

First-in-class HCN1 selective inhibitors for the management of neuropathic pain

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Akelos Inc.

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NOTE REGARDING FORWARD-LOOKING STATEMENTS

Some of the information in this slide deck contains forward-looking statements within the meaning of the federal securities laws. Forward-looking statements typically are identified by the use of terms such as "anticipates," "believes," "can," "continue," "could," "estimates," "expects," "intends," "may," "plans," "potential," "predicts," "should," or the negative of these terms, although some forward-looking statements are expressed differently.

These statements include, among others, those related to:

The results of research and development activities

Uncertainties relating to preclinical and clinical testing

The cost, timing and outcome of the regulatory development and approval process

Our budgets, expenditures and financing plans Our need for substantial additional funds Patent and intellectual property matters

Our dependence on third parties, including contract research and contract clinical trial organizations

Market opportunity and competition

You should be aware that our business is subject to risks and uncertainties, including the foregoing, that could cause actual results to differ materially from those contained in the forward-looking statements. Readers are cautioned not to place undue reliance on forward-looking statements, which speak only as of the date thereof. We expressly disclaim any obligation or undertaking to release publicly any updates or revisions to any forward-looking statements contained herein to reflect any change in our expectations or any changes in events, conditions or circumstances on which any such statement is based.

This slide deck also contains projections and forecasts that have been prepared by Akelos for internal use and are based on assumptions about conditions and courses of action that management believes are reasonably possible, but not necessarily probable. Projections or forecasts compiled on the basis of a set of different conditions and courses of action could differ substantially from those included herein. Readers of these projections and forecasts should be aware that some of the conditions and courses of action in management's assumptions inevitably will not materialize and unanticipated events and circumstances may occur. Therefore, the actual results achieved during the projections or forecasts period will vary from the projections and forecasts, and the variations may be material.



Mission

To support the growing number of patients who suffer from **neuropathic pain**, a taxing condition with limited treatment options.



First in class non-opiate, anti-hyperalgesic therapy specifically for the treatment of neuropathic pain

Active preclinical development program with defined endpoints and outcomes

Experienced team with a track record of launch success

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Neuropathic pain is a chronic condition, with substantial risks tied to current treatment options

Treatment Options Plagued with Side Effects and Limited Efficacy¹

Gabapentinoids

Serotonin– norepinephrine reuptake inhibitors (SNRI)

Tricyclic antidepressants (TCAs)

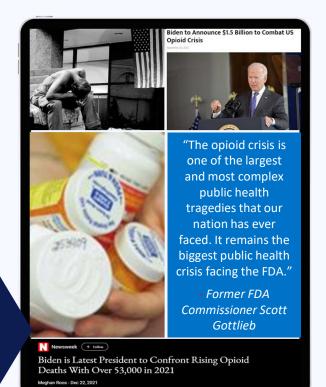
Opioids

Topical treatment

Neurotoxin

Based on the clinical evidence review conducted by the CDC²

"...long-term opioid use for chronic pain is associated with serious risks including increased risk for opioid use disorder, overdose, myocardial infarction, and motor vehicle injury."





Treatment Guidelines: Poor Risk-Benefit Profile

Low/inconsistent efficacy paired with side-effects

Treatments for Neuropathic Pain		Drugs	Adverse Effect
First Line Therapy	Gabapentinoids	Gabapentin (Gralise®) Pregabalin (Lyrica®)	Lethargy, vertigo, peripheral swelling, blurred vision, increased body weight
	Tricyclic antidepressants (TCAs)	Amitriptyline	Anticholinergic effects, QT prolongation (arrhythmia), suicide risk, urinary retention
	Serotonin–norepinephrine reuptake inhibitors (SNRI)	Duloxetine (Cymbalta®) Venlafaxine (Effexor®)	Nausea, lethargy, constipation, ataxia, dry mouth, vertigo, hyperhidrosis, hypertension
Second Line	Opioids	Tramadol (Ultram®) Tapentadol (Nucynta®)	Nausea/vomiting, constipation, lethargy, seizures, ataxia
Therapy	Topical treatment	Lidocaine, Capsaicin	Local erythema, itching and rash, pain, rare cases of high blood pressure
Third-line therapy	Strong opioids	Morphine, Oxycodone	Nausea, vomiting, constipation, dizziness and lethargy, respiratory depression
	Neurotoxin	Botulinum toxin	Pain at injection site

Source: Cavalli et al. Int J Immunopathol Pharmacol. 2019.



Akelos is developing solutions to treat neuropathic pain: a prevalent, costly condition

In the United States



Associated costs exceed \$348 billion/year²





Pain: An unpleasant sensory and emotional experience associated with actual or potential tissue damage

Major types of pain¹

Acute Pain

Pain that occurs immediately in response to tissue injury. It serves a biologically important function and although unpleasant, is not pathologic.

Functional Pain

Pain without obvious origin. Examples include fibromyalgia and irritable bowel syndrome

Chronic Pain

Any pain lasting longer than 3 months

Inflammatory Pain

Inflammation caused by an inappropriate immune system response. Conditions include gout and rheumatoid arthritis

Neuropathic Pain

Pain caused by injury to neurons - can arise from injured cells in central nervous system (ex., post-stroke) or peripheral nervous system (ex., sensory nerve transection)

Neuropathic Pain²

Derives from numerous conditions and diseases, including:

Chemotherapy-induced peripheral neuropathy

Diabetes

Multiple sclerosis

Strok

Eimb Amputation

Often chronic

Source: 1. Journal of Pain & Relief, Accessed 10-15-20; 2. Brain & Spine Foundation, Accessed 10/2/20

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CIPN

Chemotherapy Induced Peripheral Neuropathy



Progressive, enduring, and often irreversible condition: pain, numbness, tingling and sensitivity to cold in the hands and feet (can progress to the arms/legs)

30% of chemotherapy patients and 93% of those receiving platins develop CIPN – common treatment for solid tumors

Often so unbearable that patients discontinue treatment despite increased risk of death



CIPN is a global problem

2015 2017 2022

17.5 million cancer casesworldwide▲ (33% compared to 2005)¹

24.5 million cancer cases worldwide (▲ 40% in two years)¹

New cancer cases in US 1.9 million²



World Health Organization estimates new cancer cases to rise by $\triangle 70\%$ over the next two decades¹

Depending on chemotherapeutic class, CIPN occurs in up to 90% of patients¹

No meaningful prevention

No effective therapy

Attractive regulatory path



Market Opportunity



The neuropathic pain market is expected to grow to US\$ 9.5 Bn between 2021 and 2031.

The neuropathic pain market, in the last 5 years (2015 and 2020), witnessed a CAGR of 5.5%.



The Global Neuropathic Pain Market is estimated to be valued at US\$ 7.56 Billion in 2023 and is expected to exhibit a CAGR of 6.2% during the forecast period (2023-2030).



"The overall demand for therapeutic drugs, including neuropathic pain medicines, remains relatively stable during economic downturns due to their essential role in treating health conditions."





Neuropathic pain market is expected to reach \$13.3 Billion in 2032

Growing at a CAGR of 5.6% (2022-2032)



"By indication ... chemotherapy induced peripheral neuropathy is projected for most prominent growth rate."



Few Effective Treatments for CIPN Patients

Physicians resort to treatments lacking clinical evidence1

Duloxetine resulted in minimal pain reduction in patients with CIPN² (Cymbalta®; Lilly, 2018 Q4th sales US\$ 184.5M)



and placebo was 0.73 (95% CI, 0.26-1.20)."

Efficacy of Gabapentin in the Management of Chemotherapy-induced Peripheral Neuropathy

A Phase 3 Randomized, Double-Blind, Placebo-controlled, Crossover Trial (NOOC3)

Ravi D. Rao, Mes¹ John C. Michalak, Mo² Jeff A. Sloan, mo³ Gamini S. Soori, wo4 Daniel A. Nikcevich, MO, PRO David O. Warner, Mo Paul Novotny, as Gilbert Y. Wong, Mo⁸ and the North Central Cancer Treatment Group

Department of Medical Oncology, Mayo Clinic and Mayo Foundation, Rochester, Memorata Department of Medical Grookings, Cedar Rapids Incolings Project CCOP, Circlar Rapids, Buss. Department of Neurology, Mayo Chric and Mayo Foundation, Rechester, Microscota BACKGROUND. The antiepileptic agent, gabapentin, has been demonstrated to relieve symptoms of peripheral neuropathy due to various etiologies. On the ba-sis of these data, a multicenter, double-blind, placebo-controlled, crossover, randomized trial was conducted to evaluate the effect of gabapentin on symptome of chemotherapy-induced peripheral neuropathy (CIPN).

METHODS. Patients with symptomatic CIPN who complained of 'average' daily pain scores of either 1) ≥4 on a 0-10 numerical rating scale (NRS); or 2) ≥1 on the 0-3 Eastern Cooperative Opcology Group neuropathy scale (ENS) were eligible (higher numbers indicate greater severity of symptoms in both scales). Patients were randomized to receive gabapentin (target dose, 2700 mg) or placebo for 6 weeks. Crossover occurred after a 2-week washout period. CIPNrelated symptoms were evaluated weekly by questionnaires. Statistical methods followed established methods for crossover designs, including Student t tests to compare average intrapatient differences between treatments and linear models to adjust for potential concomitant covariates.

RESULTS. There were 115 patients who were randomly assigned to the treatment or control arm. Both groups were well matched by symptoms at study entry. Changes in symptom severity were statistically similar between the 2 groups during the study. Adverse events were mild and similar in both groups.

CONCLUSIONS. This trial failed to demonstrate any benefit to using gabapentin to treat symptoms caused by CIPN. Cancer 2007;110:2110-8. © 2007 American

"This trial failed to demonstrate any benefit to using gabapentin to treat symptoms caused by CIPN."



Blockbuster Treatments; Limited Efficacy

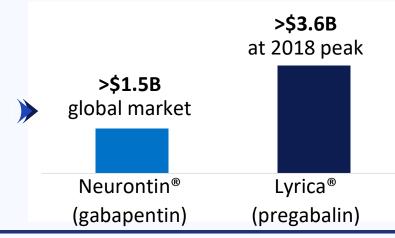
Patients report unsatisfactory pain relief¹

Complex regimen – wide range of effectiveness

Burden of trial-and-error therapy regimens

Forced to choose between benefits and adverse effects

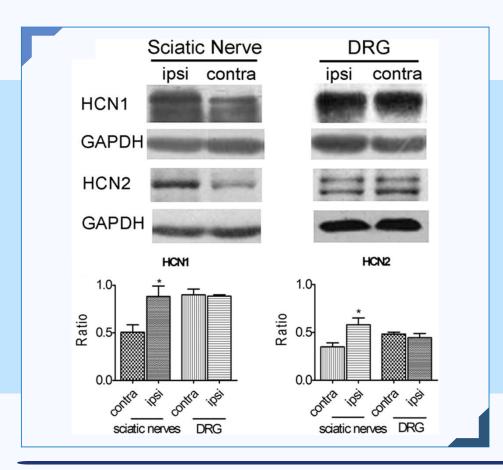
with gabapentinoids for neuropathic pain despite widespread use²







HCN1 Expression – Post Peripheral Nerve Injury



Rat chronic constriction injury model

- Following nerve injury (chronic constriction), HCN1 expression markedly increases in the injured sciatic nerve, but not in the uninjured nerve (contralateral hind limb)
- MCN2 increases as well, but much less than for HCN1

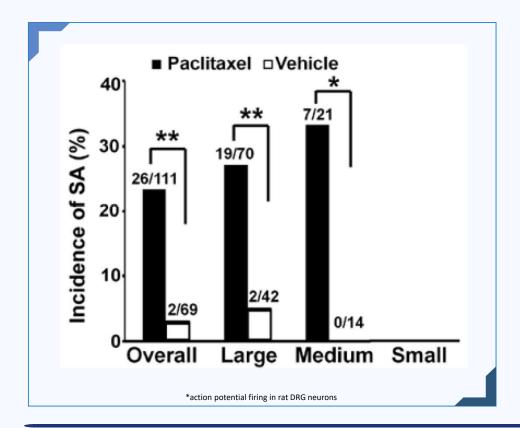
Source: Jiang et al. Pain 2008

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Paclitaxel Increases Spontaneous Activity in Sensory Neurons*

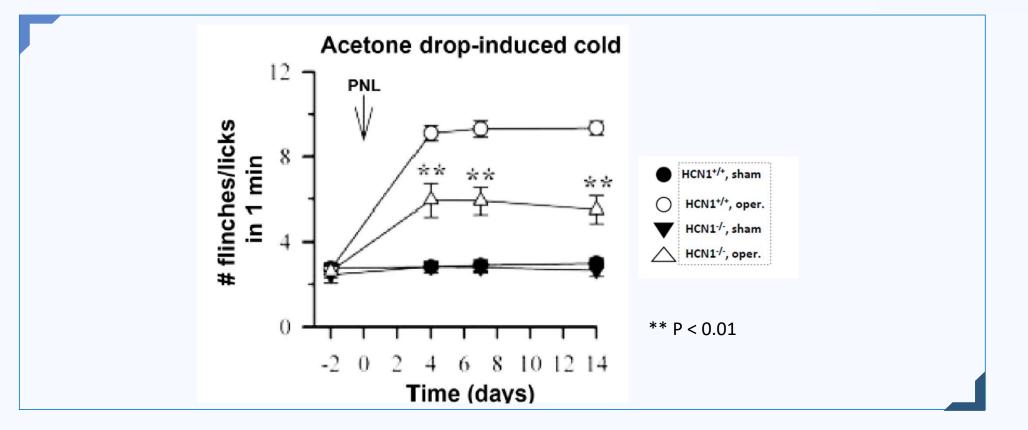
Significantly increases HCN1 gene expression by ~1.8-fold



Gene	Ion Channel	Mean Fold Change	SEM	P Value
Accn2 /	Amiloride-sensitive cation channel 2, neuronal	1.210	0.167	0.335
Cacna1d	Ca_1.3	1.232	0.348	0.573
Cacnati	Ca.3.3	1.278	0.238	0.363
Hon1	HCN1	1.758**	0.064	0.007
Kena2	K,1.2	1.566*	0.066	0.013
Kona5	K_1.5	0.689	0.116	0.115
Konab2	K _{B2}	1.206	0.160	0.327
Kend2	K.4.2	1.327	0.078	0.053
Kenh1	K,10.1	1.260	0.136	0.195
Kenh7	K 11.3	1.452*	0.077	0.028
Konj1	K,1.1	0.730*	0.048	0.031
Kenj13	K,1.4	1.449	0.218	0.175
Konj15	K,4.2	1.545	0.211	0.092
Konj16	K,5.1	1.252	0.482	0.653
Konj3	K,3.1	1.356*	0.038	0.011
Konj5	K,3.4	0.655*	0.061	0.030
Konk1	K ₂₀ 1.1	0.752*	0.046	0.033
Kenn2	K _{cs} 2.2	1.233	0.088	0.119
Kengt	K,7.1	2.010	0.386	0.120
Keng3	K,7.3	1.248	0.128	0.192
Pyr3 I	Brain ryanodine receptor-calcium release channel	1.528*	0.089	0.027
Scn1a	Na,1.1	1.326	0.288	0.375
Scn1b	Na _i β1	1.299	0.331	0.461
Scn8a	Na,,1.6	1.205	0.223	0.455
Scr9a	Na,1.7	1.258**	0.017	0.004
Slc12a5	KCC2	1.287	0.277	0.409
Trpm1	TRPM1	0.733	0.094	0.105
Trpm6	TRPM6	1.382	0.111	0.075
Trpm8	TRPM8	1.210	0.133	0.254
Trpv1	TRPV1	1.215	0.079	0.113
Trpv3	TRPV3	1.997*	0.140	0.019



HCN1 Contributes to Cold Allodynia



Source: Momin et al. J Physiol 2008

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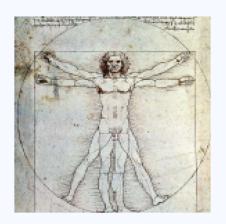
Target engagement HCN1 in human sensory neurons



In humans, HCN1 mRNA is present in a larger proportion of DRG neurons than is HCN2 (~2.1-fold). In mice, HCN2 mRNA-positive and HCN1 mRNA-positive DRG neurons are seen with the same frequency¹

In humans, HCN1 mRNA is present at twice the level of that for HCN2, and ~11-fold and ~29-fold than that for HCN3 and HCN4, respectively²

Functional
(electrophysiologic)
analysis suggests that
HCN1 is the primary
isoform in human
sensory neurons³









Additional evidence identified in key journals

nature

Article | Published: 31 July 2024

Propofol rescues voltage-dependent gating of HCN1
channel epilepsy mutants

Elizabeth D. Kim, Xiaoan Wu, Sangyun Lee, Gareth R. Tibbs, Kevin P. Cunningham, Eleonora Di Zanni, Marta E. Perez, Peter A. Goldstein, Alessio Accardi, H. Peter Larsson [™] & Crina M. Nimigean [™]

Nature 632, 451-459 (2024) | Cite this article

Further defining the underlying mechanism of action of propofol¹

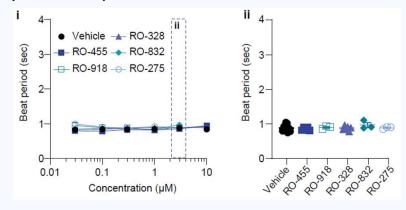
Identified the binding site for a clinically important class of molecules that target the human HCN1 ion channel. These findings will guide efforts for novel drug development for poorly treated neurologic disorders in which HCN1 channels play a role.

Cell Chemical Biology

Selective and brain-penetrant HCN1 inhibitors reveal links between synaptic integration, cortical function, and working memory

Demonstrated that selective HCN1 inhibition does not affect electrophysiological properties of human inducible pluripotent stem-cell-derived atrial-like cardiomyocytes.²

Concordant with data indicating that HCN2 and HCN4 are the primary isoforms present in human cardiac tissues.





Akelos' anchor-tethered warhead concept

Structural Concepts

AKE-1018

Small Molecule (SM)

ANCHOR

COUPLING

Hydrophilic chemistry with length to reach from anchor attachment to the hydrophobic aspect of the plasma membrane

LINKER

Hydrophobic chemistry with length and geometry to optimize reach and orientation of the pharmacophore

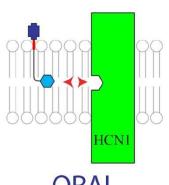
PHARMACOPHORE

Tethered analgesic 26DTB-P or analogue with enhanced anti-HCN1 potency/selectivity

Mechanistic Concepts

AKE-1018

Hydrophilic anchor retained in the extracellular space



ORAL

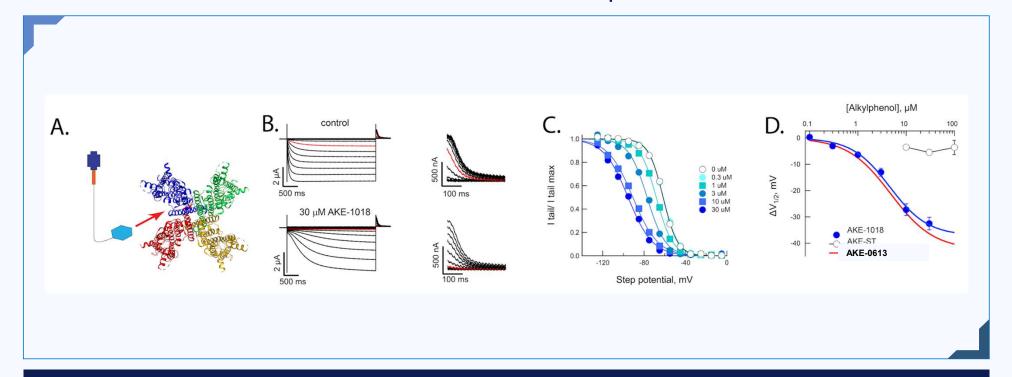
Concentrating activity at the site of action to improve safety and efficacy

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AKE-1018: Efficacy against target

Inhibits HCN1 Function in a Concentration- Dependent Manner

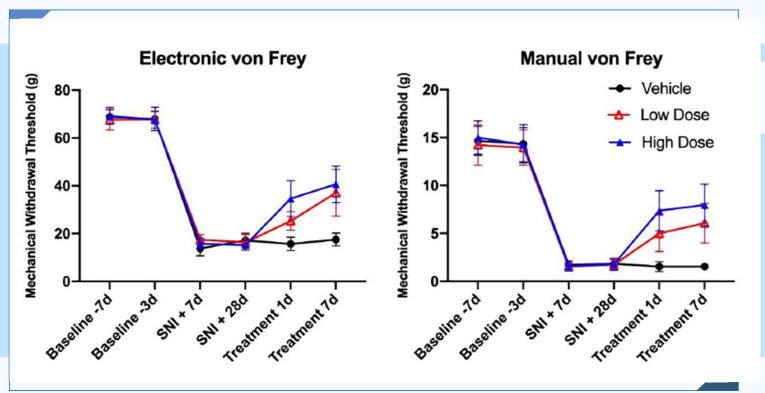


Two-electrode voltage clamp recordings from Xenopus oocytes expressing HCN1



AK-1018: Antihyperalgesic efficacy in Rat Nerve-Injury Model

Relieves nerve injury-induced mechanical allodynia, dose-dependent



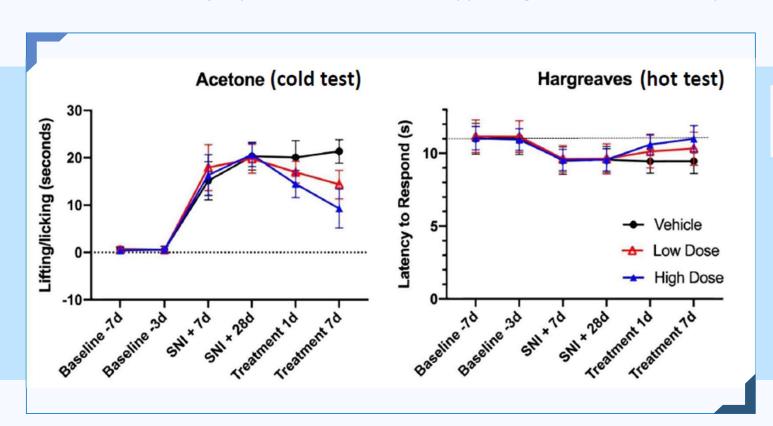
Statistically significant efficacy

Reductions in probability of response to mechanical and thermal stimulation following nerve injury



AK-1018: Antihyperalgesic efficacy in Rat Nerve-Injury Model

Relieves nerve injury-induced thermal hyperalgesia in a dose-dependent manner

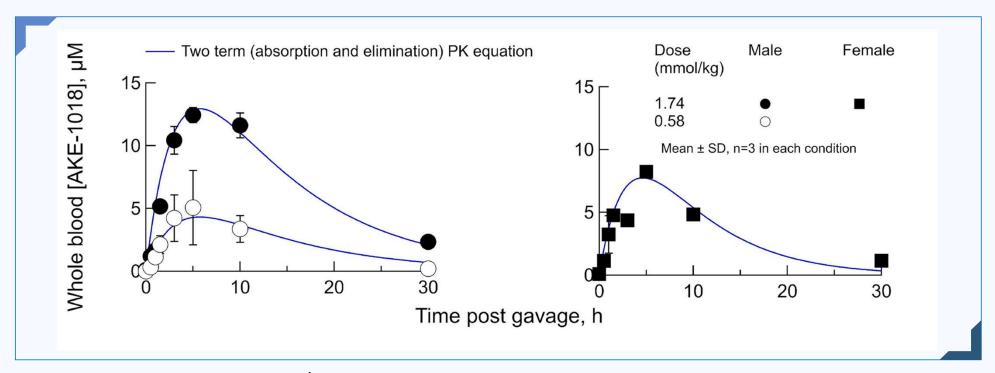


Statistically significant efficacy

Reductions in time of response to thermal stimulation following nerve injury



AKE-1018: Orally bioavailable



Following a single bolus, LC-MS/MS analysis shows AKE-1018 blood concentration persistently exceeds the IC $_{50}$ for inhibition of HCN1 (5 μ M)



AKE-1018: Designed exclusion from the CNS

PREDICTION: A CNS MPO score below 4 predicts CNS exclusion

The CNS MPO score for AKE-1018 is 2.25

OBSERVATION

AKE-1018 was gavaged at 1.74 mmol/kg on 7 consecutive days

Tissue distribution was determined by LC-MS/MS following acetonitrile extraction

AKE-1018 in Brain << AKE-1018 in Peripheral Tissues

100-fold

SIGNIFICANCE: Precludes inhibition of central HCN1

Minimizes risk of adverse CNS side effects

CNS MPO: Central Nervous System Multiparameter Optimization.



THE LEAD NCE - AKE-1018



Effective

- Orally bioavailable
- Potent and efficacious inhibitor of HCN1
- Effectively anchored to the lipid membrane extracellular leaflet in silico
- Effectively relieves mechanical and thermal hypersensitivity in male and female rats
- Excluded from the CNS as designed

Safe –

at doses > 10X

the lowest

efficacious

dose

⚠ Does not produce changes in heart rate or blood pressure

Does not produce changes in motor strength/coordination or activity (non-sedating)

⚠ Does not show potential for abuse/addiction — a hallmark of opioids



AKE-1018 - Cost through Phase I

Exclusive license to IP

Efficacy and safety

Grant-funded research

Value proposition

AKF-1018

ORAL



Partnership (sponsored research) with Cornell to develop HCN1 inhibitors



Demonstrated in lead compounds in extensive preclinical testing



\$8 million prior academic research funding for Goldstein Lab

\$1.7 million research grant from the NIH to Cornell team working with Akelos

\$3.69 million Phase I/II Fast-Track Small Business Technology Transfer (STTR) grant from the National Institute of Neurological Disorders and Stroke (NINDS).

Next Steps

Akelos is seeking an \$14 million dollar investment

Fund pre-clinical drug development and IND enabling studies for their two lead programs

Build out R&D and regulatory teams in anticipation of Phase 1 trials



Team

<u>Peter Goldstein, MD</u> Scientific Advisory Board & Scientific Co-Founder

Principal Investigator in the C.V. Starr Laboratory for Molecular Neuropharmacology, Weill Cornell Medical College 18+ years in the Department of Anesthesiology at Weill Cornell Medical Center





Gareth Tibbs, PhD Scientific Advisory Board & Scientific Co-Founder Leading authority on HCN channel function

Leading authority with deep domain expertise in biophysics of HCN channel function

B.A. and Ph.D. from University College, London; London and Dundee University in Scotland





REST

Steven R. Fox, DDS President & Chief Executive Officer

20+ years of success as an entrepreneur
Medal of Freedom recipient
Ernst & Young Entrepreneur of the Year
Former CEO of public oral care company
40 years as Doctor of Dental Surgery
Chairman, The Rebel Group
Former Faculty of Harvard University & New York University

Robert Benson, PhD

IP Advisor

Over 20 years of experience in licensing and intellectual property Principal of South Shaker Associates Former department head of Harvard University Former supervisor at the National Institute of Health



50+ years as a food and drug law specialist Former Chief Counsel, Food and Drug Administration Senior Counsel, Covington & Burling LLP, specializing in Food and Drug law Faculty member, Harvard Law School

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Strategic Advisors

Cyrus Arman, PhD, MBA Head of Business Development

Tenured experience in corporate, clinical, and commercial strategy for biotechnology companies including Amgen, Nimble Therapeutics, and NEUVOGEN, Inc.

Former President and Principal Operating Executive for CytoDyn, Inc. MBA, PhD and MS in from the University of Southern California and a BS in from the University of California San Diego





Senator Thomas Daschle Strategic Healthcare Advisor

Serves on the Health Policy and Management Executive Council at the Harvard School of Public Health

Member of the Council on Governance for Sustainability at the World

Member of the Council on Governance for Sustainability at the World Economic Forum & the Federal Advisory Board of Accenture Chair of the DuPont Advisory Committee on Agriculture Innovation and Productivity



Distinguished Scientific Advisory Board

Darryle D. Schoepp, Ph.D Strategic Advisor

30+ years in Pharmaceutical Research and Drug Discovery Former SVP, Neuroscience Research Head at Merck; VP, Neuroscience Delivery Research at Eli Lilly and Co.
Over 200 publications.,19,000 citations., and 15 US patents





Michael Levitt, PhD Acclaimed Biophysicist

Robert W. & Vivian K. Cahill Professor in Cancer Research in the Stanford School of Medicine Recipient of the 2013 Nobel Prize in Chemistry

<u>Dianna Willis, PhD</u> Prominent Pain Researcher

Head, Laboratory for Axonal and RNA Biology, Director of the Center for Pain Research, and Associate Director at the Burke Neurological Institute

Assistant Professor of Neuroscience at Weill Cornell Medicine Director, Burke-Blythedale Program in Pediatric Clinical Neuroscience





J. David Warren, PhD Biochemistry Expert and Team Leader

Staff Scientist in the Yale Center for Molecular Discovery
Adjunct Professor of Biochemistry at Weill Cornell Medicine
Former member and team leader, the Sandra and Edward Meyer Cancer
Center

Co-founder and Scientific Advisory Board member of Unii Therapeutics



Sara Page Mayo Chair in Pediatric Pain Medicine and Director Pain
Treatment Services, Boston Children's Hospital
Professor of Anesthesia (Pediatrics) at Harvard Medical School





Scott L. Dax, MS, PhD
Research and Development Champion

Former Chief Scientific Officer at CerSci Therapeutics Analgesics research team leader at Johnson & Johnson Inventor of over 100 issued patents worldwide; over 100 abstracts/publications



Vision for the future – Disruptive Therapeutics

Akelos is developing firstin-class, novel mechanism of action, therapeutics

For Neuropathic Pain

- Poor treatment options
- Market projected to grow
- It is the right time

As a Generalizable Platform



Akelos is seeking:

\$14 million dollars for AKE-1018

- Fund preclinical drug development and IND enabling studies for their two lead programs
- Build out R&D and Regulatory teams in anticipation of Phase 1 trials

\$1.5 million dollars for AKE-XG

Novel platform technology





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