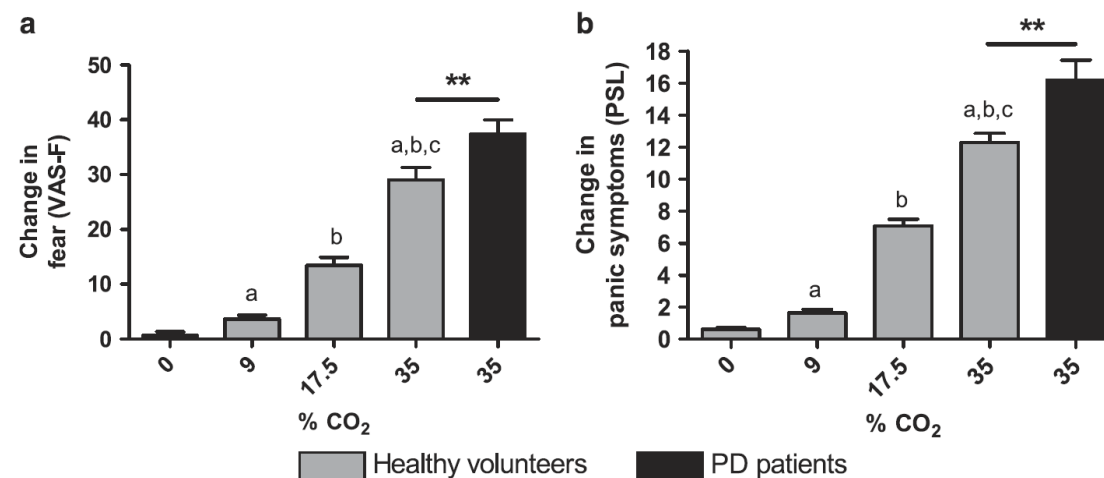
Focal epilepsy trial intended to establish proof of concept and side effect profile to support development in broader epilepsy indications

# Darigabat: Phase 1 Program in Acute Anxiety

## The Hypercapnia (CO<sub>2</sub> Inhalation) Model

- CO<sub>2</sub> inhalation challenge is translational model providing proof-of-principle for anxiolytic activity in early clinical development
- Well-established in both healthy volunteers and in patients with panic disorder
  - Hypercapnia results in increased fear and panic, as measured by Visual Analogue Scales (VAS) and the Panic Symptom List (PSL)<sup>1</sup>
- The proposed mechanism of the anxiety induced by hypercapnia model is decreased GABA and increased noradrenaline<sup>2</sup>
- The model is sensitive to drugs used to treat anxiety disorders (including benzodiazepines & SSRIs) and emerging new treatments with novel mechanisms

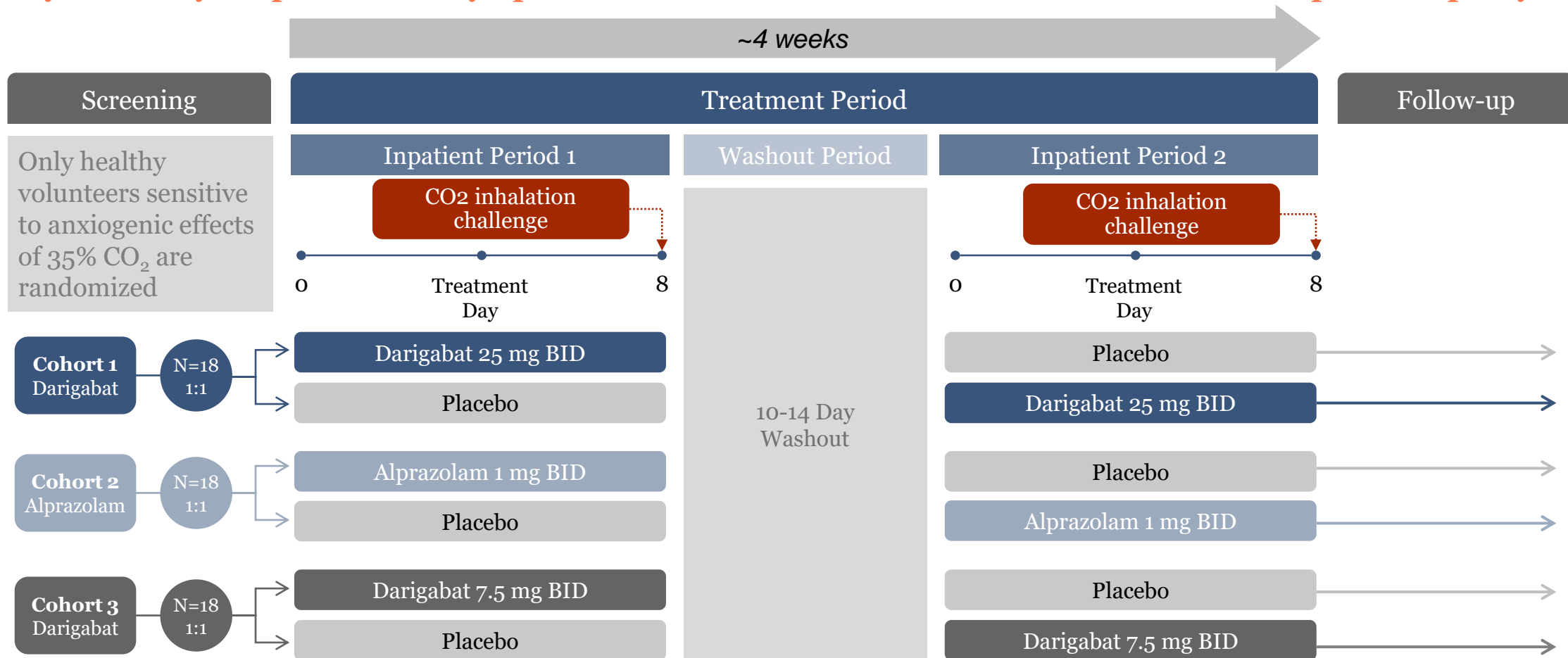
## CO<sub>2</sub> inhalation induces fear and panic symptoms in healthy volunteers and panic disorder patients



**Figure 2.** Effect of CO<sub>2</sub> on self-reported fear and panic symptoms in healthy volunteers and PD patients. In healthy volunteers (gray), both fear (a) and panic symptoms (b) increased dose-dependently. Inhaling 35% CO<sub>2</sub> triggered a more robust response in patients (black) when compared with healthy volunteers. Data represent mean+s.e.m. (a) Compared with 0% CO<sub>2</sub>,  $P < 0.001$ ; (b) compared with 9% CO<sub>2</sub>,  $P < 0.001$ ; (c) compared with 17.5% CO<sub>2</sub>,  $P < 0.001$ ; \*\* $P < 0.01$ . PD, panic disorder; PSL, Panic Symptom List; VAS-F, Visual Analog Scale for fear.

# Darigabat Phase 1 in Acute Anxiety: Data Expected 1H 2022

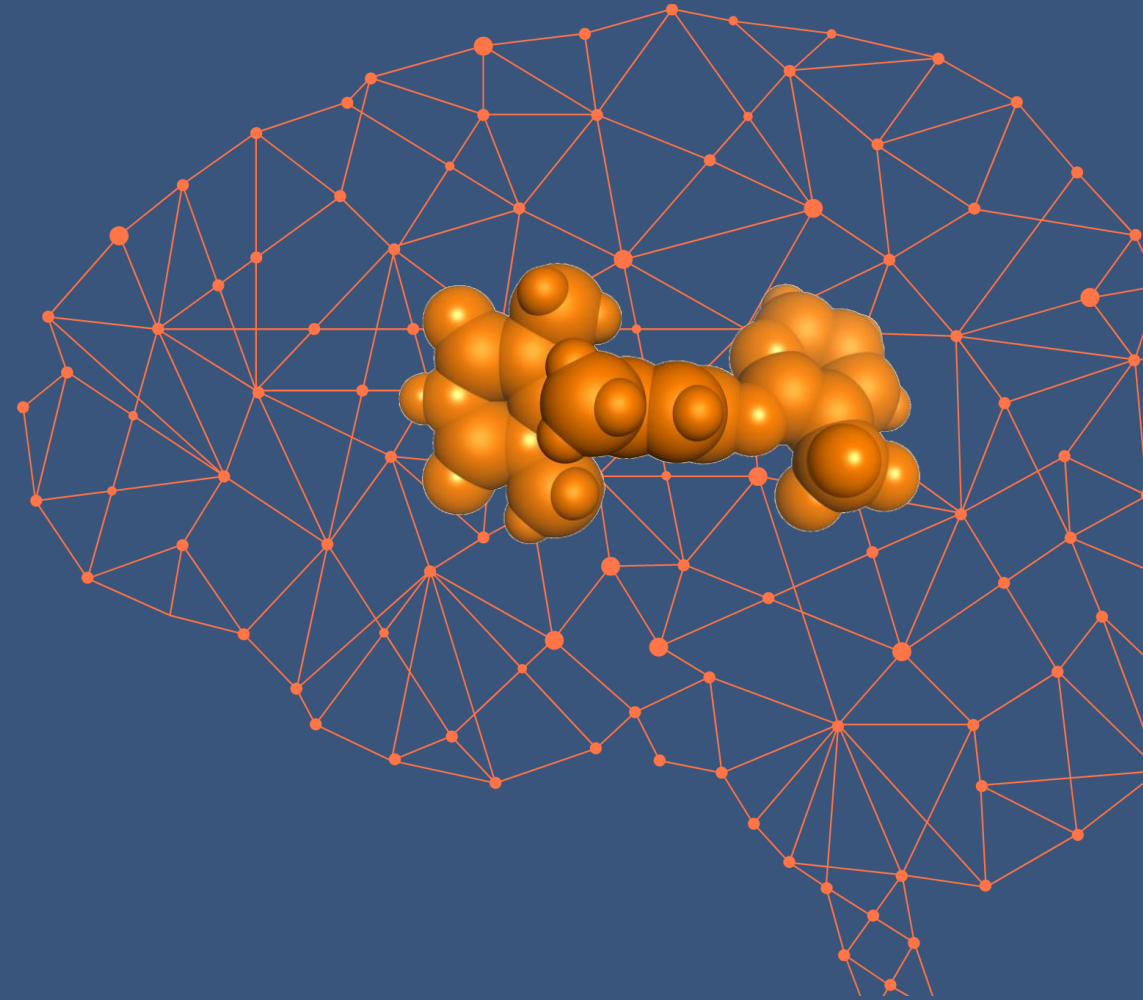
**Randomized, double-blind, placebo- and active-controlled crossover design with multiple doses over 8 days. Primary endpoint: Panic symptoms list<sup>1</sup>. Doses selected to achieve ~60 and 80% receptor occupancy**



1. The Panic Symptom List (PSL) includes 13 symptoms scored across a range of 0 (absent) to 4 (very intense) that is used to assess panic anxiety. Liebold et al. Trans Psychiatry. 2016.; Bailey et al. J Psychopharm. 2011.; Malizia et al. Arch Gen Psychiatry. 1998.; Salvatore et al. Translational Psychiatry 2020.

# D Tavapadon in Parkinson's Disease

*Partial agonist selectively targeting the dopamine D1 receptor with the goal of enhancing motor control while minimizing side effects*



# Tavapadon has Potential to be a Differentiated Treatment for Parkinson's

*Designed to be a novel backbone therapy for patients from diagnosis to the end of treatment:*

**Only\* D1/D5 selective molecule**

**Avoid D2/D3 Side Effects:** *Sudden daytime somnolence, hallucinations, acute orthostasis and impulse control disorders*

**First\* partial agonist for Parkinson's**

**Avoid Dyskinesias:** *Driven by receptor overexcitation*

**Predictable 24-hour activity**

**Sustained Effect:** *Once daily, oral dosing*

**Selective direct motor pathway activation**

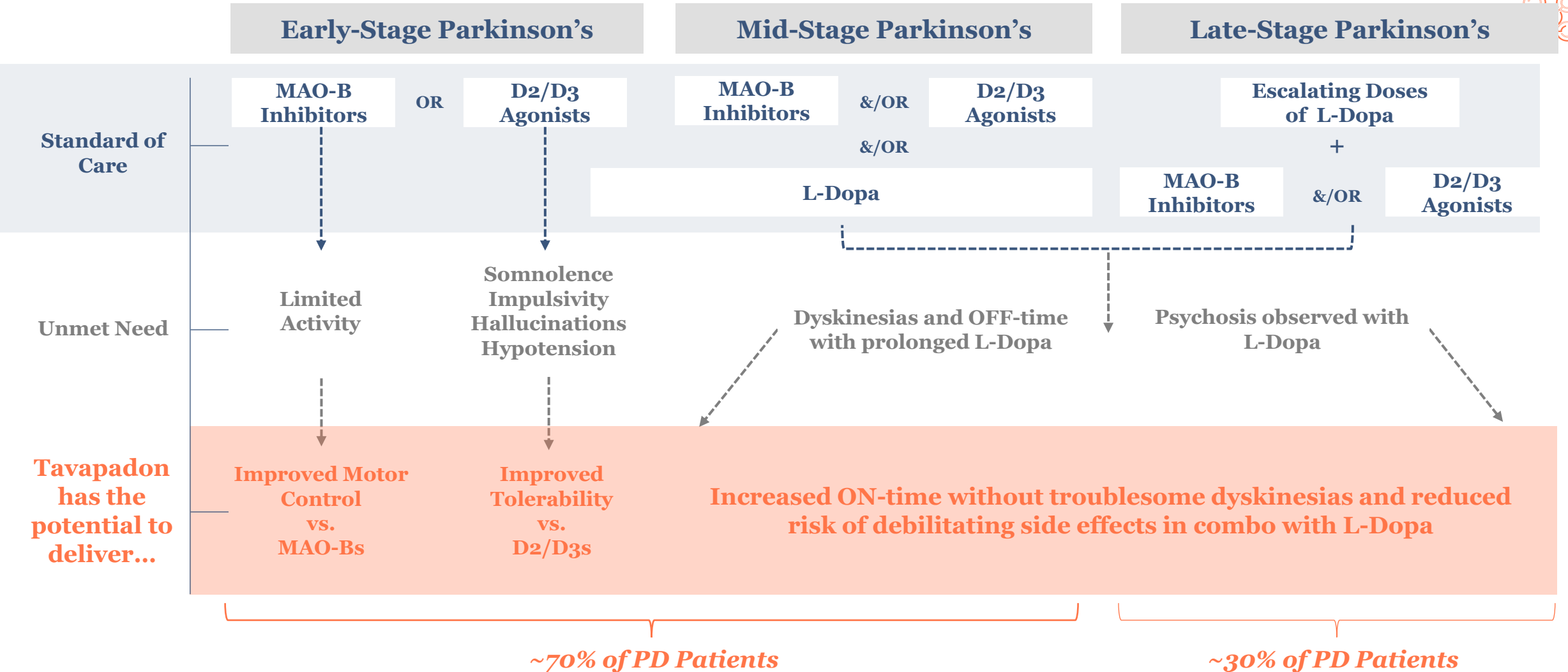
**Superior motor control over D2/D3s full agonists**

- Feedback received from FDA on our Phase 3 program (2019)
- To our knowledge, nothing else in the symptomatic pipeline positioned to provide broad therapeutic benefit and differentiation



First-in-class potential designed to offer stable motor control and favorable side effect profile with broad monotherapy and adjunct therapy benefit

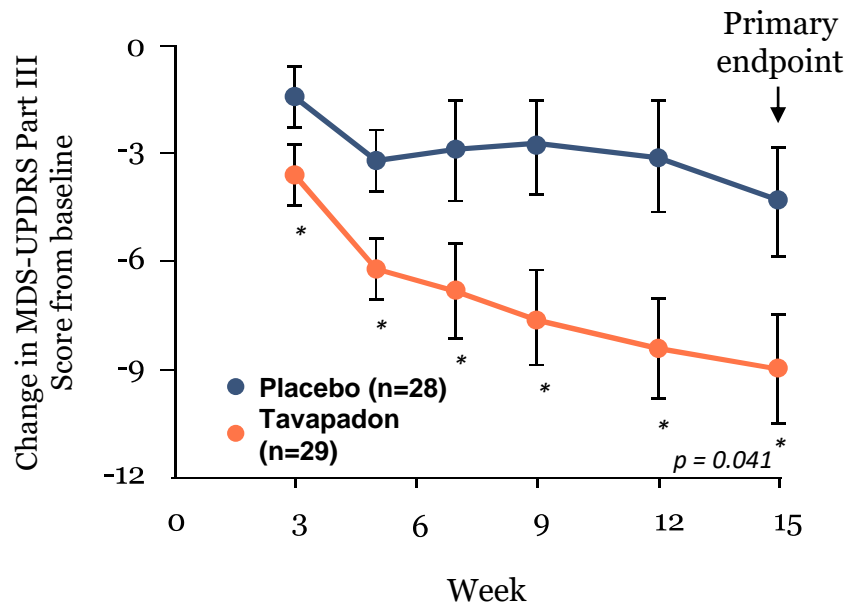
# Tavapadon Designed to Address Unmet Needs Across All Stages of Parkinson's: Early and Late



# Selective Direct Motor Pathway Activation Designed to Provide Differentiated Treatment Option in Early Parkinson's

*Potential for motor control as good or better than D2/D3s with once-daily dosing and improved side effect profile*

## Phase 2 Data: Tavapadon in Early PD<sup>1</sup> (Primary Endpoint: MDS-UPDRS III Motor Score)



**In Phase 2, tavapadon demonstrated 4.8 point MDS-UPDRS III difference vs. placebo at week 15 (p=0.04, MMRM)**

Note: Average dose of tavapadon = 9 mg; 11 patients on 15 mg top dose at week 15. Baseline Part III scores of 24.3 (tavapadon) and 25.8 (placebo).

## Additional Tavapadon Phase 2 Data<sup>1</sup>

- When adjusted to exclude patients with baseline MDS-UPDRS II of 0 or 1, **showed improvement of ~2 points over placebo on MDS-UPDRS Part II<sup>2</sup>**
- Most common AEs included headache and nausea (can be mitigated with titration)
- Tavapadon's incidence of known D2/D3 side effects:
  - Somnolence: 14%
  - Nausea: 31%
  - Hallucinations: 0%<sup>3</sup>
  - Hypotension-Related Events: 7%
  - Dizziness: 7%

**Tavapadon demonstrated 5.8 point improvement over placebo at week 15 on MDS-UPDRS Part II + III (p = 0.02, MMRM)**



# Tavapadon TEMPO-1 & -2 in Early PD: Data Expected 2H 2023



Registration-directed program includes three global Phase 3 trials optimally designed to maximize treatment effect

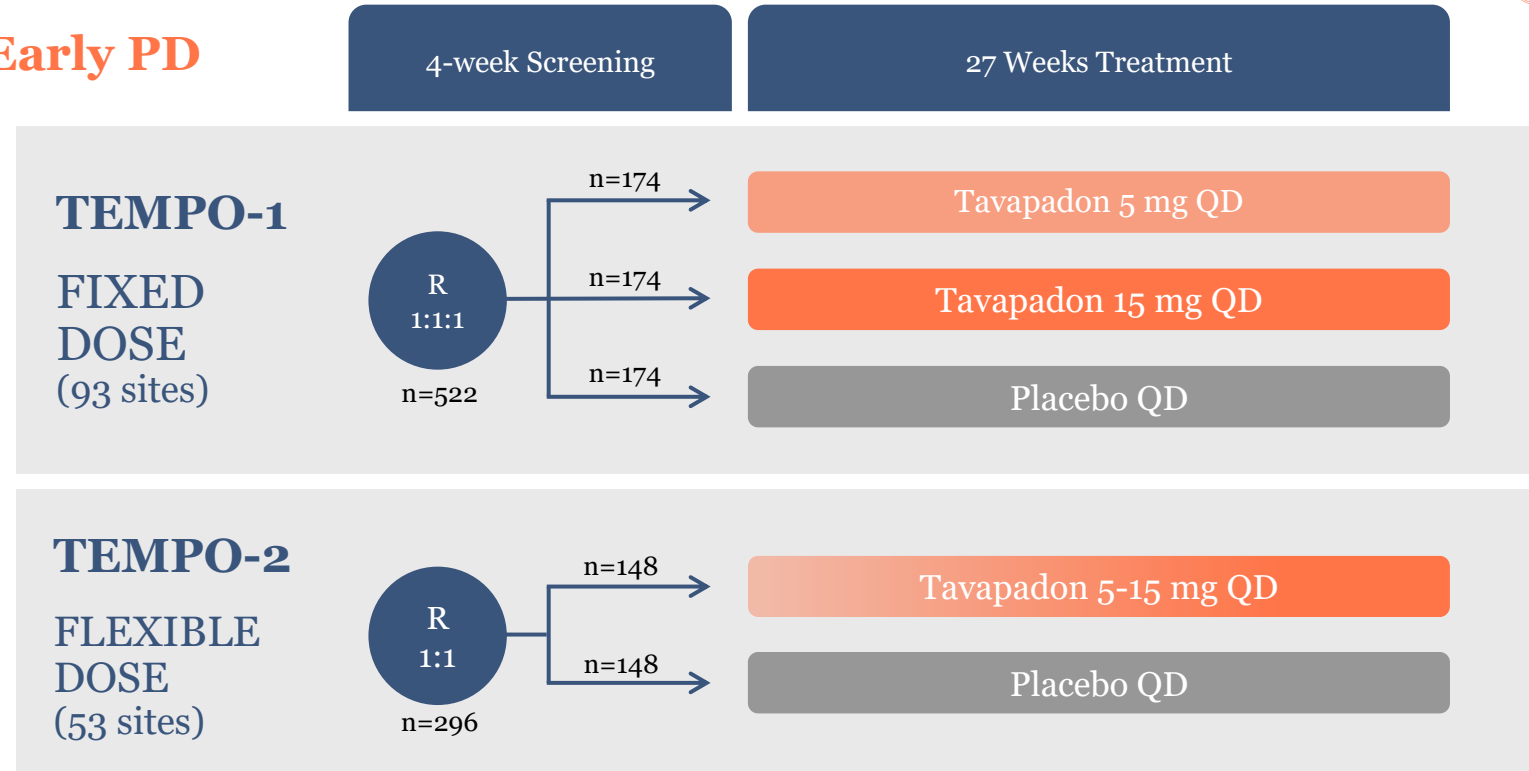
## TEMPO-1 & TEMPO-2: Phase 3 in Early PD

### Key inclusion criteria

- Adults 40-80 years old
- Baseline MDS-UPDRS<sup>(1)</sup> Part III Score  $\geq 10$  and Part II Score  $\geq 2$
- Modified Hoehn & Yahr<sup>(2)</sup> stage 1 to 2
- No concomitant meds except MAO-B inhibitors

### Primary endpoint

- Change in MDS-UPDRS Parts II+III

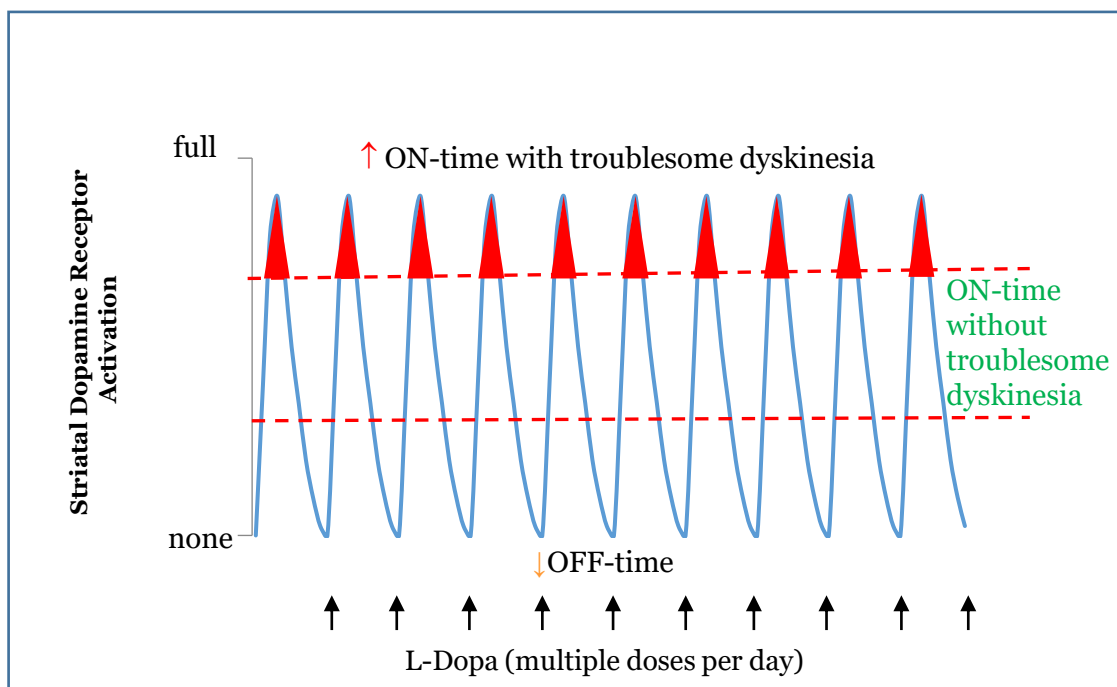




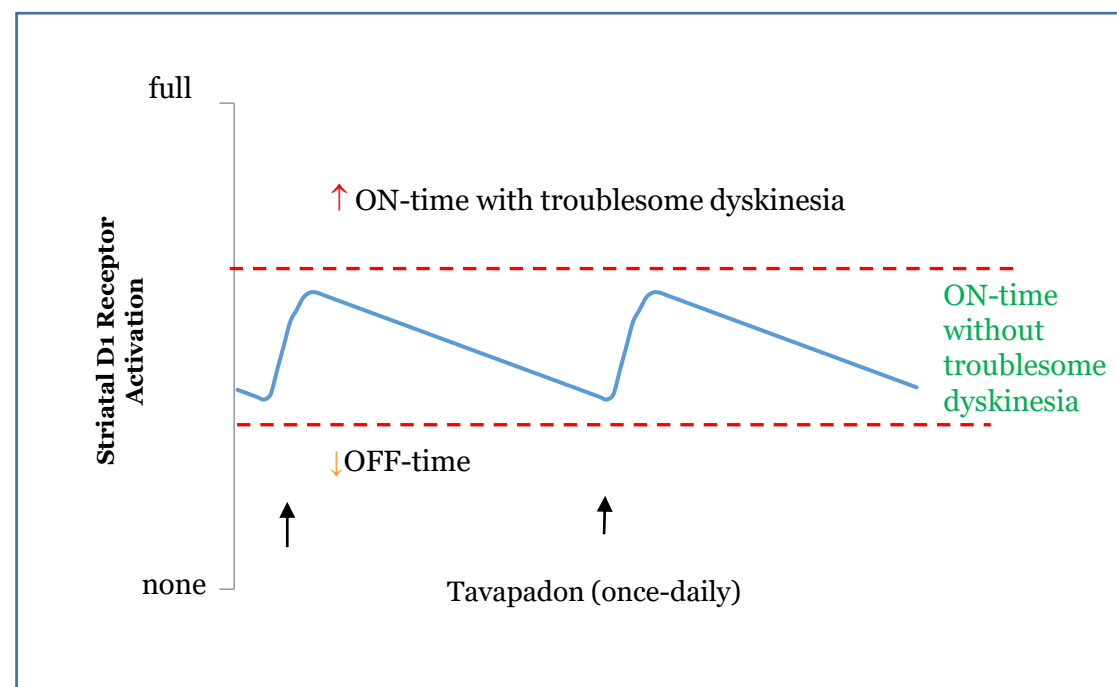
# In Late PD, Goal is to Control Motor Fluctuations and Dyskinesias Driven by L-Dopa

## L-Dopa vs. Tavapadon in Late-Stage PD<sup>1</sup>

L-Dopa is a **FULL** agonist with **SHORT** half-life



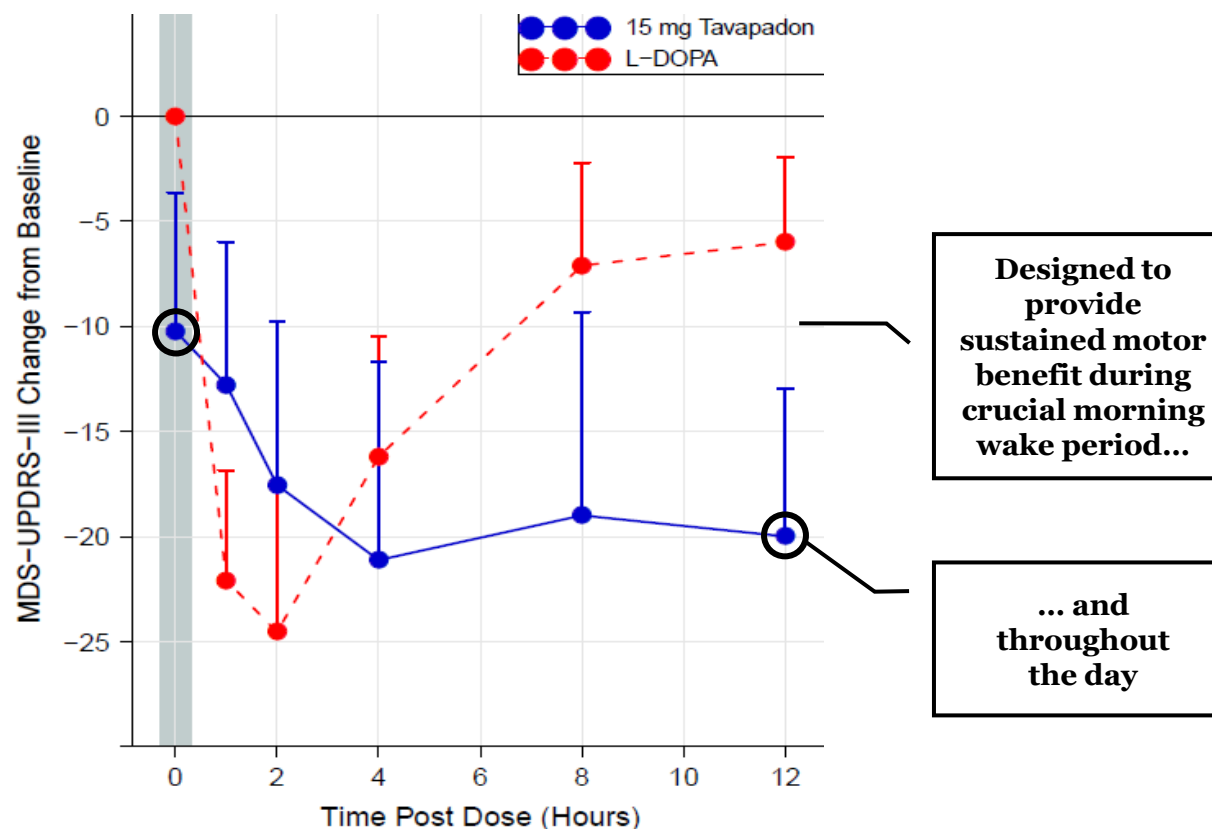
Tavapadon is a **PARTIAL** agonist with **LONG** half-life



30-40% of patients experience dyskinesias within 5 years on L-Dopa<sup>2</sup>  
40% experience OFF-time within 3-5 years on L-Dopa<sup>2</sup>

# Predictable 24-hour Activity → Sustained Effect: Once Daily, Oral Dosing

## Study 1005: Tavapadon in Late-Stage PD<sup>1</sup>



In an open-label Phase 1b trial, Tavapadon demonstrated motor improvement on par with L-Dopa, sustained due to its 24-hour half-life

# Tavapadon TEMPO-3 in Late PD: Data Expected 1H 2023



Registration-directed program includes three global Phase 3 trials optimally designed to maximize treatment effect

## TEMPO-3: Phase 3 in Late PD

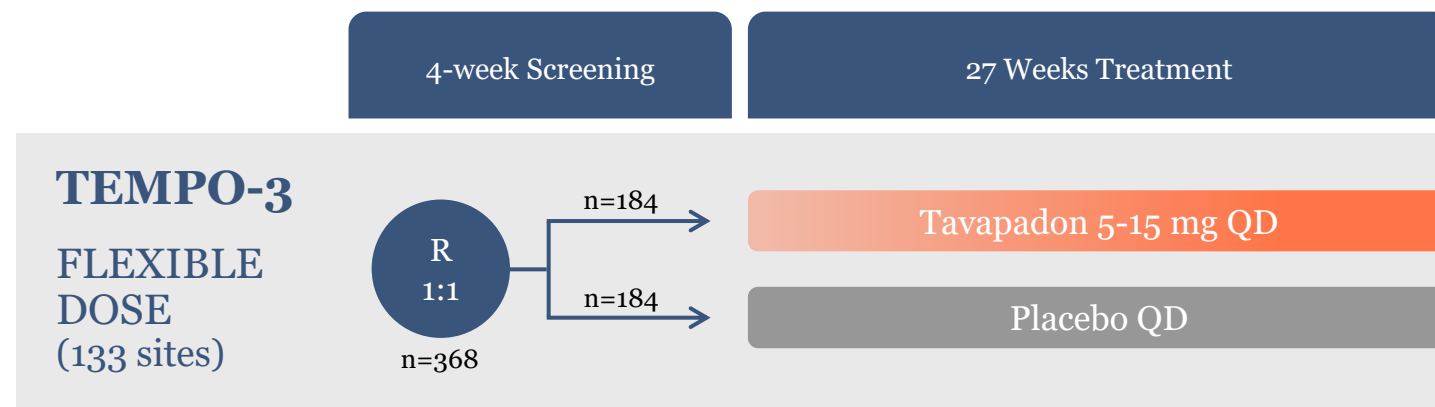
### Adjunct to levodopa

#### Key inclusion criteria

- Adults 40-80 years old
- At least 2.5 hours OFF-time on 2 consecutive days at baseline
- Modified Hoehn & Yahr<sup>(1)</sup> stage 2 to 3, with response to L-Dopa

#### Primary endpoint

- Change in ON-time without troublesome dyskinesia



# Tavapadon Commercial Potential in Parkinson's

## Tavapadon Target Profile



Novel D1/D5 mechanism



Potential similar or better motor control<sup>(1)</sup>



Potential favorable side effect profile<sup>(2)</sup>



Once-daily dosing

## Pricing & Launch

Branded US price analogs \$8-10K+/year

Payor research supports broad Medicare and Commercial coverage at price of \$8K+ /year

Strong side effect profile and motor control differentiation would reduce reimbursement restrictions

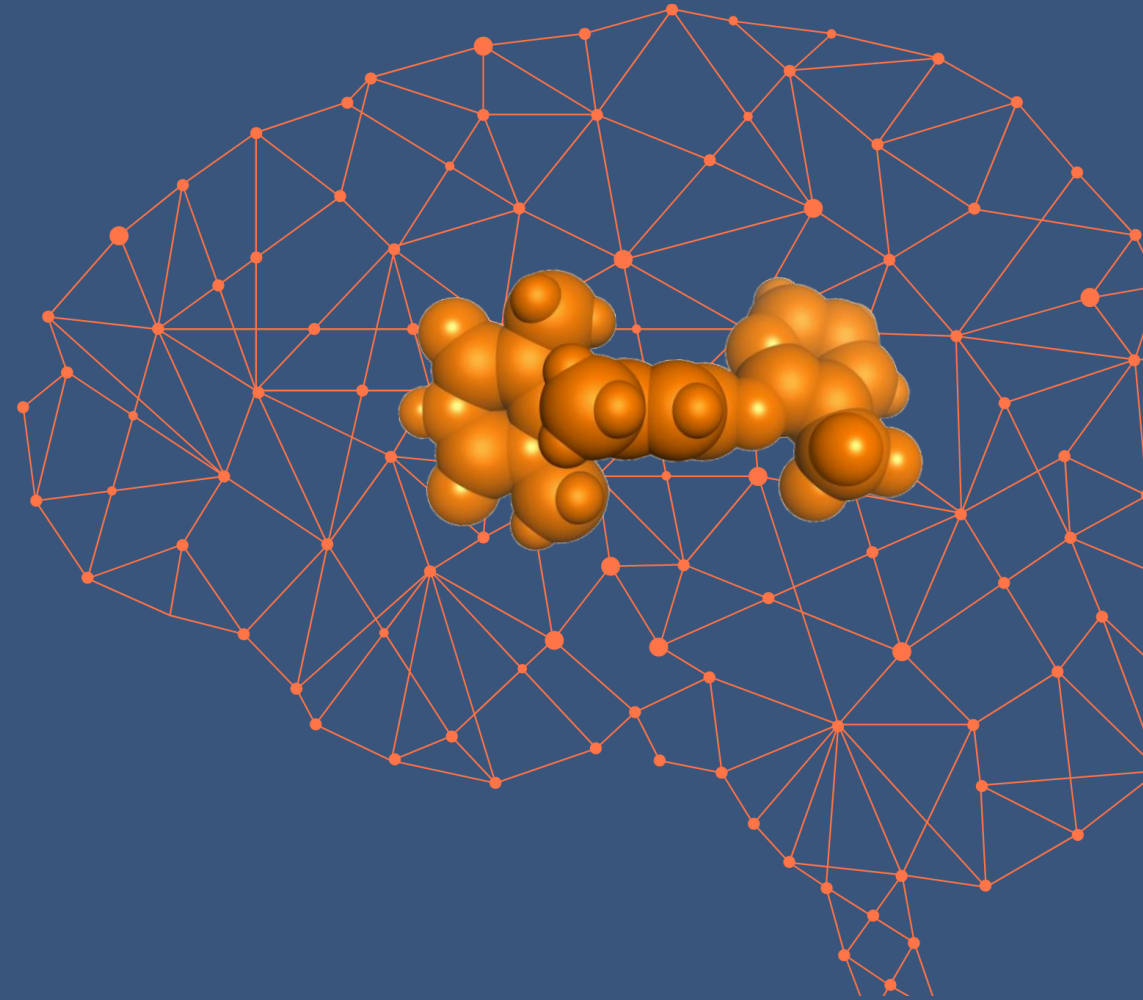
Patients and physician research supports acceptability of branded co-pays for a tavapadon-like differentiated profile



Differentiated profile supports pricing comparable to branded market leaders which have broad reimbursement

## CVL-871 in Dementia-Related Apathy

*Partial agonist selectively targeting the dopamine D1 receptor with the goal of modulating motivation and reward pathways to address apathy in patients with mild-to-moderate dementia*



# High Unmet Need in Apathy, which Affects ~50% of Patients with Dementia<sup>1</sup>

## What is Apathy?

Leading neuropsychiatric symptom in dementia

Social disengagement and loss of emotion leads to:

- Impaired decision-making
- Lack of empathy, affection, or concern
- Loss of interest in personal well-being and relationships
- Inability to initiate and maintain normal daily activities
- Interference with basic function\*

## CVL-871: Potential to be the First Treatment for Dementia-Related Apathy

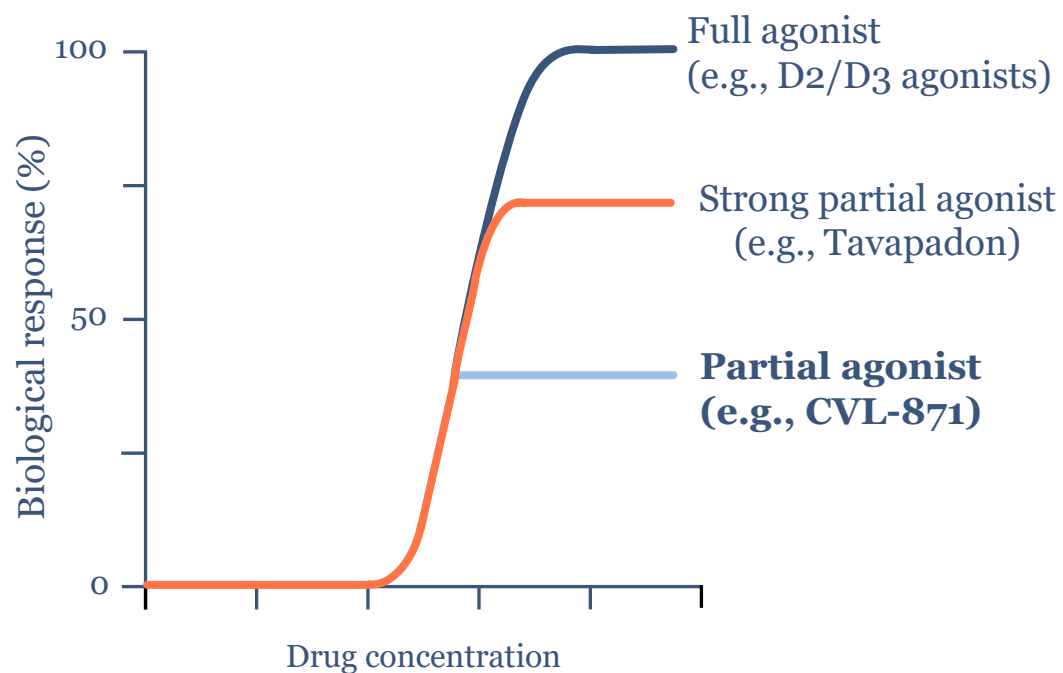
High Unmet Need	>50M Dementia Patients Worldwide <sup>2</sup>	>3X Mortality Risk <sup>3</sup>	Among strongest predictors of disease progression <sup>4</sup>	Early institutionalization & ↑ caregiver burden <sup>4</sup>
No Approved Treatment	Acetylcholinesterase Inhibitors	▷	No proven effect	
Off-label use of...	SSRIs/SNRIs	▷	No established benefit May worsen apathy symptoms	
	Methylphenidate	▷	Schedule II stimulant with CV risk in elderly patients	

# CVL-871: D1/D5 Partial Agonism for Dementia-Related Apathy

## CVL-871 Summary

- Like tavapadon, CVL-871 is a selective D1/D5 partial agonist
- While tavapadon drives up to ~70% biological response at the D1/D5 receptors, CVL-871 has ~40% partial agonism
- Potentially optimal level of agonism for modulating neuronal pathways related to motivation and reward
- Dopaminergic enhancement may improve apathy based on historical studies of methylphenidate
- Potential non-stimulant option for treatment of dementia-related apathy

## Degrees of Agonism (Illustrative)





# CVL-871 Phase 2a Exploratory Trial: Data Expected 2H 2022

## Phase 2a Trial in Dementia-Related Apathy

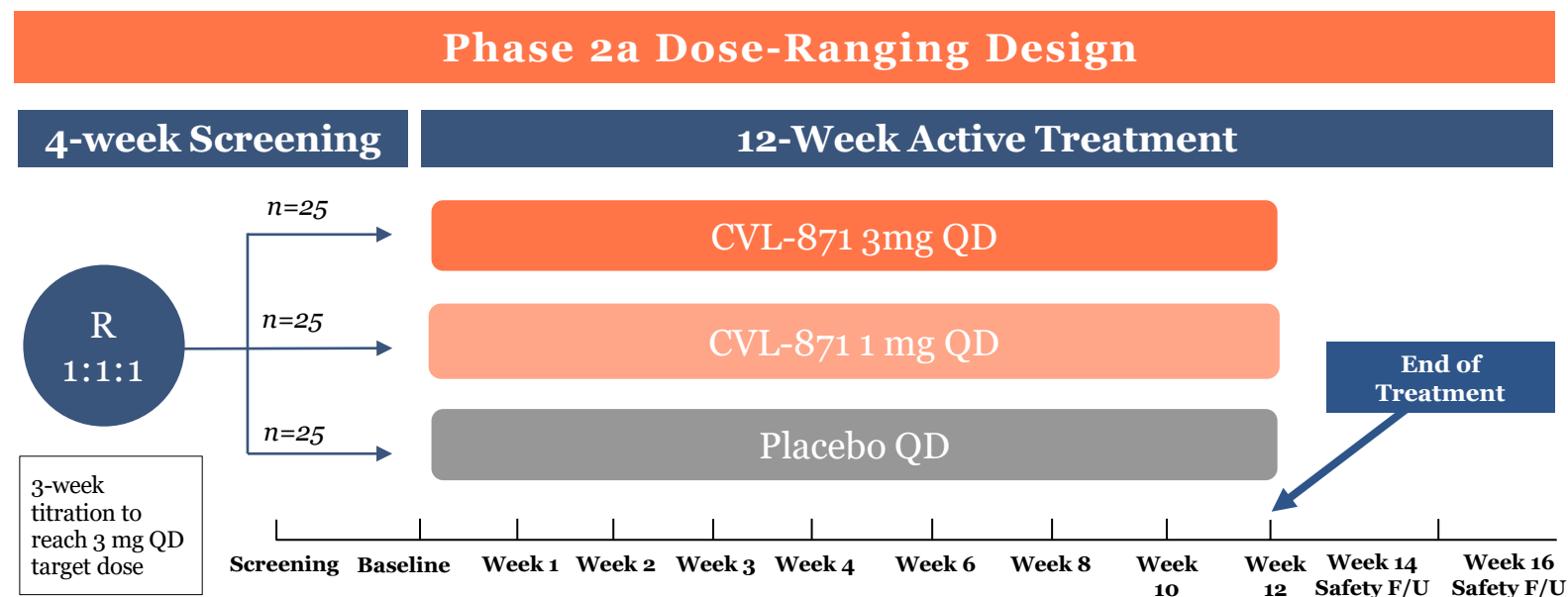
### Key inclusion criteria

- Adults 50-85 years old
- NPI-Apathy domain frequency and severity scores each  $\geq 2$
- Mild-to-moderate dementia
- MMSE 15-26; CDR 0.5-2.0

### No primary endpoint

### Exploratory efficacy measures

- **Apathy/Global:** NPI/NPI-C, DAIR, AES-C, mADCS-CGIC/CGIS, Caregiver CGIC/CGIS
- **Function:** DAD, Zarit Caregiver Burden
- **Cognition:** ADAS-Cog13, Trail Making A, Digit Span, COWAT



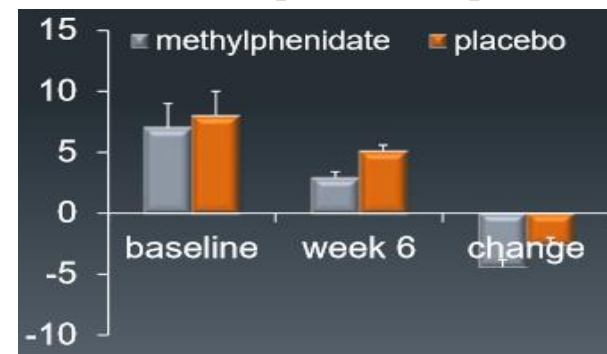
# Increased D1 Receptor Activation May Improve Apathy

## D1 Activation Potential in Apathy

- Dopamine acting via D1 in the striatum directly promotes motivation and goal-directed behavior
- D1 density reduces with age and reduction in dopamine signaling is associated with behavioral / psychological symptoms of dementia (BPSD)
- Methylphenidate (MPH), an NDRI\*, significantly improved apathy in AD patients in 2 independent Phase 2 trials

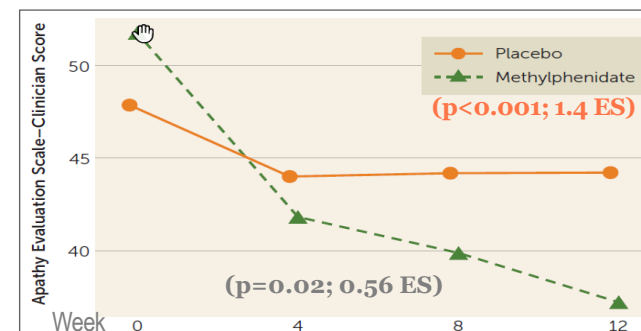
## Methylphenidate Phase 2 Trials

**ADMET1 Trial:** showed NPI Apathy global score improvement of 1.8 points over placebo



ADMET1 Trial-Rosenberg, et al J Clin Psychiatry 2013

**Veterans AD Apathy Trial:** showed AES-C score improvement of 9.9 points over placebo at week 12

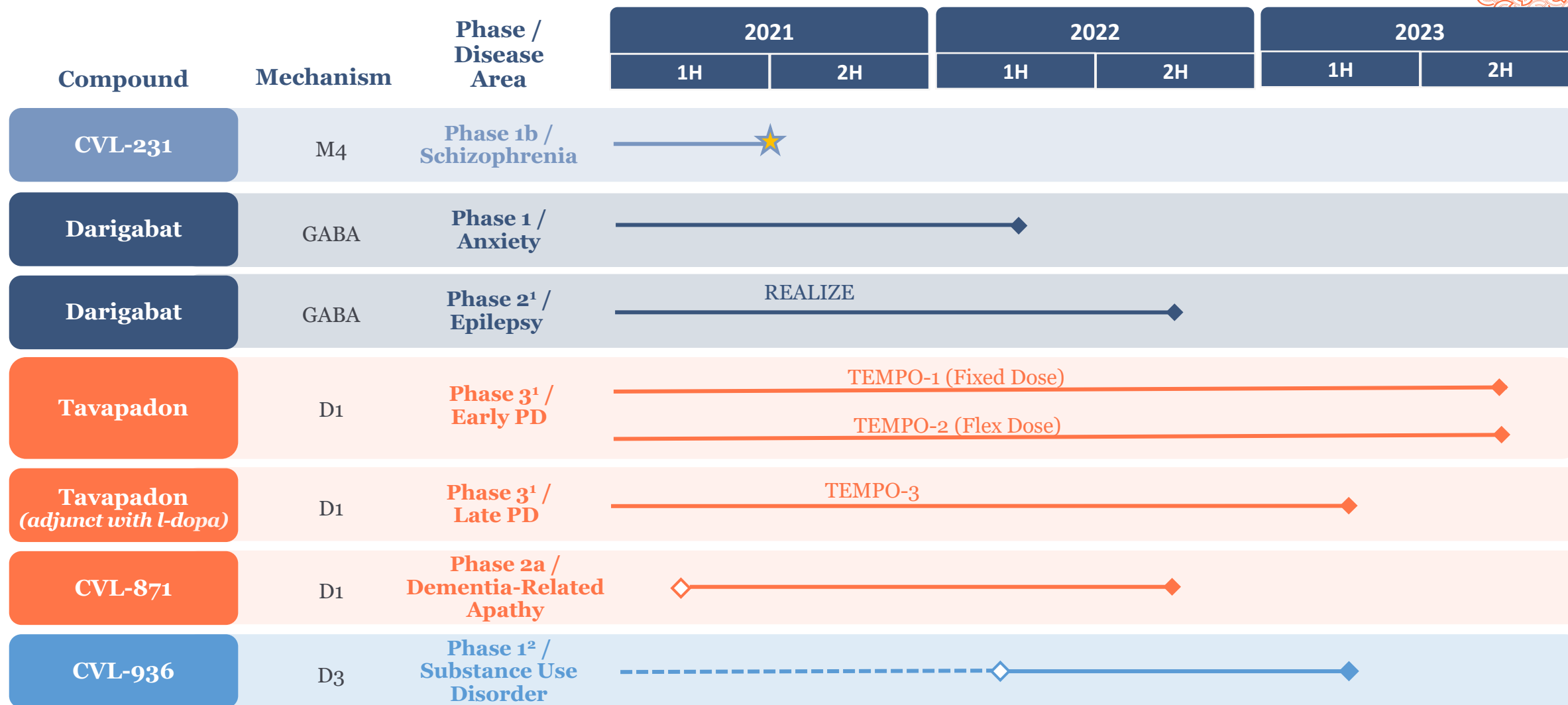


Veterans AD Apathy Trial, Padala et.al, Am J Psychiatry 2018

# Transforming the Possible in Neuroscience



# Multiple Milestones Expected Over Next Three Years



◇ Estimated Trial Initiation

◆ Estimated Topline Data

# Cerevel is Transforming Possibilities for Tomorrow

Multiple Programs Aimed at Providing New Options for Millions of Patients

## Multiple near-term milestones

- Schizophrenia
- Epilepsy
- Parkinson's

## Expansion to other diseases

- Alzheimer's Psychosis
- Anxiety
- Apathy
- Substance Abuse Disorder

## Long-term discovery efforts

Disease-modifying therapies based on human genetics and novel targets addressing:

- Neuronal loss
- Synaptic health

Compound	Mechanism	Disease Area	Discovery	Pre-clinical	Phase 1	Phase 2	Phase 3
CVL-231	M4 PAM	Schizophrenia					
CVL-865	GABA <sub>A</sub> α2/3/5 PAM	Epilepsy					
Tavapadon	D1/D5 Partial Agonist	Early Parkinson's					
Tavapadon (adjunct with L-Dopa)	D1/D5 Partial Agonist	Late Parkinson's					

Compound	Mechanism	Disease Area	Discovery	Pre-clinical	Phase 1	Phase 2	Phase 3
CVL-231	M4 PAM	Schizophrenia					
CVL-865	GABA <sub>A</sub> α2/3/5 PAM	Epilepsy					
CVL-865	GABA <sub>A</sub> α2/3/5 PAM	Anxiety					
Tavapadon	D1/D5 Partial Agonist	Early Parkinson's					
Tavapadon (adjunct with L-Dopa)	D1/D5 Partial Agonist	Late Parkinson's					
CVL-871	D1/D5 Partial Agonist	Dementia-Related Apathy					
CVL-936	D3-Preferring Antagonist	Substance Use Disorder					

Compound	Mechanism	Disease Area	Discovery	Pre-clinical	Phase 1	Phase 2	Phase 3
CVL-231	M4 PAM	Schizophrenia					
CVL-865	GABA <sub>A</sub> α2/3/5 PAM	Epilepsy					
CVL-865	GABA <sub>A</sub> α2/3/5 PAM	Anxiety					
Tavapadon	D1/D5 Partial Agonist	Early Parkinson's					
Tavapadon (adjunct with L-Dopa)	D1/D5 Partial Agonist	Late Parkinson's					
CVL-871	D1/D5 Partial Agonist	Dementia-Related Apathy					
CVL-936	D3-Preferring Antagonist	Substance Use Disorder					
CVL-354	KORA	MDD / SUD					
CVL-947	PDE4	MDD / Schizophrenia					
Lead Optimization	M4 Agonist	Schizophrenia					
Lead Optimization	LRRK2	Parkinson's					

50M+ Patients WW



100M+ Patients WW



Premier Neuroscience Company

# Appendix



## Who We Are is in Our Name

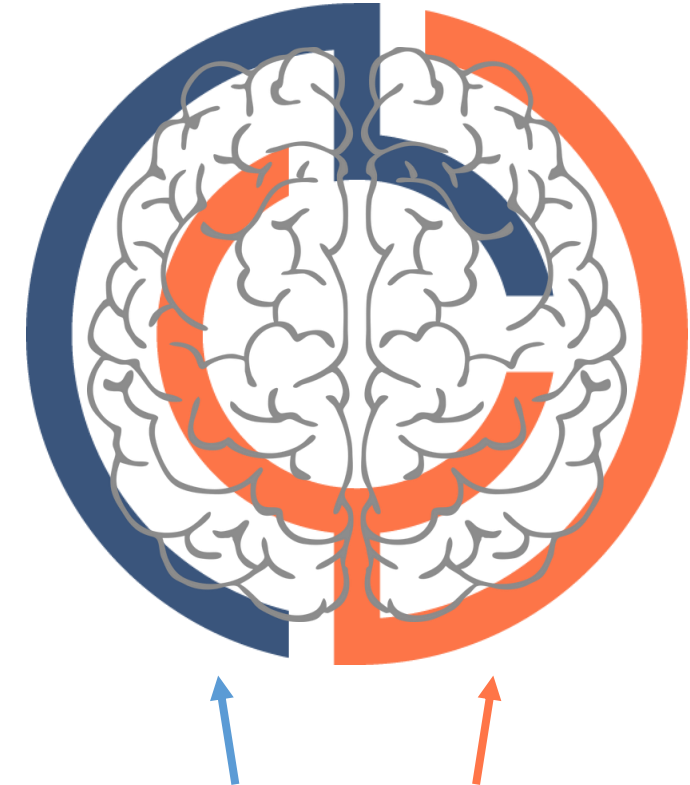


**cere** = cerebrum

**revel** = revelation/reveal

We are bold thinkers, deep experts, resilient pathfinders, and transparent partners who push the boundaries of scientific understanding to unlock breakthrough CNS therapies that could have real impact on people's lives.

## Brain hemispheres



**Lock in key**

Selective / Targeted Mechanisms

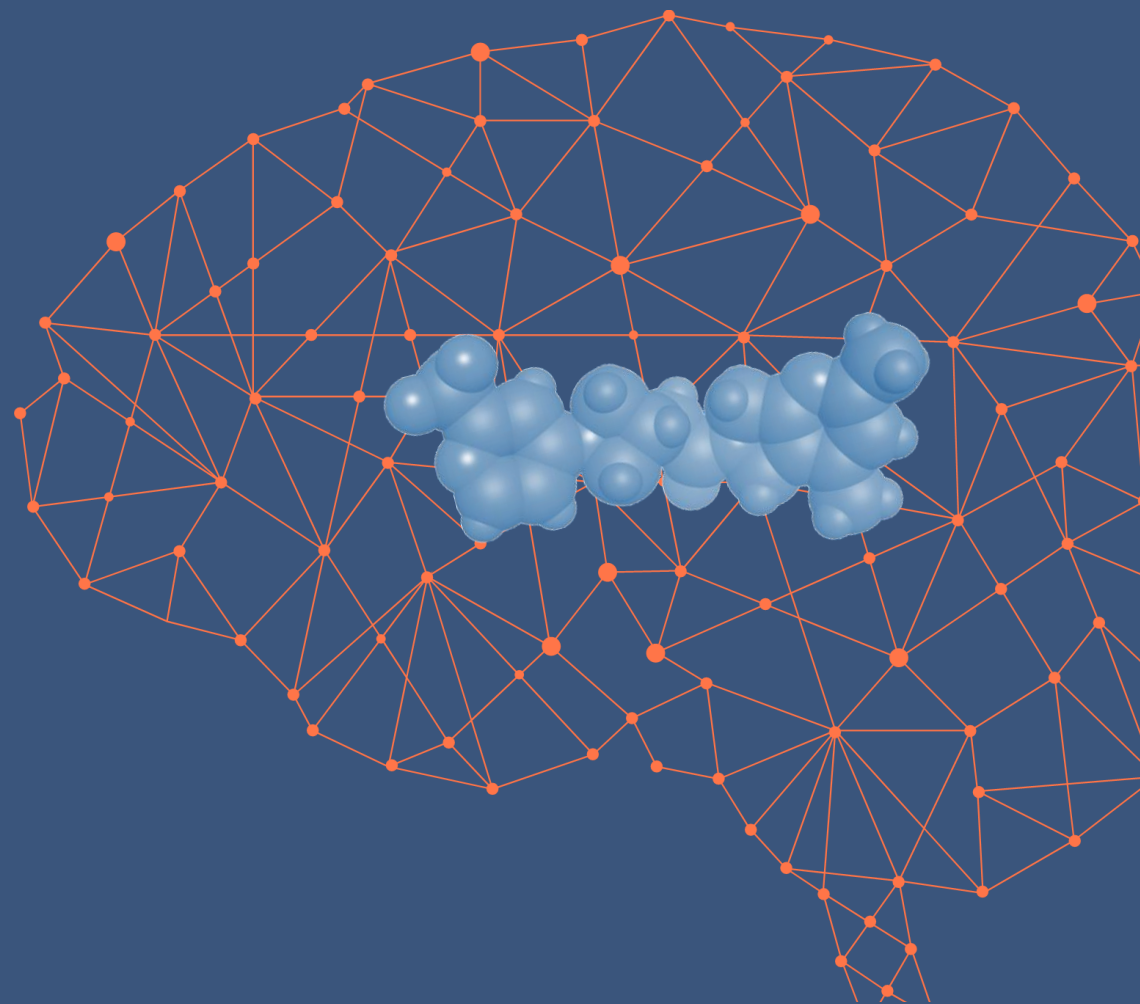


# Cerevel Clinical Pipeline: Broad, Deep and Diverse

Compound	Disease Area	Discovery	Pre-clinical	Phase 1	Phase 2	Phase 3	Upcoming Milestone	Mechanism
Tavapadon	Early Parkinson's						Ph. 3 Data 2H 2023	D1/D5 Strong Partial Agonist ★
Tavapadon (adjunct with L-Dopa)	Late Parkinson's						Ph. 3 Data 1H 2023	
Darigabat	Epilepsy						Ph. 2 Data 2H 2022	GABA <sub>A</sub> α2/3/5 PAM ★
Darigabat	Anxiety						Ph. 1 Data 1H 2022	
CVL-231	Schizophrenia						Ph. 2 Data	M4 PAM ★
CVL-871	Dementia-Related Apathy						Ph. 2a Data 2H 2022	D1/D5 Partial Agonist ★
CVL-936	Substance Use Disorder						Under evaluation	D3 Preferring Antagonist

# ■ M4 PAM (CVL-231) in Schizophrenia

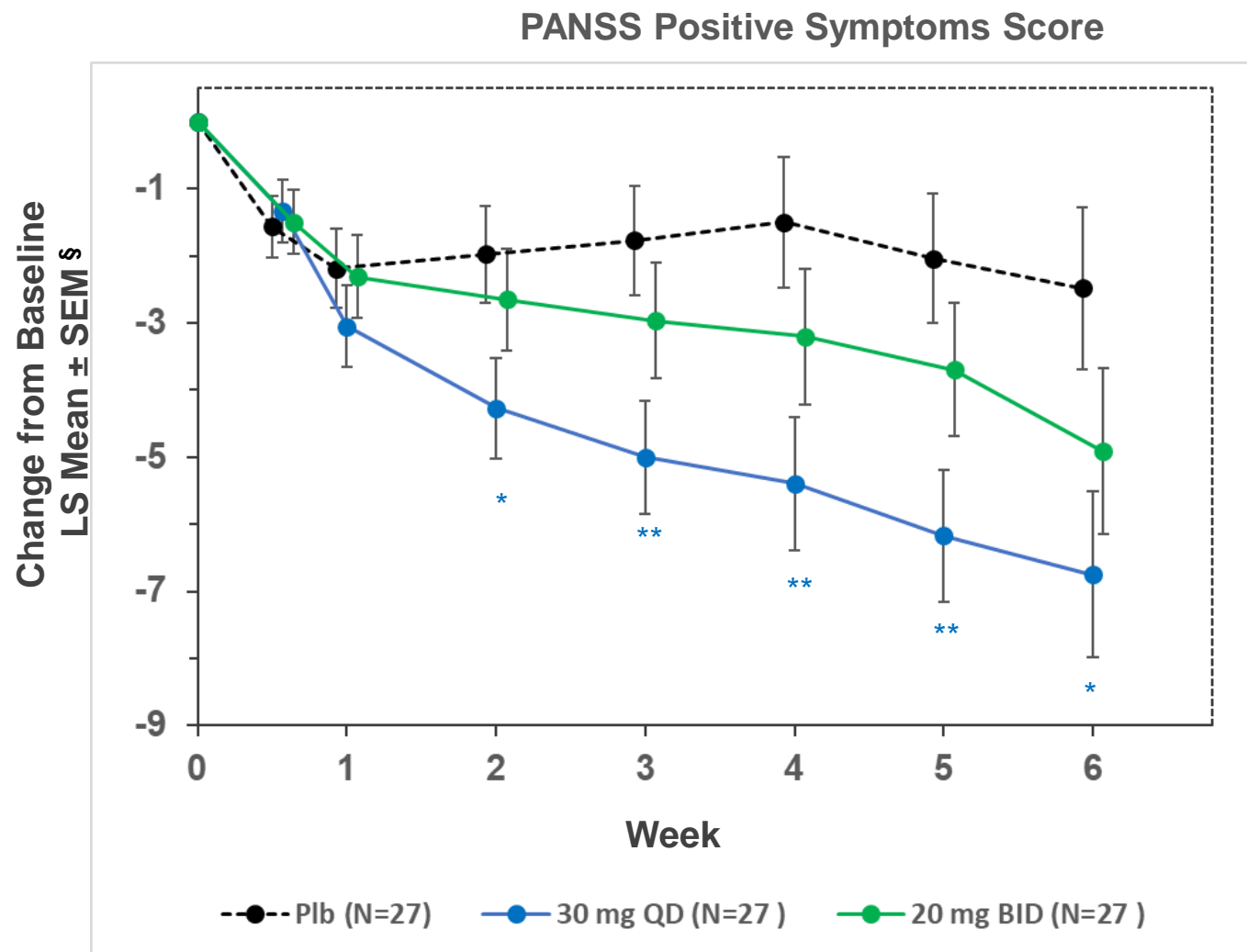
*Additional Slides*



# Phase 1b Part B: Demographics & Baseline Characteristics

	PBO N= 27	CVL-231 30 mg QD N= 27	CVL-231 20 mg BID N= 27	All CVL-231 N= 54	Total N= 81
<b>Demographics</b>					
Age (years) at Screening: Mean (SD)	41 (9.7)	41 (8.1)	38 (9.8)	40 (9.0)	40 (9.2)
% Male: N (%)	19 (70%)	23 (85%)	21 (78%)	44 (81%)	63 (78%)
Race: N (%)					
Black or African American	17 (63%)	20 (74%)	19 (70%)	39 (72%)	56 (69%)
White	9 (33%)	7 (26%)	7 (26%)	14 (26%)	23 (28%)
Other	1 (4%)	0	1 (4%)	1 (2%)	2 (2%)
Weight (kg) Prior to Dosing: Mean (SD)	90.0 (16.0)	85.4 (13.3)	85.4 (15.4)	85.4 (14.3)	86.9 (14.9)
<b>Disease Characteristics at Baseline: Mean (SD)</b>					
PANSS Total Score	93 (8.8)	93 (7.3)	97 (7.9)	95 (7.7)	95 (8.1)
PANSS Positive Score	24 (2.7)	25 (3.0)	26 (2.6)	26 (2.8)	25 (2.8)
PANSS Negative Score	23 (3.3)	22 (3.7)	24 (3.8)	23 (3.8)	23 (3.6)
CGI-S Score	5 (0.6)	5 (0.5)	5 (0.7)	5 (0.6)	5 (0.6)

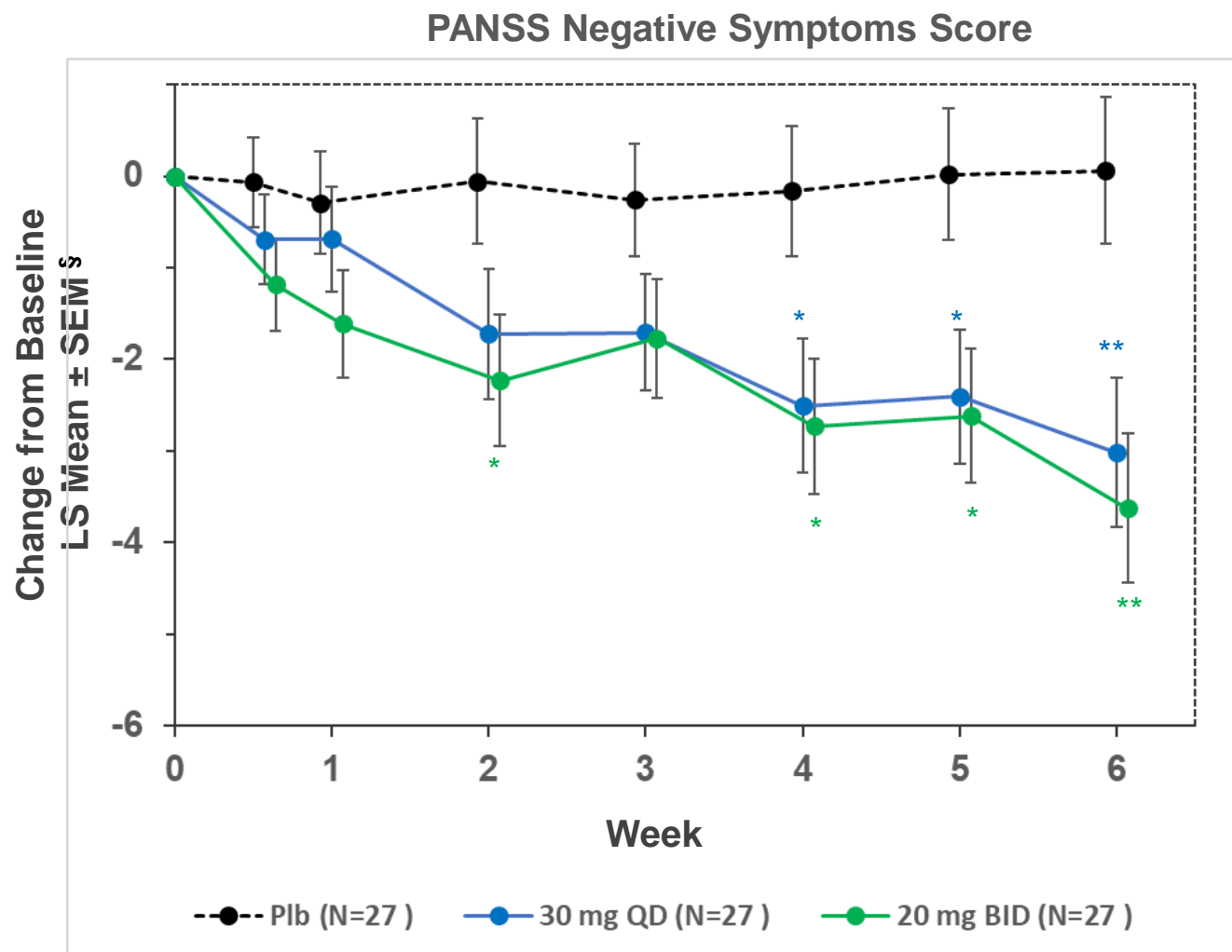
# Phase 1b: PANSS Positive Symptoms Score



- 30 mg QD: 4.3 Point improvement versus placebo at Week 6 (6.8 of 30 mg QD vs 2.5 placebo) with  $P=0.016$
- 20 mg BID: 2.4 Point improvement versus placebo at Week 6 (4.9 of 20 mg BID vs 2.5 placebo) with  $P=0.166$
- Combined CVL 231: 3.3 Point improvement versus placebo at Week 6 (5.8 of CVL231 vs 2.5 placebo) with  $P=0.028$

\*  $P<0.05$  vs Placebo \*\*  $P<0.01$  vs Placebo

# Phase 1b: PANSS Negative Symptoms Score



- 30 mg QD: 3.1 Point improvement versus placebo at Week 6 (3.0 of 30 mg QD vs -0.1 placebo) with  $P=0.009$
- 20 mg BID: 3.7 Point improvement versus placebo at Week 6 (3.6 of 20 mg BID vs -0.1 placebo) with  $P=0.002$
- Combined CVL 231: 3.4 Point improvement versus placebo at Week 6 (3.3 of CVL231 vs -0.1 placebo) with  $P=0.001$

\*  $P<0.05$  vs Placebo \*\*  $P<0.01$  vs Placebo

## Phase 1b: Safety & Tolerability – Adverse Events

	PBO N= 27	CVL-231 30 mg QD N= 27	CVL-231 20 mg BID N= 27	All CVL-231 N= 54
Days on IMP				
Mean (SD)	37 (9.6)	36 (12.8)	35 (13.6)	36 (13.1)
Range	8, 42	4, 42	2, 42	2, 42
Number (%) Subjects with TEAE	14 ( 52%)	14 ( 52%)	15 ( 56%)	29 ( 54%)
Number (%) Subjects with TEAE Related to IMP	10 ( 37%)	7 ( 26%)	12 ( 44%)	19 ( 35%)
Number (%) Subjects with Serious TEAE	0	2 ( 7%)	1 ( 4%)	3 ( 6%)
Number (%) Subjects with AE of Special Interest (AESI )	3 ( 11%)	2 ( 7%)	4 ( 15%)	6 ( 11%)
Number (%) Subjects with TEAE Leading to Discontinuation of IMP	0	2 ( 7%)	1 ( 4%)	3 ( 6%)

# Phase 1b: Safety & Tolerability - Adverse Events

*Incidences of All CVL-231  $\geq$  2% and > Placebo*

	PBO N= 27	CVL-231 30 mg QD N= 27	CVL-231 20 mg BID N= 27	All CVL-231 N= 54
Number (%) Subjects				
Headache	7 ( 26%)	8 ( 30%)	7 ( 26%)	15 ( 28%)
Nausea	1 ( 4%)	2 ( 7%)	2 ( 7%)	4 ( 7%)
Back pain	1 ( 4%)	2 ( 7%)	1 ( 4%)	3 ( 6%)
Blood creatine phosphokinase increased	0	1 ( 4%)	2 ( 7%)	3 ( 6%)
Dizziness	0	1 ( 4%)	2 ( 7%)	3 ( 6%)
Dry mouth	0	3 ( 11%)	0	3 ( 6%)
Somnolence	0	1 ( 4%)	2 ( 7%)	3 ( 6%)
Pruritus	0	1 ( 4%)	1 ( 4%)	2 ( 4%)



# Serious AEs (SAEs) and AEs of Special Interest (AESIs)

	PBO N= 27	CVL-231 30 mg QD N= 27	CVL-231 20 mg BID N= 27	All CVL-231 N= 54
Number (%) Subjects with SAE				
COVID-19	0	0	1 ( 4%)	1 ( 2%)
Accidental overdose**	0	1 ( 4%)	0	1 ( 2%)
Schizophrenia**	0	1 ( 4%)	0	1 ( 2%)
Number (%) Subjects with AESI*				
Blood pressure increased	2 ( 7%)	0	0	0
Heart rate increased	1 ( 4%)	0	1 ( 4%)	1 ( 2%)
Blood pressure diastolic increased	0	0	1 ( 4%)	1 ( 2%)
Sinus tachycardia	0	0	1 ( 4%)	1 ( 2%)
Psychotic disorder**	0	0	1 ( 4%)	1 ( 2%)
Schizophrenia**	0	1 ( 4%)	0	1 ( 2%)
Accidental overdose**	0	1 ( 4%)	0	1 ( 2%)

**\*\* AEs leading to discontinuation of treatment with IMP. No other AE leading to discontinuation of IMP**

\* AESIs specified in the protocol include 1. AEs that result in the discontinuation of treatment with IMP, 2. events that satisfy the criteria for suspected Hy's Law (ALT or AST >3 × ULN, AND serum bilirubin ≥2 × ULN, AND alkaline phosphatase <2 × ULN), 3. events of heart rate >120 bpm, and confirmed by ECG, 4. events of confirmed QTcF is >500 msec or the increase from baseline is >75 msec in subjects without significant hypokalemia, 5. events of mean triplicate blood pressure reading >160 mmHg systolic or >100 mmHg diastolic with confirmation.

# Safety & Tolerability

## Cardiovascular AESI Summary

- Vital sign and ECG abnormalities defined in the AESI section of the protocol required immediate reporting to the sponsor for collection and risk characterization regardless of clinical significance.
  - Protocol defined CV abnormality thresholds included HR >120 bpm, systolic BP >160 mmHg, or diastolic BP >100 mmHg.
- Six (6) subjects had CV abnormality threshold AESI's reported (3 on active treatment, 3 on placebo). No subjects were symptomatic, and no events were considered clinically significant or associated with other reported AEs.

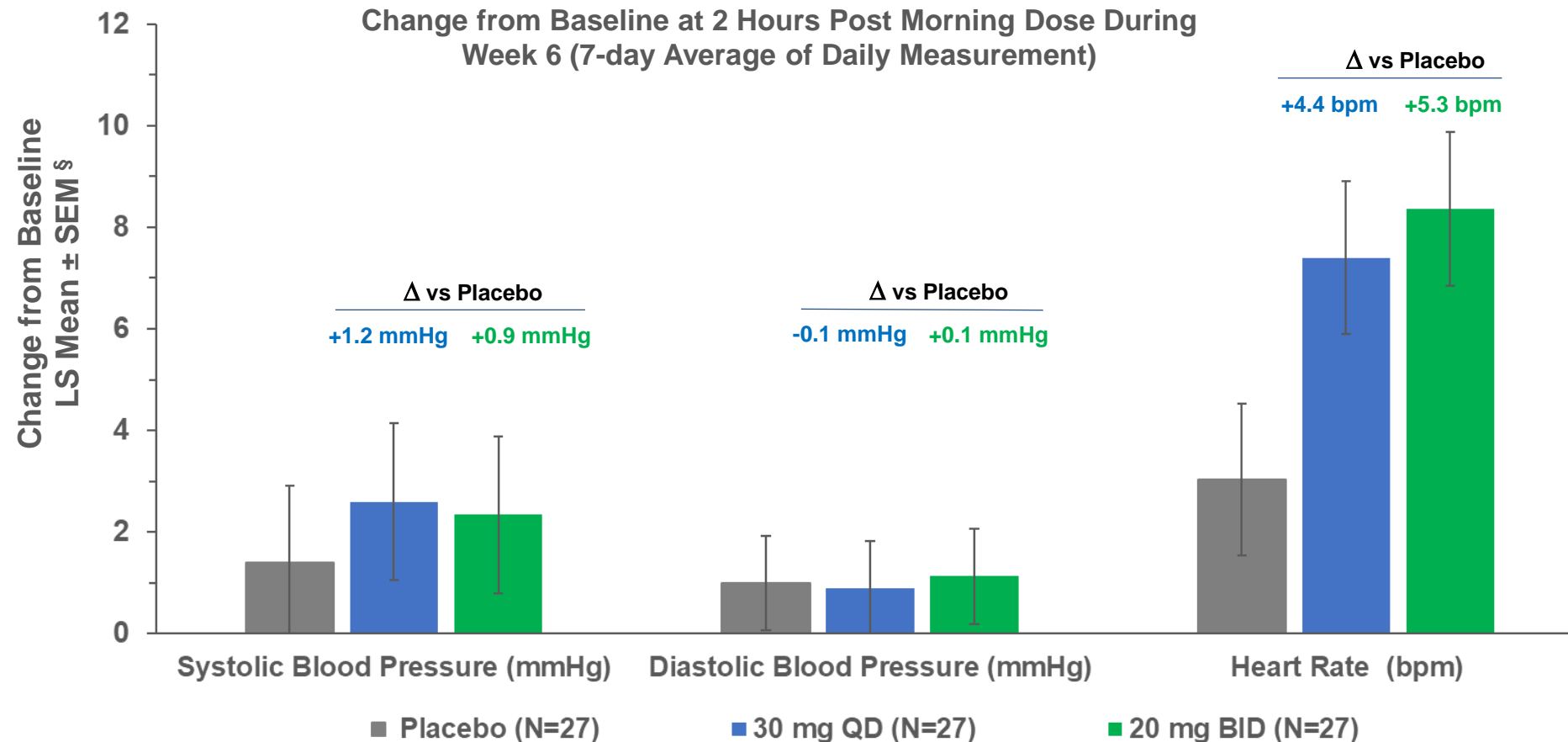
	Subject	Treatment	AESI PT (severity)	Start Date	End Date	Baseline value	Vital Sign Abnormality
Placebo	1	Placebo	Blood pressure increased (mild)	Day 23 (2 hrs post a.m. dose)	Day 23	Systolic BP: 121 mmHg	Systolic BP: 168 mmHg
	2	Placebo	Blood pressure increased (mild)	Day 10 (2 hrs post a.m. dose)	Day 10	Systolic BP: 127 mmHg	Systolic BP: 162 mmHg
	3	Placebo	Heart rate increased (mild)	Day 21 (2 hrs post p.m. dose)	Day 22	HR: 75 bpm	HR: 128 bpm
CVL-231 (20 mg BID)	4	CVL-231 20 mg BID	Heart rate increased (mild)	Day 21 (2 hrs post p.m. dose)	Day 22	HR: 78 bpm	HR: 121 bpm
	5	CVL-231 20 mg BID	Sinus tachycardia (moderate)	Day 1 (2 hrs post a.m. dose)	Day 1	HR: 83 bpm	HR: 123 bpm
	6	CVL-231 20 mg BID	Blood pressure diastolic increased (mild)	Day 25 (2 hrs post p.m. dose)	Day 26	Diastolic BP: 81 mmHg	Diastolic BP: 111 mmHg
				Day 28 (2 hrs post p.m. dose)	Day 29	Diastolic BP: 81 mmHg	Diastolic BP: 103 mmHg
				Day 39 (2 hrs post p.m. dose)	Day 40	Diastolic BP: 81 mmHg	Diastolic BP: 104 mmHg

\* AESI = Adverse Events of Special Interest. AESIs specified in the protocol include 1. AEs that result in the discontinuation of treatment with IMP, 2. events that satisfy the criteria for suspected Hy's Law (ALT or AST >3 × ULN, AND serum bilirubin ≥2 × ULN, AND alkaline phosphatase <2 × ULN), 3. events of heart rate >120 bpm, and confirmed by ECG, 4. events of confirmed QTcF is >500 msec or the increase from baseline is >75 msec in subjects without significant hypokalemia, 5. events of mean triplicate blood pressure reading >160 mmHg systolic or >100 mmHg diastolic with confirmation.

# Safety & Tolerability

## Blood Pressure and Heart Rate Effects

- Modest elevations in SBP, DBP, and HR that were observed with CVL-231 compared to placebo that decreased over time, with the average change from baseline during Week 6 in SBP, DBP, and HR for both the 30 mg QD and 20 mg BID groups showing no clinically meaningful difference versus placebo

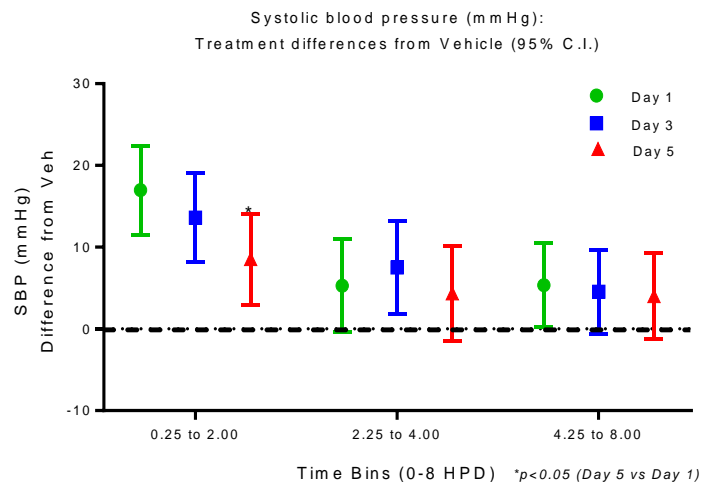




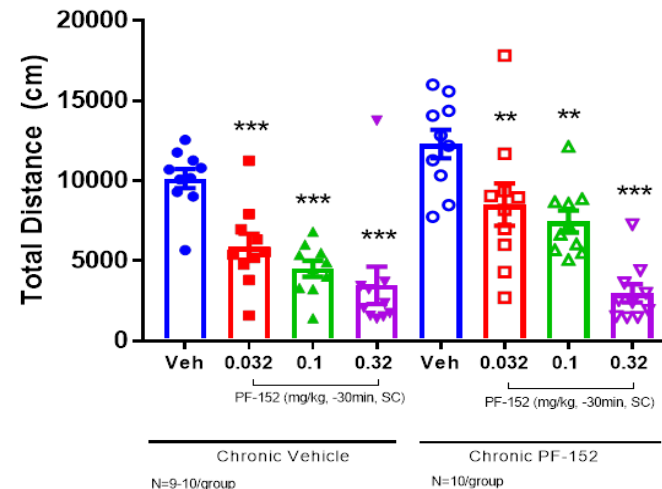
# Cardiovascular Effects may be Attenuated with Titration and Repeat Dosing

Repeated dosing of M4 Agonist Tool in rodents showed attenuation of cardiovascular effects without impact on antipsychotic activity; in addition, CVL-231 showed attenuation of heart effects in a 3-month canine toxicology study

## 5-Day repeat dosing of M4 Agonist Tool: Attenuation of Blood Pressure Effects in Mice



## 14-Day repeat dosing of M4 Agonist Tool: No Attenuation of Antipsychosis in Mice



## 3-Month Study of CVL-231: Attenuation of Heart Rate Effects in Canines

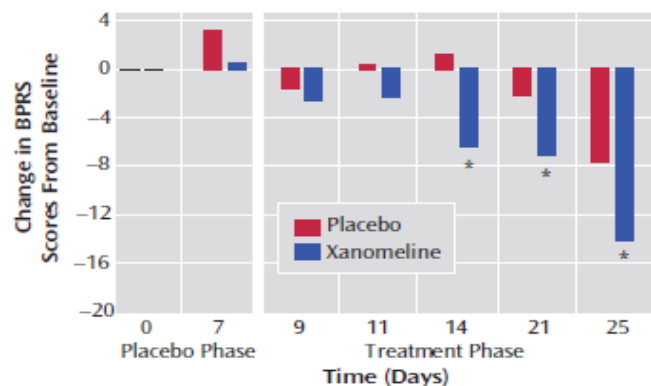
- On Day 1, observed heart rate increases were statistically significant and outside normal range
- On Days 43 and 90, heart rate increases were small and not statistically significant; all mean heart rate values were within normal range and not considered adverse

# Xanomeline Clinical Data: Compelling Activity, Limited by Side Effect Profile

## Xanomeline (Non-selective Agonist) Impacted Symptoms...

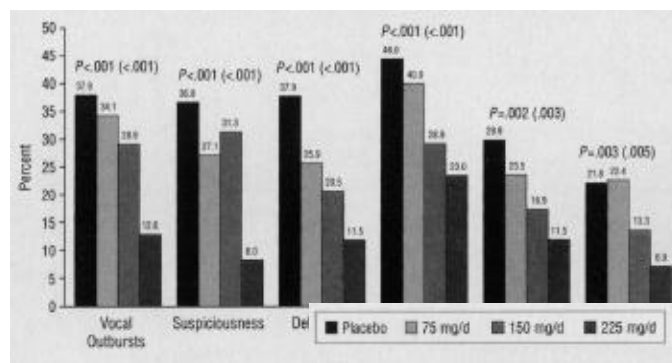
### 2008 Phase 2 in Schizophrenia

Statistically significant impact on **total BPRS** and **PANSS** scores in schizophrenia patients<sup>1</sup>



### 1997 Phase 2 in Alzheimer's Disease

Statistically significant impact on **agitation** and **other psychosis-related endpoints** in Alzheimer's patients<sup>2</sup>



## ...But Development Was Limited by GI Side Effects

Table 3. Adverse Events\*

Event	Placebo (n=87)	Dose†			Total (N=342)	P‡
		Low (n=85)	Medium (n=83)	High (n=87)		
Sweating	4 (4.6)	12 (14.1)	38 (45.8)	66 (75.9)	120 (35.1)	<.001
Nausea	17 (19.5)	24 (28.2)	29 (34.9)	45 (51.7)	115 (33.6)	<.001
Vomiting	8 (9.2)	11 (12.9)	33 (39.8)	37 (42.5)	89 (26.0)	<.001
Dyspepsia	7 (8.0)	20 (23.5)	23 (27.7)	21 (24.1)	71 (20.8)	.007
Chills	1 (1.1)	8 (9.4)	22 (26.5)	32 (36.8)	63 (18.4)	<.001
Chest pain	1 (1.1)	5 (5.9)	13 (15.7)	10 (11.5)	29 (8.5)	.004
Increased salivation	0 (0)	2 (2.4)	6 (7.2)	21 (24.1)	29 (8.5)	<.001
Syncope	4 (4.6)	3 (3.5)	11 (13.3)	11 (12.6)	29 (8.5)	.03
Fecal incontinence	0 (0)	4 (4.7)	1 (1.2)	5 (5.8)	11 (3.2)	.04
Nausea and vomiting	2 (2.3)	0 (0)	1 (1.2)	7 (8.0)	10 (2.9)	.009
Dysphagia	1 (1.1)	0 (0)	2 (2.4)	6 (6.9)	9 (2.6)	.03

\*Only events statistically significant at  $P < .05$  are given. Values are number (percentage) of patients unless otherwise indicated.  
 †Low-dose group received 25 mg of xanomeline tartrate 3 times a day; medium, 50 mg 3 times a day; high, 75 mg 3 times a day.  
 ‡Pearson  $\chi^2$  test.

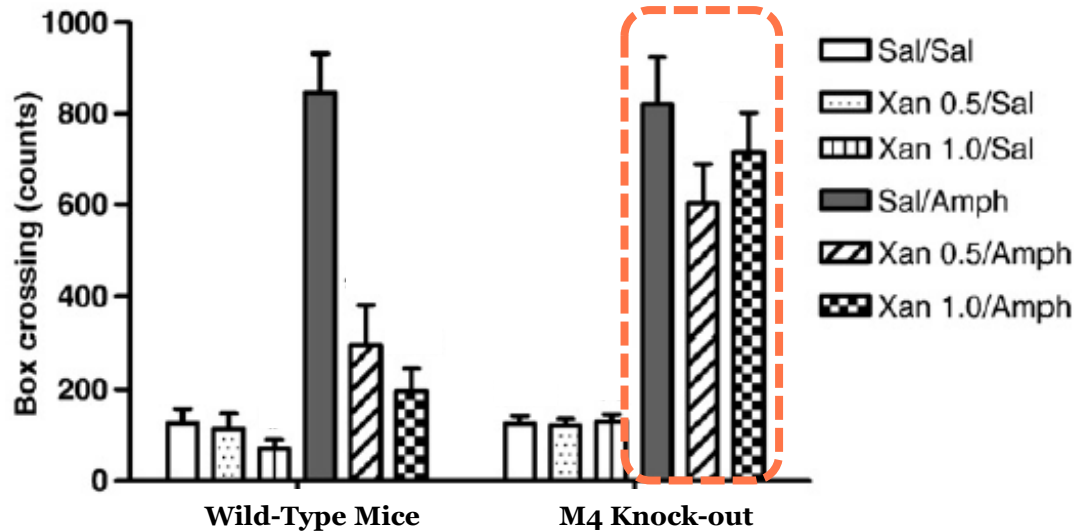
Xanomeline's high rate of nausea, vomiting and dyspepsia is likely driven by non-selective muscarinic agonism

## Mechanism Supported by Phase 2 Data for KarXT

- Karuna is developing a BID fixed-dose combination of xanomeline with trospium to offset side effects of GI, dry-mouth and constipation
- In a 5-week Phase 2 study, KarXT demonstrated an 11.6 point reduction in PANSS total score from baseline vs. placebo ( $p < 0.0001$ )
- ~70 completers in each arm, with discontinuation rates similar between placebo and treatment group
- Represents a robust reproduction of 2008 xanomeline Phase 2 data in schizophrenia

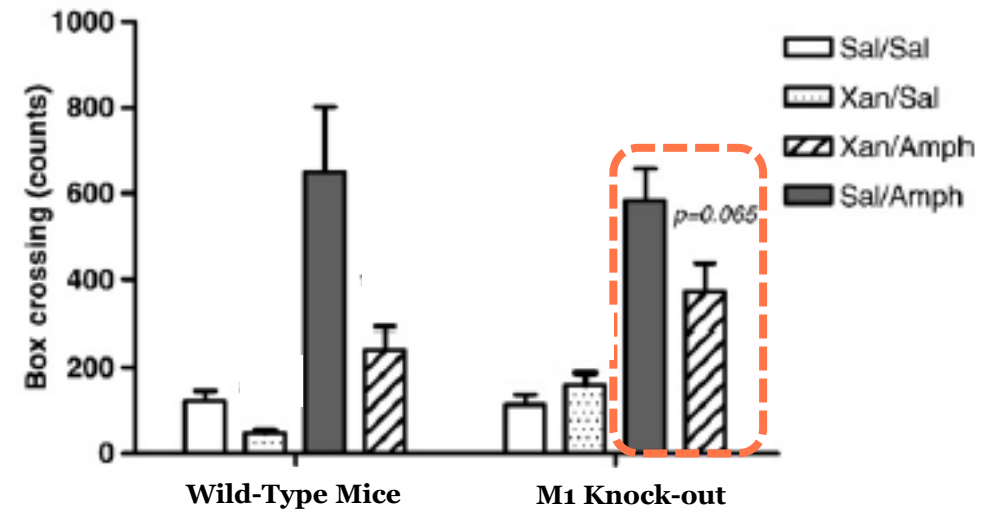
# Preclinical Evidence: M4 Modulation Drives Antipsychosis

## No Effect of Xanomeline in M4 Knock-out Mouse Model



Xanomeline had no effect on amphetamine-induced hyperactivity in M4 knock-out mice

## Reduction in Hyperactivity in M1 Knock-out Mice



Xanomeline reduced hyperactivity in M1 knock-out mice



In mouse studies, M4 receptors drive the antipsychotic activity of xanomeline



# Important Insights on Side Effects of M4 PAM

Results of a Phase 1 SAD trial indicated CVL-231 was generally well-tolerated with asymptomatic transient effects on heart rate and blood pressure

## Phase 1 SAD Trial (N=17)

Tested doses up to 30 mg

---

Relatively well tolerated with no SAEs

---

Most frequently reported treatment-emergent AEs: fatigue, dizziness, headache and dry mouth

---

Moderate treatment-emergent transient increases in blood pressure and pulse rate observed

---

Cardiovascular effects were asymptomatic and transient in nature

## Insights

Preclinical studies show CV effects attenuated with repeat dosing

---

KarXT data also suggest that CV effects attenuate over time with repeat dosing

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Tolerability may be differentiated in schizophrenia patients and CV effects may be attenuated with repeat dosing and/or titration.



# Phase 2 data for MK-7622 (M1 PAM) in Alzheimer's disease

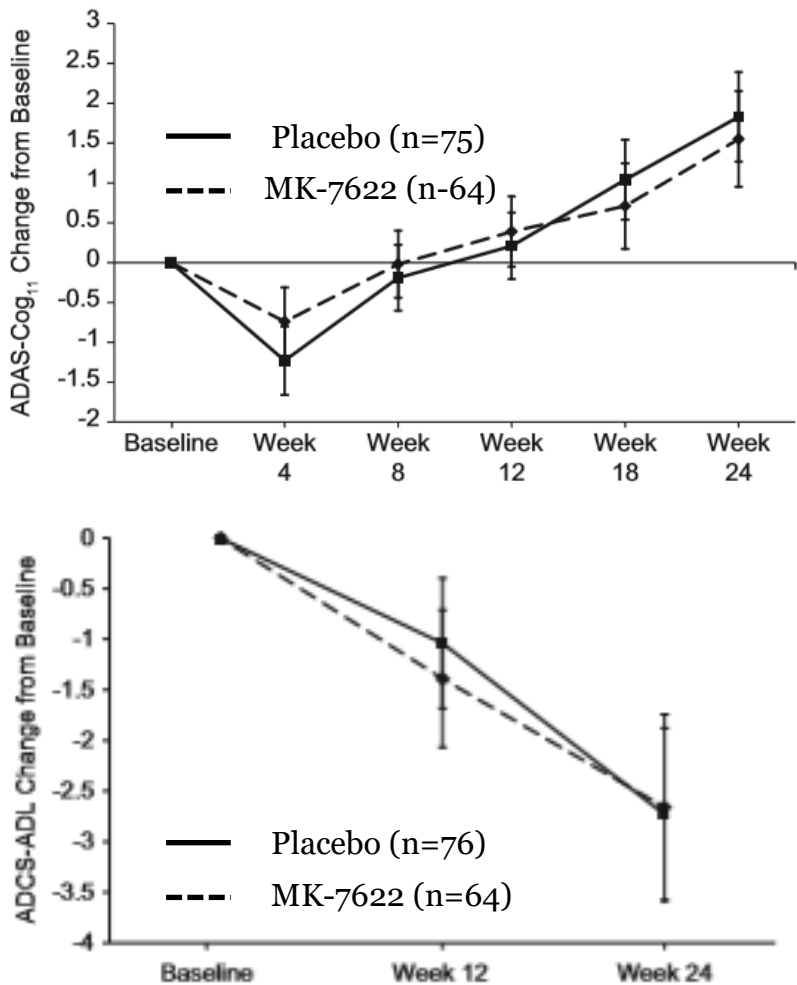
## Summary

- Randomized double-blind proof-of-concept trial as adjunctive therapy in mild-to-moderate Alzheimer's disease
- Conducted by Merck; data published 2018
- Trial stopped early for futility

## Results

- **No difference from placebo on either cognition or activities of daily living (ADL) scales**
- Discontinuation rate of 16% on MK-7622 vs 6% on placebo
- Cholinergically-related adverse event rate of 21% on drug vs 8% on placebo

## Results in Cognition and ADL

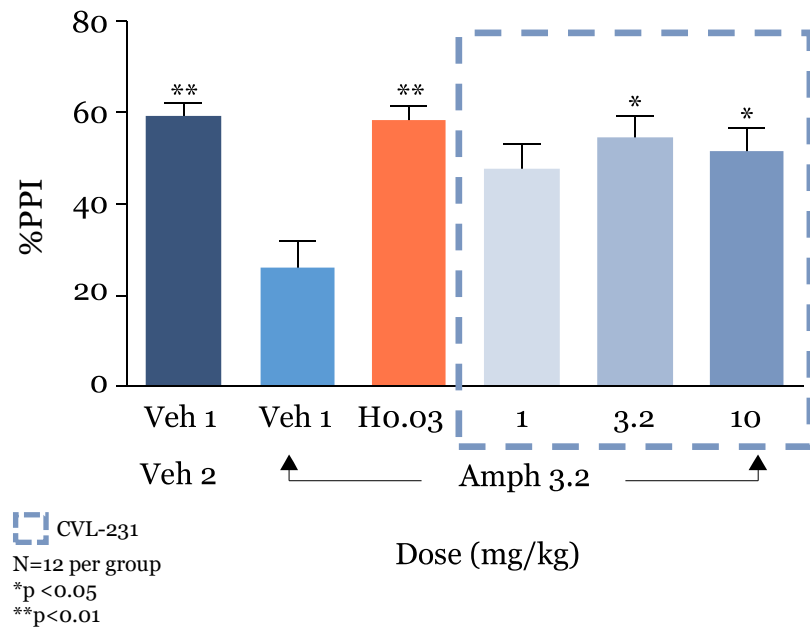


## Side Effect Profile

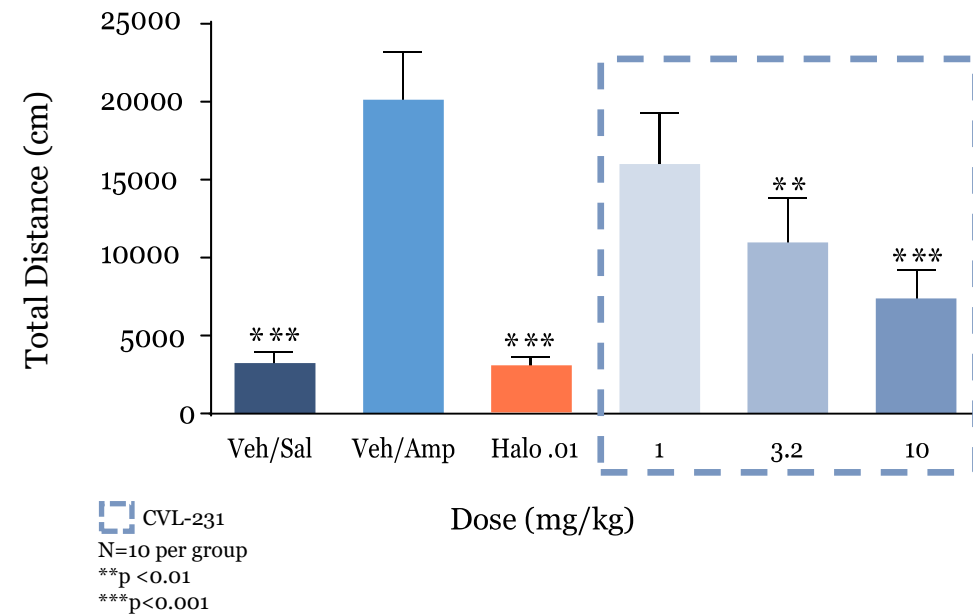
Most Common AEs (>5%)	MK-7662 (n=119)	Placebo (n=120)
Diarrhea	18 (15.1%)	7 (5.8%)
Headache	11 (9.2%)	6 (5.0%)
Rhinorrhea	7 (5.9%)	1 (0.8%)
Urinary Incontinence	6 (5.0%)	0 (0.0%)
Weight Decrease	6 (5.0%)	2 (1.7%)
Urinary Tract Infection	6 (5.0%)	7 (5.8%)
Fall	2 (1.7%)	6 (5.0%)

# M4 PAM Preclinical Data in Psychosis

CVL-231 showed similar effect to haloperidol in reversing amphetamine-disrupted Pre-pulse Inhibition (PPI) in rats



CVL-231 showed dose-dependent reductions on amphetamine-induced locomotion in rats



In multiple rodent models of psychosis, CVL-231 demonstrated antipsychotic activity consistent with atypical antipsychotics

# Potential Indications for M4 PAM Beyond Schizophrenia

## Pipeline in a Pill

**Goal to be a novel MOA  
and next generation treatment  
in Schizophrenia**

Aiming for a Side Effect and Tolerability  
Profile Appropriate for Chronic Use in  
Elderly Populations

## Potential Large Indications Worldwide

▶	Schizophrenia	~21M Patients
▷	Alzheimer's Psychosis	~20M Patients
▷	Cognition	>50M Patients
▷	PD-LID	~5M Patients



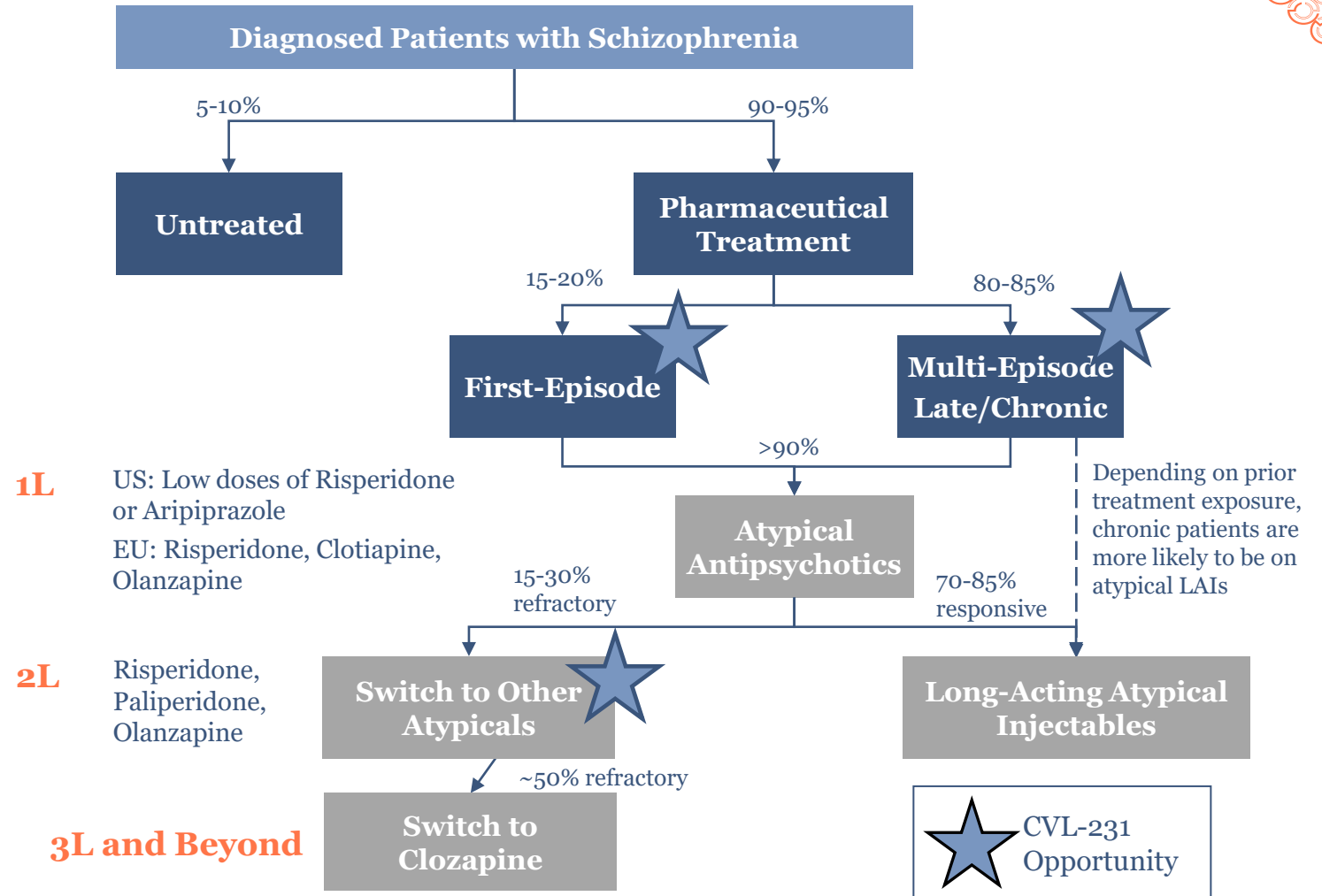
Potential to expand use outside of core schizophrenia population  
to behavioral and psychological symptoms of dementia

# CVL-231 Commercial Potential in Schizophrenia

## Multiple Potential Entry Points for CVL-231 in the Treatment Paradigm

### Potential for CVL-231 to be a New Standard of Care

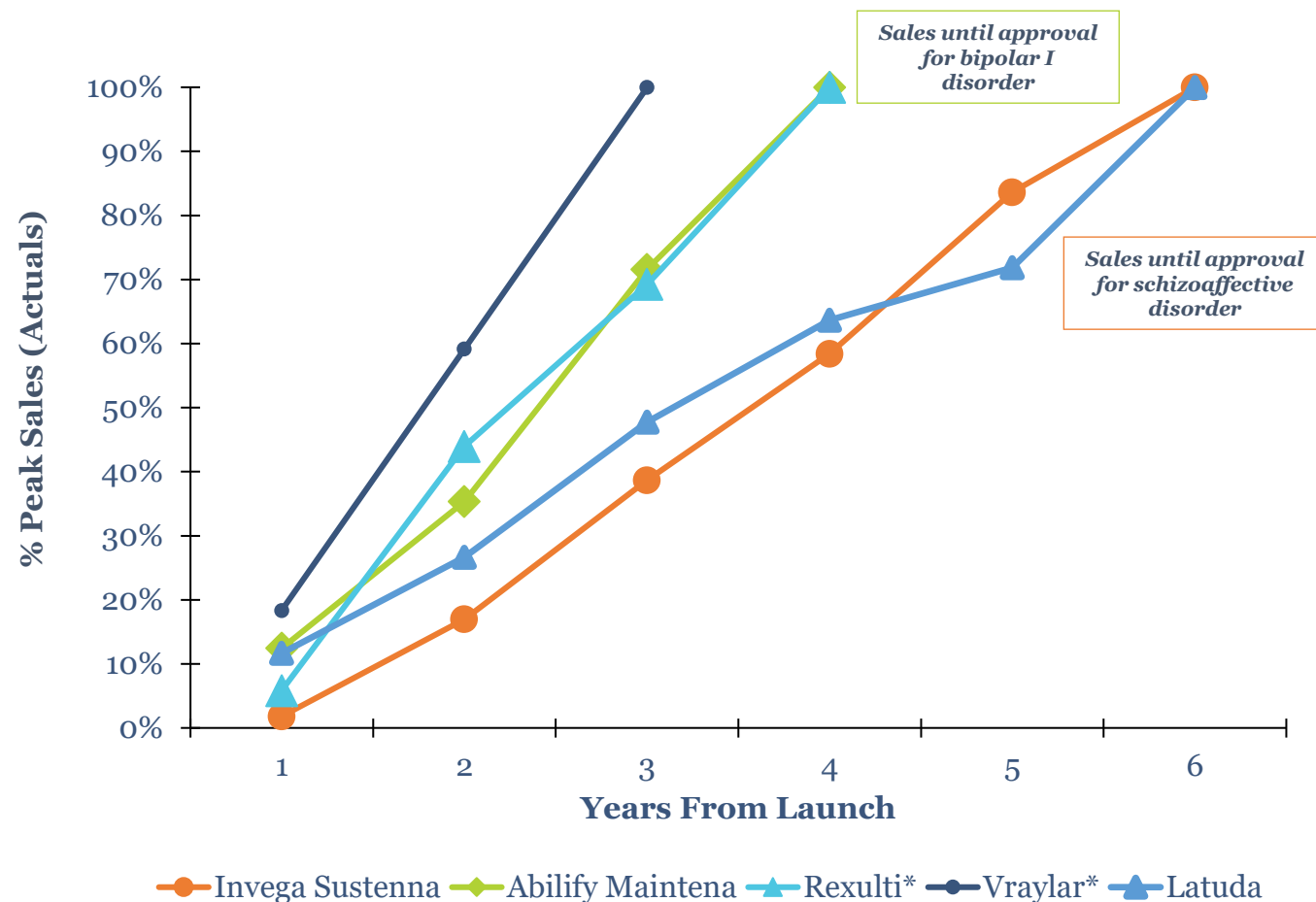
- Potential for improved SE profile could position CVL-231 as first-line treatment of newly diagnosed and ongoing schizophrenia patients, including DRP
- If an improved tolerability and metabolic profile is demonstrated, CVL-231 could displace atypical antipsychotics in patients with treatment-related side effects



# Schizophrenia Therapies: Rapid Historic Uptake Despite Limited Differentiation

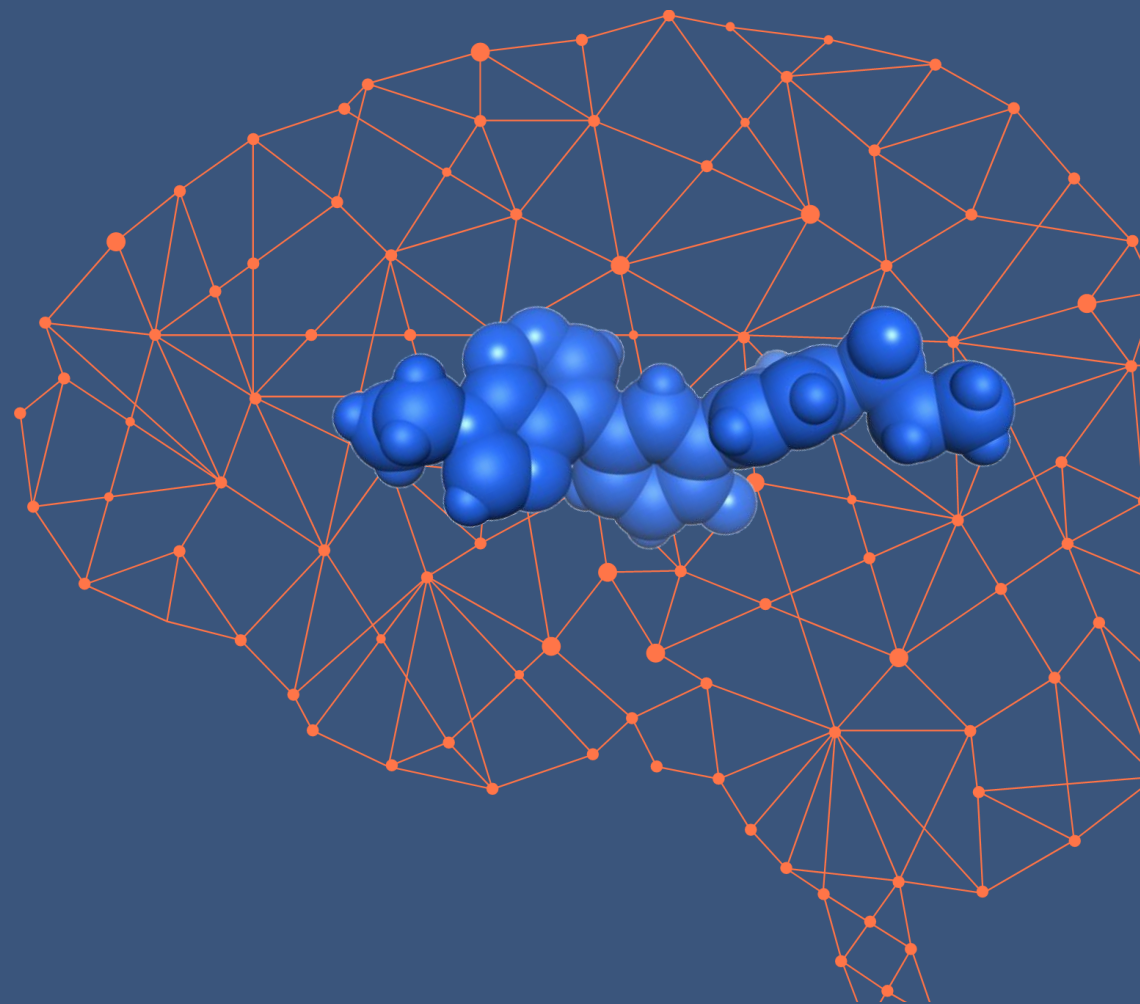
Drug	US 2018 Schizophrenia Sales	2018 US Share
Latuda (lurasidone)	\$973M	13.5%
Invega Sustenna (paliperidone LAI)	\$981M	6.2%
Rexulti (brexpiprazole)	\$449M	8.1%
Abilify Maintena (aripiprazole LAI)	\$331M	2.1%
Vraylar (cariprazine)	\$164M	2.6%

**Schizophrenia US Sales Ramp – Actuals**  
(through 2018 or until first non-schizophrenia indication launch)

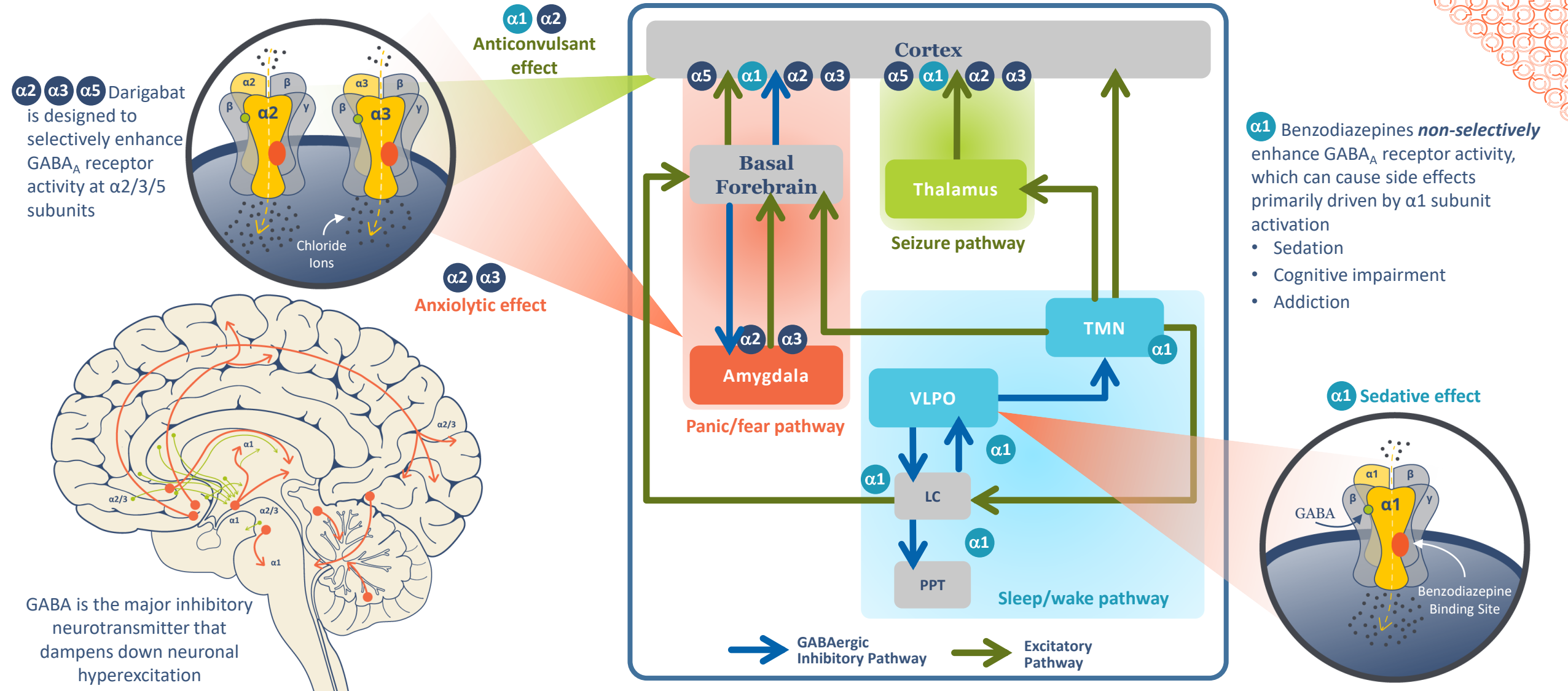


# Darigabat in Epilepsy

*Additional Slides*



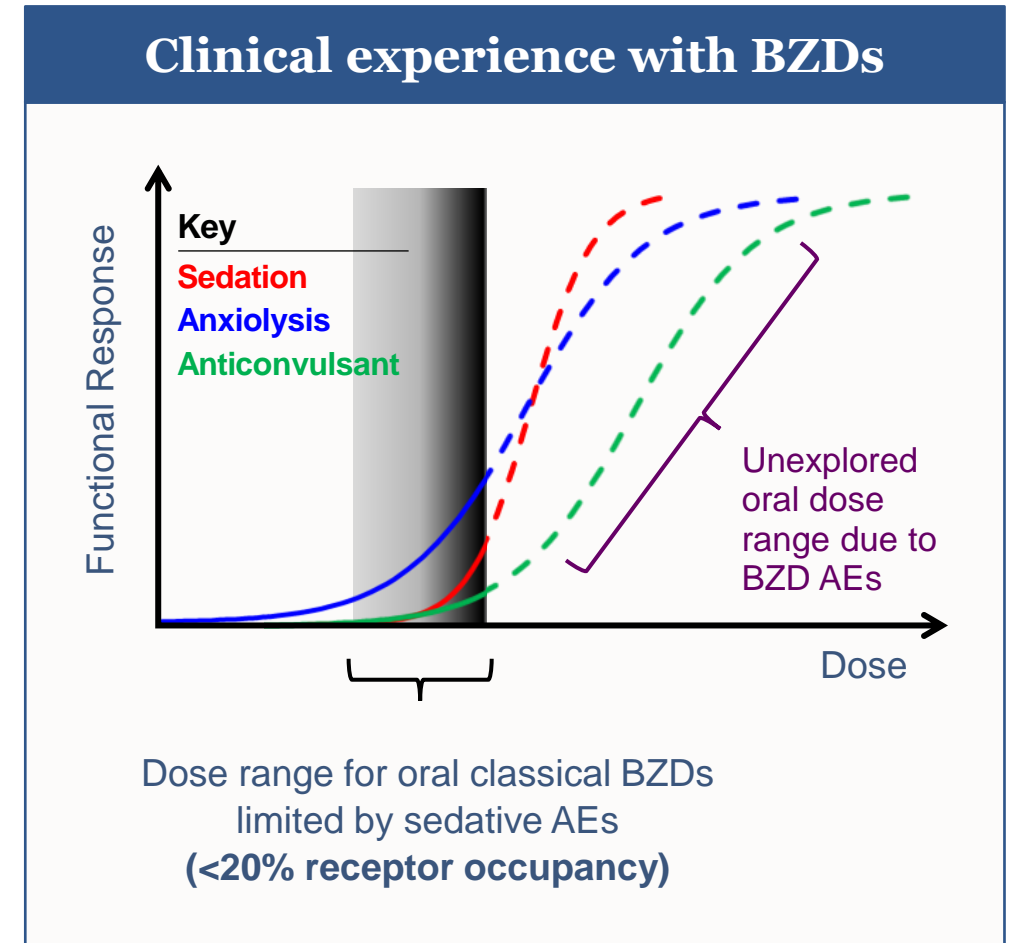
# Darigabat Mechanism: Selective $\alpha 2/3/5$ GABA<sub>A</sub> Receptor PAM





# The Problem With Benzodiazepines (abridged...)

- BZDs are efficacious in a range of indications but use and dose is limited by adverse events, even at low receptor occupancy
  - Sedation, somnolence, cognitive impairment, falls, overuse, misuse and addiction
- In general, BZDs are used acutely in epilepsy but not indicated for chronic use due to tolerance or loss of efficacy
- Darigabat has the potential to be used chronically by minimizing adverse events, risk of tolerance and abuse

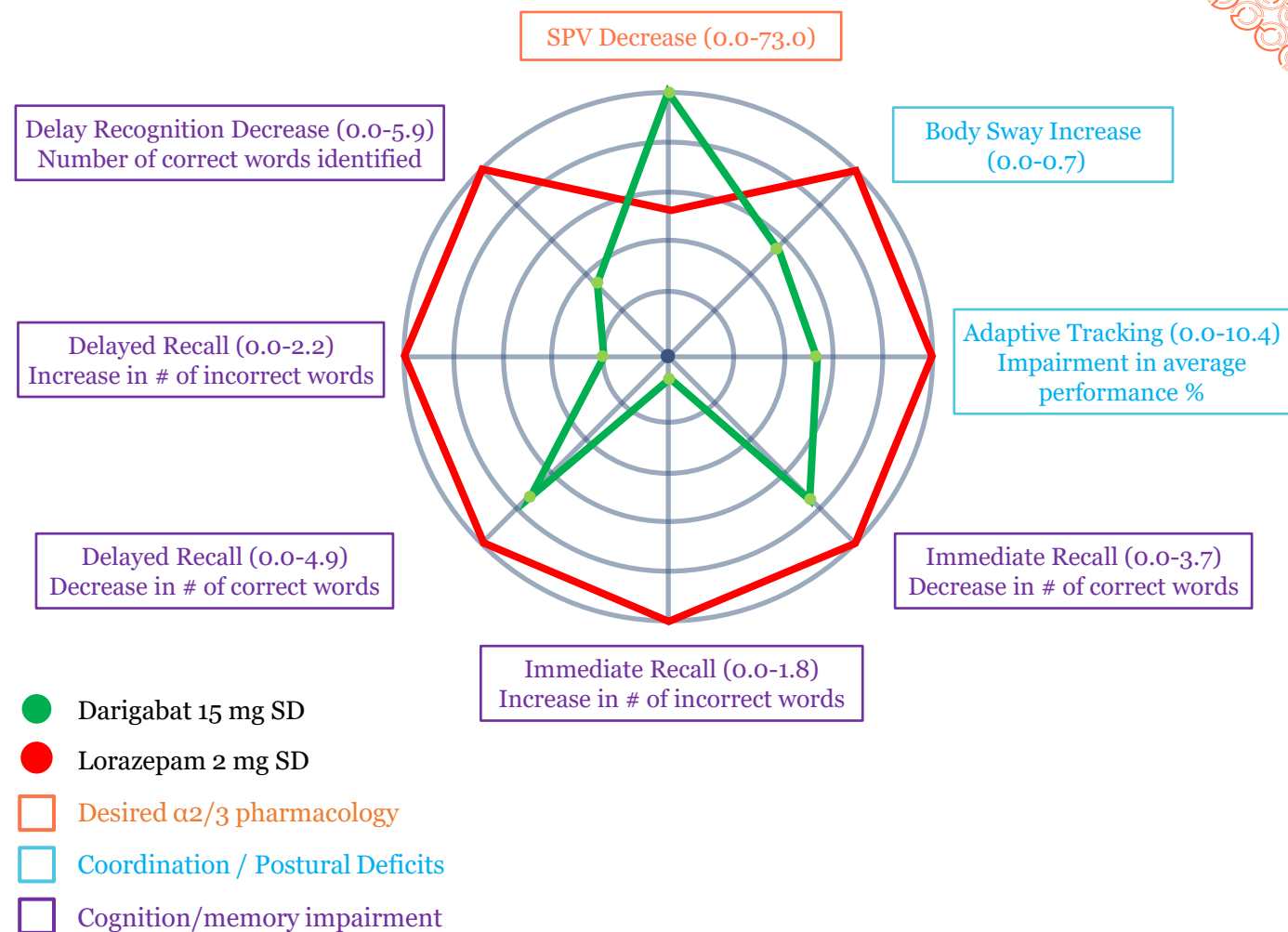


# Darigabat: Favorable Pharmacology in NeuroCart, Differentiated From a BZD

NeuroCart is a comprehensive battery of tests to evaluate CNS functional domains

Darigabat first-in-human study tested the following brain functions based on known GABA<sub>A</sub> receptor pharmacology:

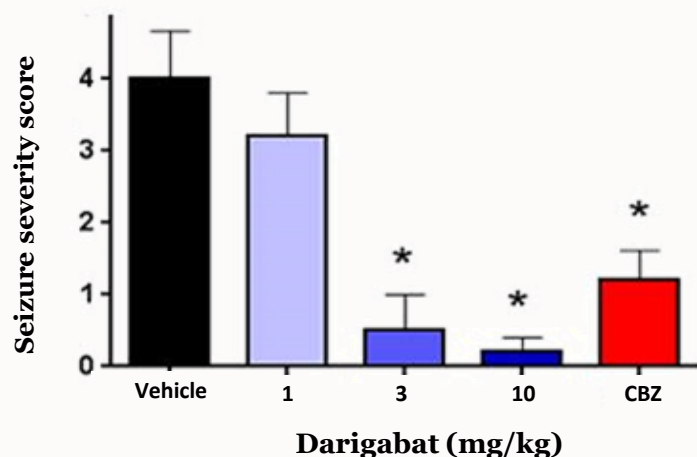
- Saccadic peak velocity (SPV) - desired  $\alpha 2/3$  pharmacology
- Body sway - undesired  $\alpha 1$  pharmacology
- Adaptive tracking - undesired  $\alpha 1$  pharmacology
- Visual-verbal learning test - undesired  $\alpha 1/5$  pharmacology
- Relative to 2 mg lorazepam, darigabat demonstrated a larger decrease in SPV and smaller impairment on body sway, adaptive tracking and cognitive tests



# Darigabat is Anticonvulsant in a Range of Preclinical Models

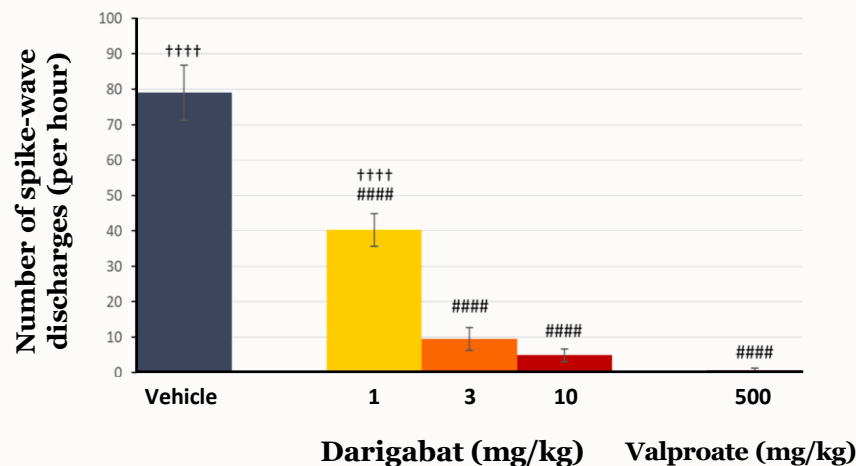
- Strong correlation of animal models of seizures translating to clinical activity across mechanism
- Darigabat demonstrated broad spectrum activity at  $\sim >50\%$  receptor occupancy
  - Darigabat is active in pentylenetetrazol-induced seizures
  - Amygdala kindling is a validated model for predicting activity in focal seizures
  - Genetic absence epilepsy rat model predictive of activity in absence (generalized) seizures

## Amygdala Kindled Seizures in Rats: Focal Seizures



\*  $p < 0.05$

## Genetic Absence Epilepsy in Rats: Generalized Seizures



++++  $p < 0.0001$  vs. valproate; #####  $p < 0.0001$  vs. vehicle

**Darigabat demonstrated broad spectrum preclinical anticonvulsant activity, potentially through high receptor occupancy at  $\alpha 2$  subunits**

# Potential Indications for Darigabat Beyond Epilepsy

## Pipeline in a Pill

**Potential for benzo-like activity with targeted GABA  $\alpha$  2/3/5 receptor selectivity**

Benzos (Non-selective GABA Modulators)  
Widely Prescribed for Seizures, Anxiety,  
and Other Indications

## Potential Large Indications Worldwide

▶	<b>Epilepsy</b>	<b>~65M Patients</b>
▶	<b>Anxiety Disorders</b>	<b>~13M Patients (G7)</b>
▷	<b>Agitation</b>	<b>15-20M Patients</b>
▷	<b>Bipolar Disorder</b>	<b>~46M Patients</b>



Significant need for GABA modulators that are better tolerated, less sedating, less addictive and supportive of chronic use

# Darigabat TPP: Benzo-like Activity for Chronic Treatment

## Darigabat Summary

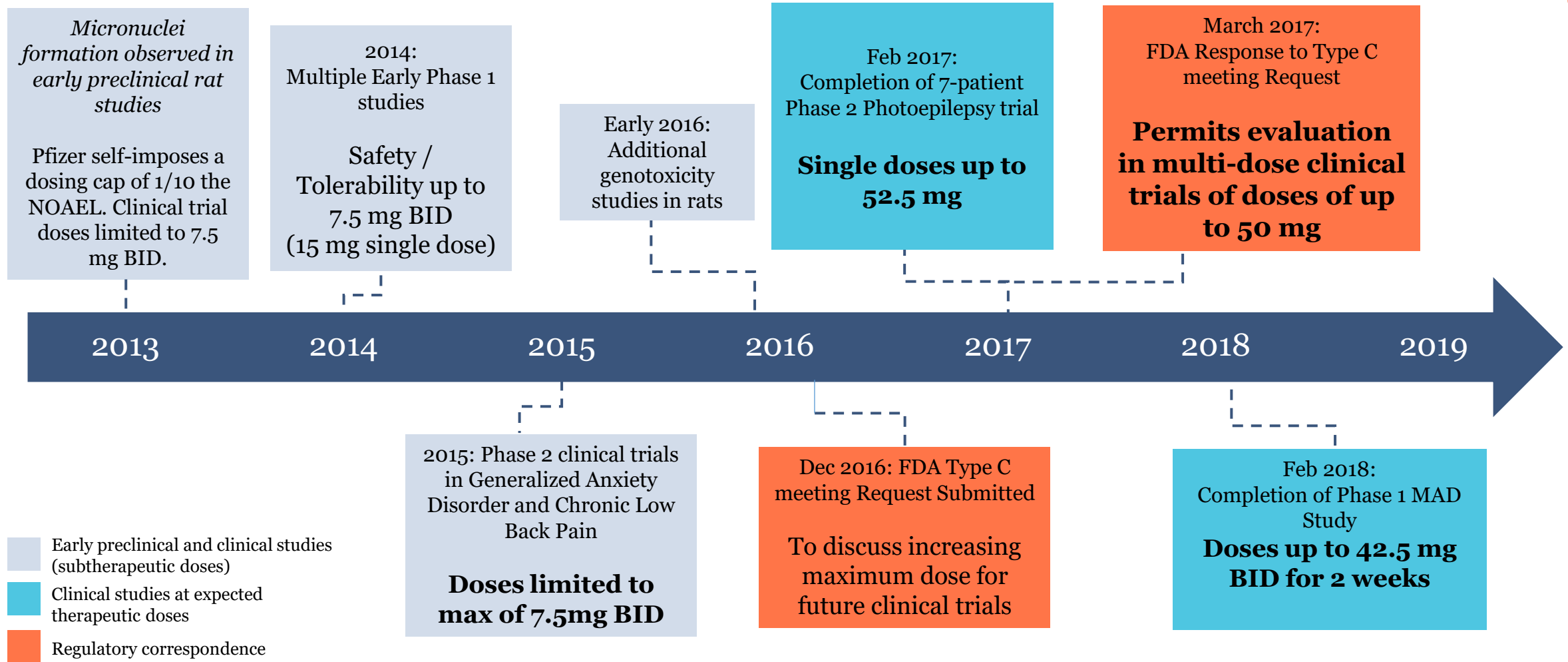
- Large markets (Focal & Generalized)
- Novel mechanism
- Potential for better activity than chronic treatment alternatives
- Potentially favorable side effect profile
- Attractive pricing analogs

## Pricing & Launch

- High branded sales despite many generics
- Branded US price analogs >\$10K/year
- Complex to change treatment in epilepsy
- 7-year+ average uptake in the category

# History of Darigabat Development

- Results of early clinical trials were believed to be limited by Pfizer's self-imposed dosing cap



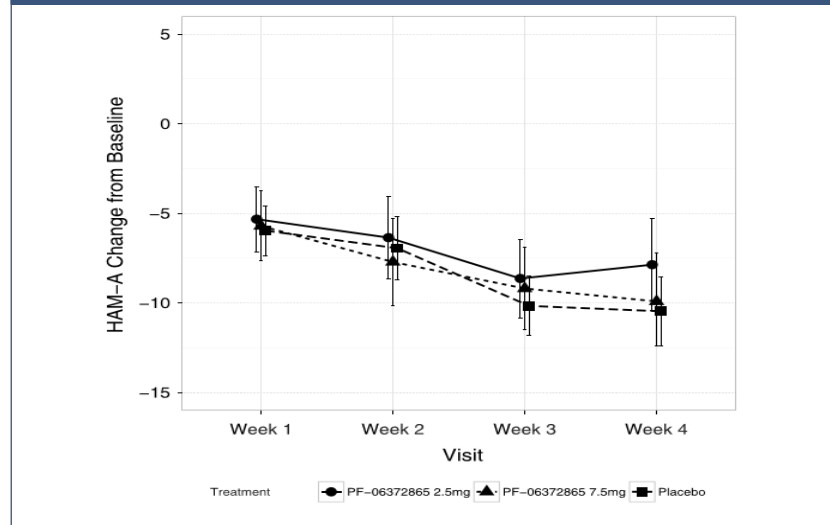
# Prior Clinical Studies in Anxiety and Chronic Low Back Pain

Use of subtherapeutic doses and small sample size believed to account for lack of activity in prior trials

## Phase 2: Generalized Anxiety Disorder

- Included drug-resistant patients on continued background treatment
- Sequential parallel comparison design
- Primary endpoint: HAM-A (minimum score at entry 20-22)
- 4 weeks on treatment: 2.5 mg BID darigabat, 7.5 mg BID darigabat, placebo
- Study stopped early for project prioritization - 90 enrolled of planned 384

### Darigabat not differentiated from placebo on HAM-A

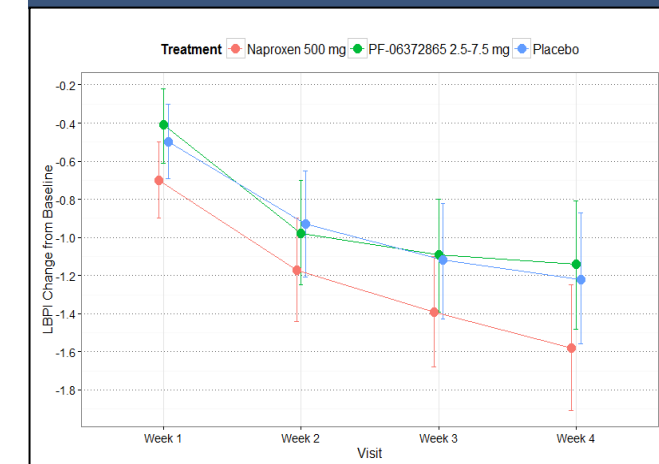


> 50% receptor occupancy remains unexplored in anxiety

## Phase 2: Chronic Low Back Pain

- Included patients with > 6 months low back pain without radiculopathy
- Primary endpoint: change from baseline in low back pain score (measured on numerical rating scale)
- 4 weeks on parallel treatment: 7.5 mg BID darigabat, placebo, 500 mg naproxen BID (positive control)
- Study stopped early for futility following a planned interim analysis after 50% subjects had completed treatment

### Darigabat not differentiated from placebo, naproxen



> 50% receptor occupancy remains unexplored in pain



# Darigabat Favorable Side Effect & Tolerability Profile Across Trials

*Darigabat has been tested in 289 subjects and was generally well-tolerated. There have been no clinically significant side effect observations from physical examination, vital sign measurements, laboratory safety assessments, or ECG parameters and no reports of sedation across single and multiple dose trials*

## I. Across Phase 1 trials:

- 81 healthy subjects received single doses of darigabat (0.04 to 100 mg); 55 healthy subjects received multiple doses of darigabat (2.5 to 42.5 mg BID)
- Most common AEs: dizziness, somnolence, and fatigue. All AEs across trials have been mild or moderate in severity
- No drug-related SAEs in Phase 1 trials
- Titration in multiple dose healthy volunteer studies appeared to reduce the incidence of somnolence and dizziness

## II. Across Phase 2 trials:

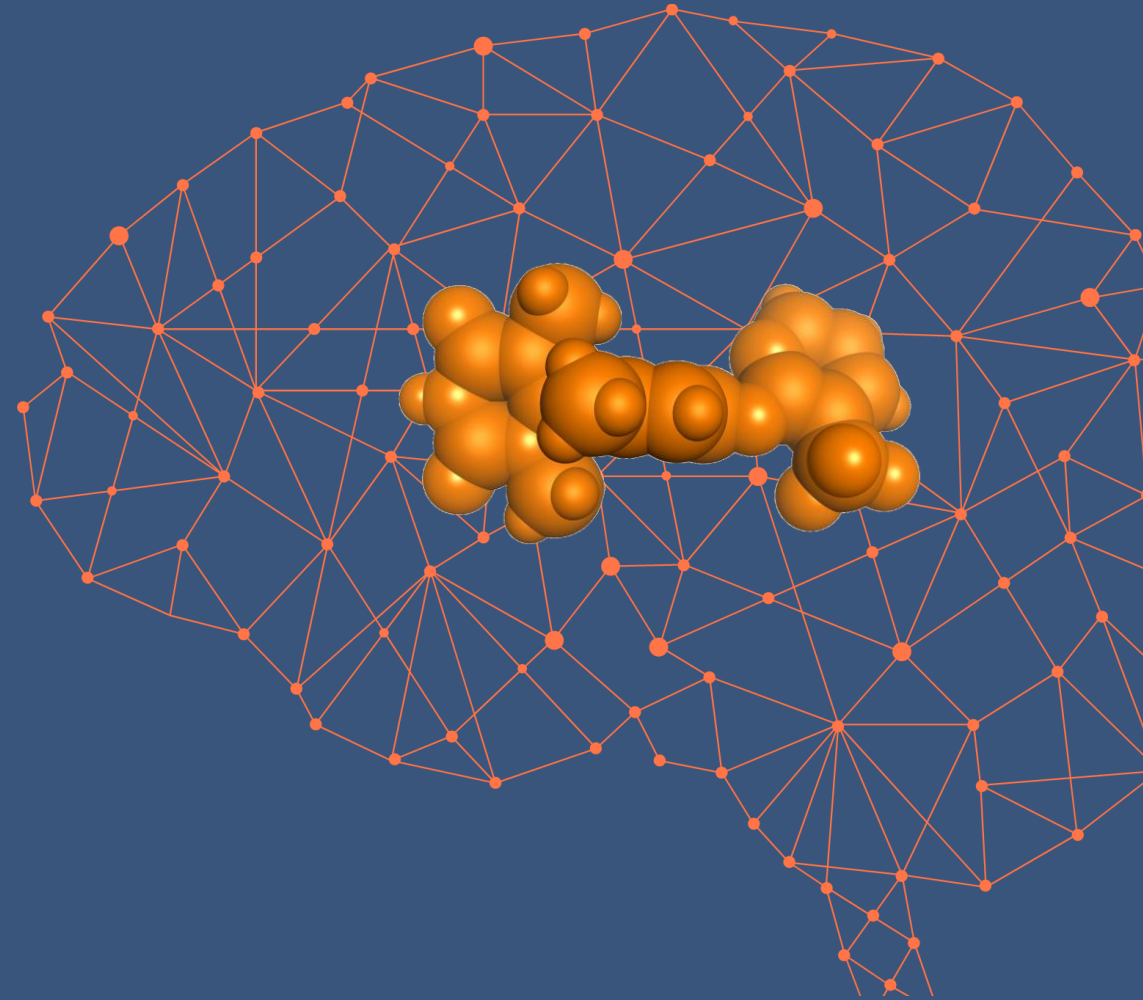
- 146 subjects received multiple doses of darigabat (2.5 to 7.5 mg BID); 7 subjects with documented photosensitive epilepsy received single doses of 17.5 mg and 52.5 mg in a crossover trial
- Most common AEs: dizziness and somnolence; the majority of AEs were mild or moderate
- In Study B7431007, there was limited increase in sleepiness as measured by the Epworth Sleepiness Score with either darigabat 7.5 mg, darigabat 2.5 mg or placebo at Week 2 and Week 4
- In Study B7431006, one patient experienced an SAE (transient ischemic attack) that was considered related to darigabat by the investigator. The patient had a history of high cholesterol levels and high blood pressure and was diagnosed with diabetes mellitus after the onset of TIA
- Use of titration in multi-dose Phase 2 trials appeared to mitigate CNS effects, including somnolence, over time

## III. Other considerations:

- No evidence to date of withdrawal effects
- No evidence of the bone marrow effects seen in preclinical studies
- Reproductive effects are being addressed for all trials with requirements for contraception and standard warnings

# ■ Tavapadon in Parkinson's Disease

*Additional Slides*

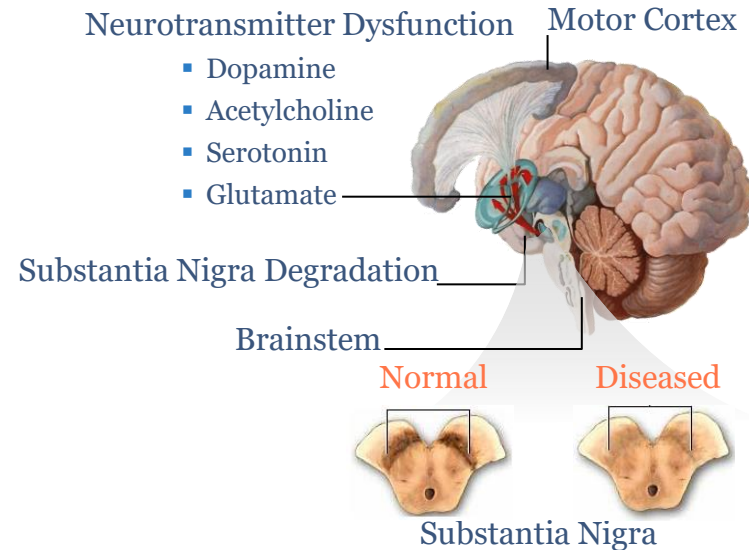


# Parkinson's Disease Overview

Parkinson's disease is a progressive neurodegenerative disorder affecting regions of the brain that control balance and movement

## Description

- Parkinson's disease is a degenerative neurological disorder characterized by progressive depletion of dopaminergic neurons in the substantia nigra region of the brain
- The lack of dopamine causes neurons to fire without normal control, leaving patients unable to control or direct their movement



## Common Symptoms

- Symptoms of Parkinson's disease can be segmented into two categories – motor and non-motor:
  - Motor symptoms include tremor, decreased bodily movement (hypokinesia), slowness of movement (bradykinesia), stiffness and poor balance
  - Non-motor symptoms include cognitive dysfunction, psychosis, mood disorders, fatigue, *etc.*

## Progression

- As symptom severity increases, patients often require increased doses of medication with decreasing efficiency, leading to “off” episodes
  - “Off” episodes are characterized by decreased motor function when patient's plasma drug levels fall below therapeutic levels
- Long-term levodopa use also leads to the development of dyskinesia or uncontrolled movement in PD patients

## Genetic Indications

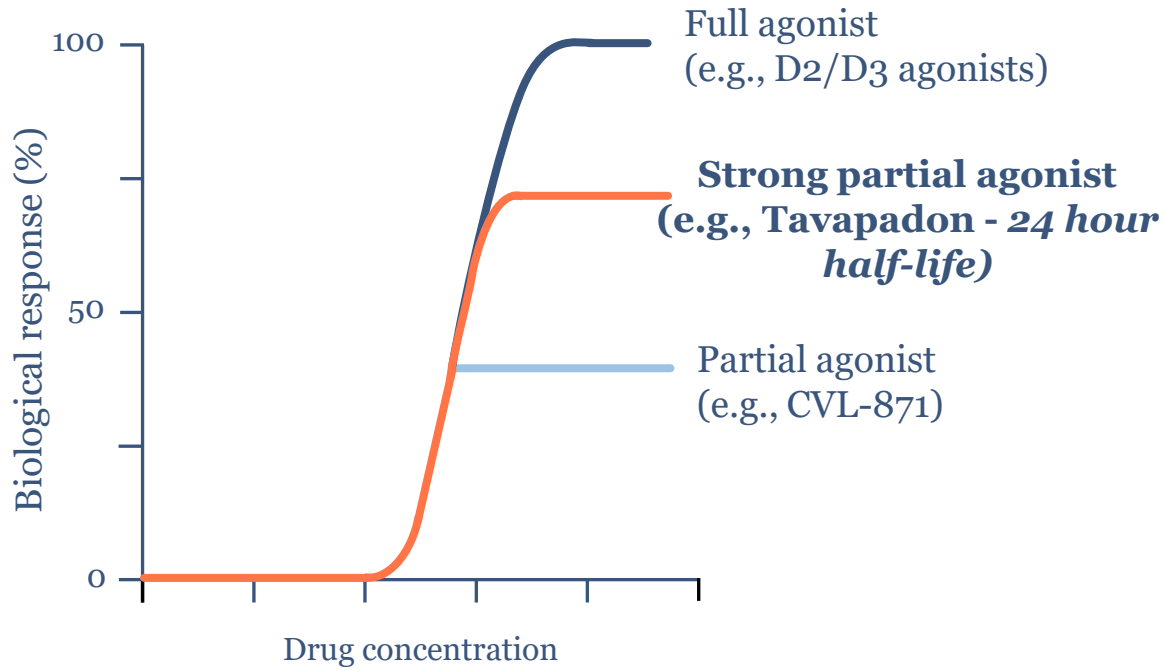
- Approximately 15% of Parkinson's patients have a family history of the disease. Such familial cases of the disease can be caused by mutations in the LRRK2, SNCA, PARK7, PINK1 or PRKN genes
- LRRK2 mutations attract greater attention from researchers since there are more known populations with this risk factor
  - G2019S is the most common LRRK2 mutation accounting for 3-6% of familial PD, and 1-2% of sporadic cases worldwide
  - This mutation is especially frequent in the Ashkenazi Jew and ArabBerber populations

# Selectively Targeting Partial Agonism Designed to Improve Motor Control and Tolerability

## D1/D5 Receptor Selectivity

D2/D3 Activation (Indirect Pathway)	Potential Effect	D1/D5 Activation (Direct Pathway)
+	Motor Control	++
	Cognition	++
	Motivation / Drive	++
-	Dose-Limiting Hypotension	
	Impulse Control Disorders	
	Sudden Daytime Sleepiness	

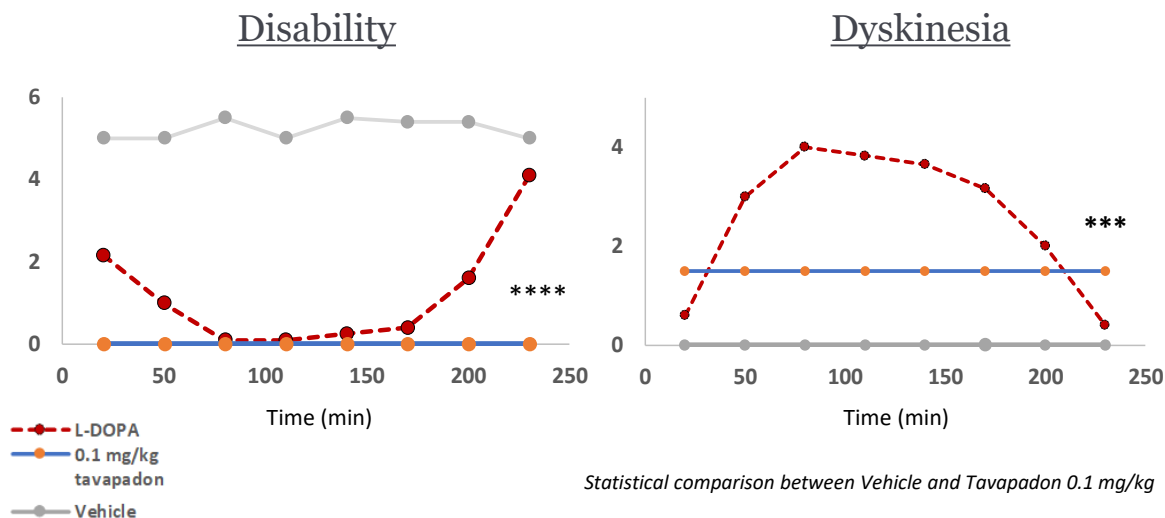
## Degrees of Agonism (Illustrative)



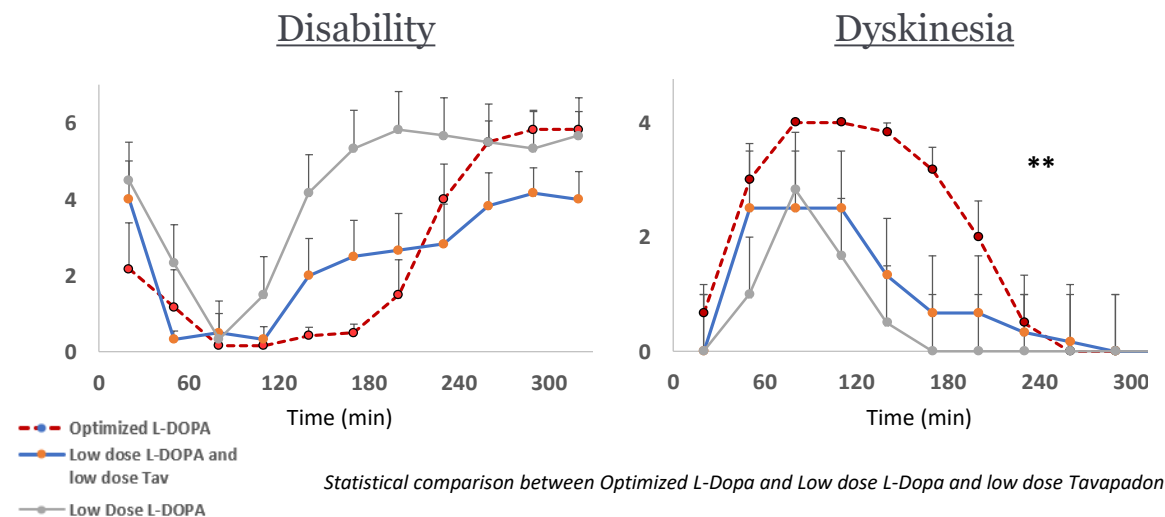
# First Partial Agonist for Parkinson's → Avoids Dyskinesias

Unique and attractive combination of activity and low dyskinesias in highly translatable model of Parkinson's

## Effect of Tavapadon vs. L-dopa on Disability and Dyskinesia



## Potential to Reduce L-dopa Dose to Achieve Motor Control with Reduced Dyskinesia



Compared to L-dopa, tavapadon robustly reduced parkinsonian symptoms in the MPTP-lesioned primate model with a more **lasting effect** and **lower dyskinesia** levels

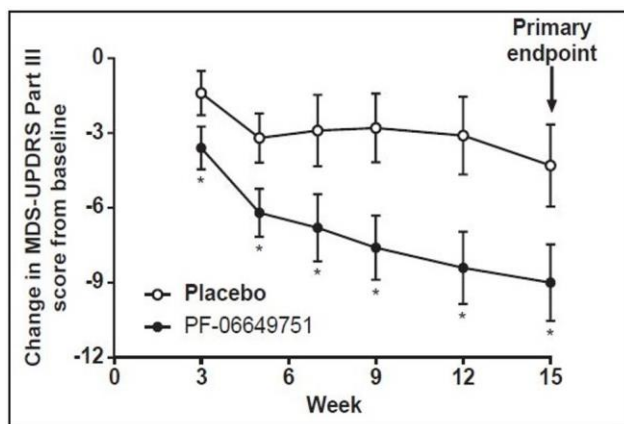
The combination of 33% L-dopa dose with 40% tavapadon dose showed **similar activity to L-dopa alone with statistically significant reduction in dyskinesia**

# Phase 3 Program Designed to Show Superior Treatment Profile

*Phase 2 Results Inform Phase 3 Design*

## Phase 2 Results

### MDS-UPDRS III



### MDS-UPDRS II+III

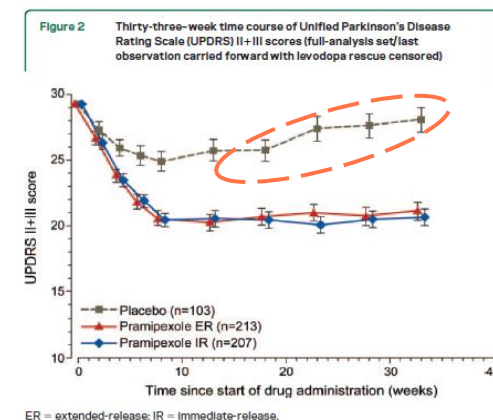
**5.8 point improvement vs. placebo at week 15 on MDS-UPDRS II + III**

**Baseline score of 2 or greater on MDS-UPDRS II**

**~2 point improvement vs. placebo on Part II, excluding participants with baseline score of 0 or 1 in Phase 2\***

## Phase 3 Design

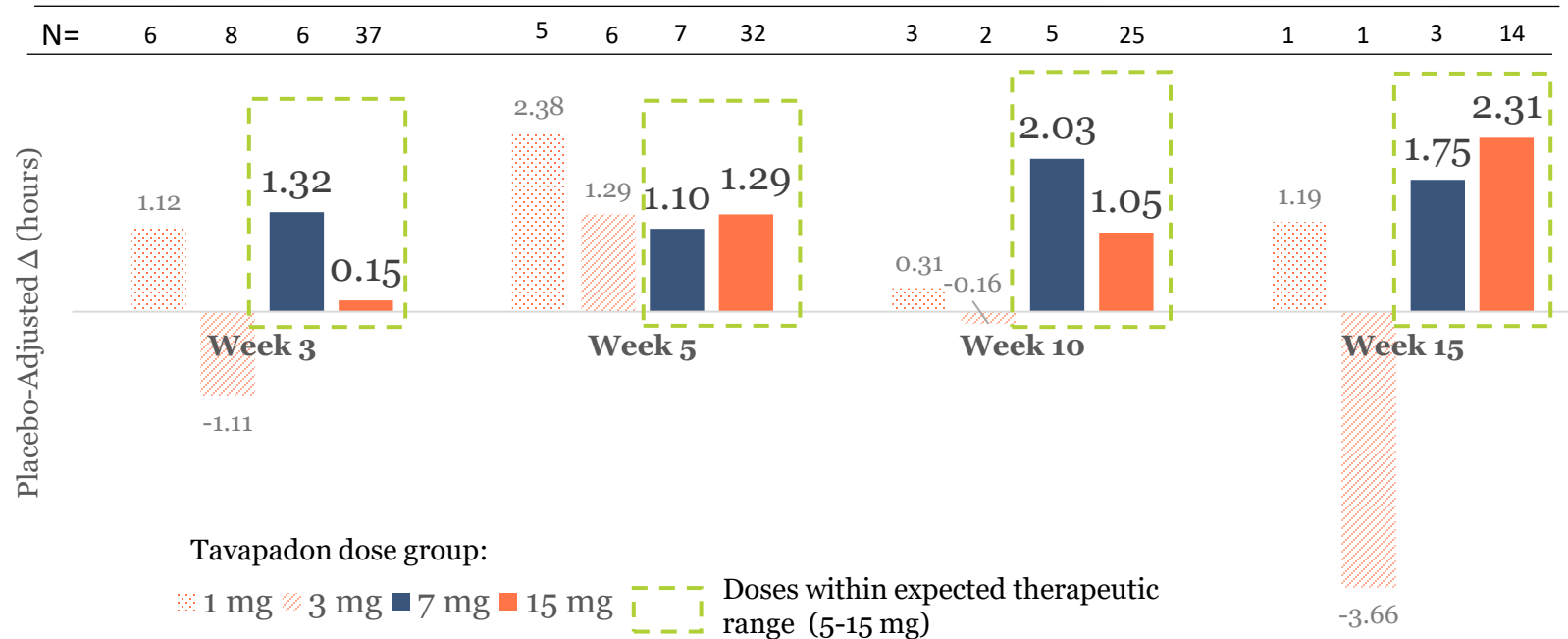
### Placebo Attenuation at 6 Months



*Further upside from forced titration to achieve maximum tolerated dose of tavapadon (less than 40% of patients were on the top dose in Phase 2)*

# Tavapadon Phase 2 Results: Clinically Meaningful ON-Time without Troublesome Dyskinesias

**Tavapadon generally demonstrated at least 1 hour of improvement in ON-time without troublesome dyskinesias in late-stage PD**



*Note: Tavapadon showed -0.6 hour reduction on the primary endpoint, change in OFF-time at week 10*

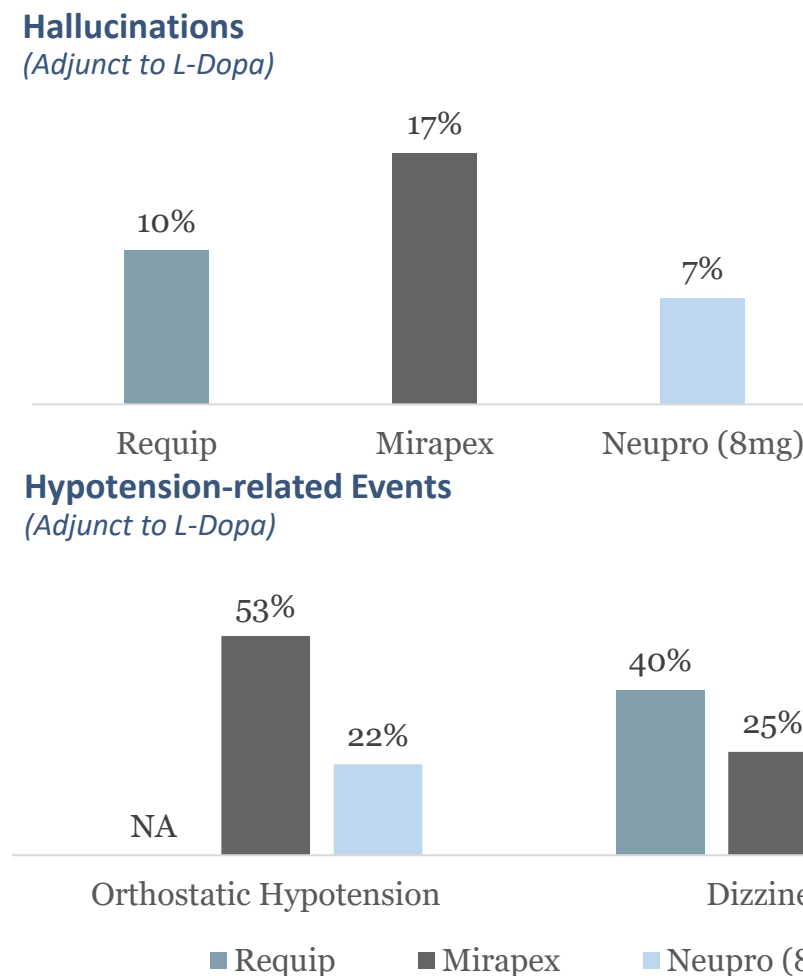
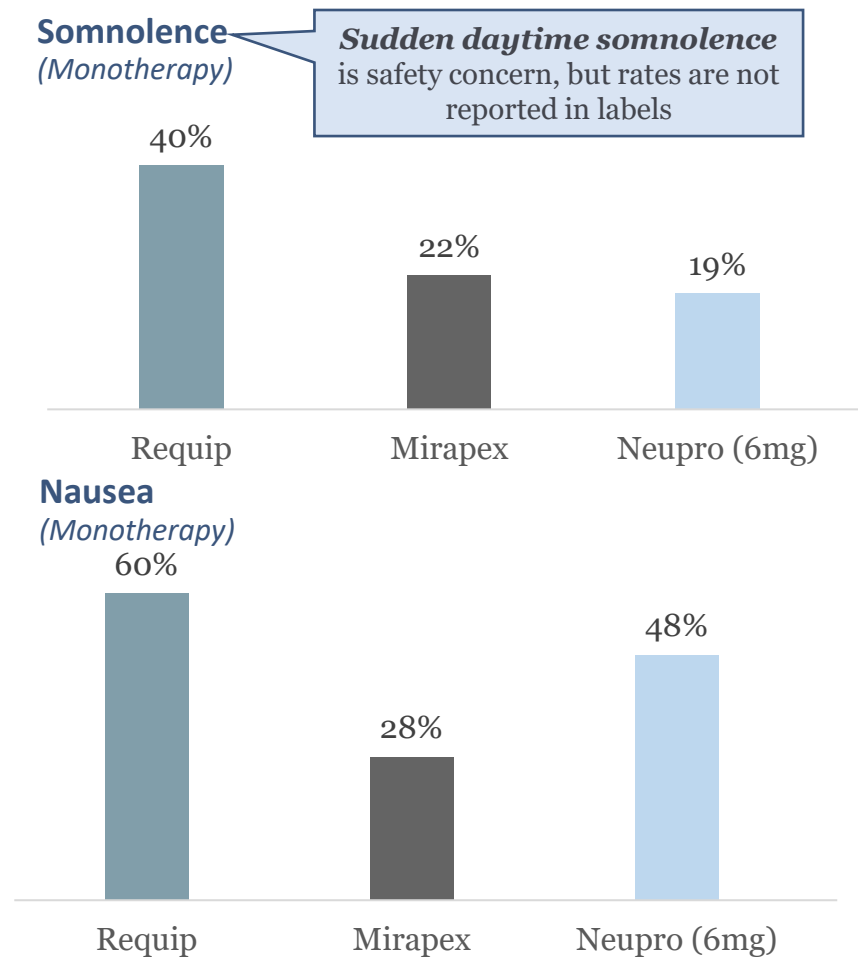


Tavapadon showed clinically meaningful benefit within therapeutic dose range of 5 mg to 15 mg



# Historical D2/D3 Labels Show Significant Side Effect Profile

*D2/D3 Side Effects: Sudden daytime somnolence, hallucinations, nausea and acute orthostasis*



# Overview of Tavapadon Clinical Trials To Date

Protocol ID	Phase	Trial End Date	N= (active/total)	Design
B7601001	Phase 1	7 Feb 2014	18/18	Single ascending dose (0.25-2.5 mg) in healthy volunteers (HV)
B7601002	Phase 1	16 Apr 2015	61/77	Multiple ascending dose study in HV (0.5-5 mg QD)
B7601007	Phase 1	04 Dec 2014	9/9	Single ascending dose (0.25 and 0.75 mg) with an antiemetic
B7601006	Phase 1	14 Sept 2017	11/11	CYP3A Victim DDI
B7601005	Phase 1b	10 Mar 2016	45/50	Open label multiple ascending dose (5/15/25 mg) in PD patients Adjunct with lowering of levodopa dose
B7601009	Phase 1b	28 Feb 2016	18/18	Placebo controlled single ascending dose (0.75/1/3/6/9 mg) in PD patients Monotherapy
B7601003	Phase 2	10 Nov 2017	85/108	Adjunct with levodopa (1/3/7/15 mg) in advanced PD patients (w/ OFF-time ≥2.5h at baseline) Three week dose titration, 15 weeks total dosing
B7601011	Phase 2	29 Jan 2018	29/57	Monotherapy in newly diagnosed PD patients; flexible dosing Seven week dose titration, 15 weeks total dosing

# Thank you

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