

The background of the slide features a blurred image of laboratory glassware, including several glass bottles and test tubes, overlaid with a blue and grey geometric design.

NOVEL THERAPEUTICS
FOR **METABOLIC &**
ENDOCRINE DISORDERS

Corporate Presentation

September 2018

Forward-Looking Statements

This presentation contains statements about our future expectations, plans and prospects that constitute forward-looking statements for purposes of the safe harbor provisions of the Private Securities Litigation Reform Act of 1995. Actual results may differ materially from those indicated by these forward-looking statements as a result of various important factors, including risks relating to: both our and our collaborators' ability to successfully research, obtain regulatory approvals for, develop and commercialize products based upon our technologies; our ability to obtain and maintain proprietary protection for our technologies and product candidates; our reliance on third parties to manufacture our preclinical and clinical drug supplies; competitive pressures; our ability to obtain and maintain strategic collaborations; compliance with our in-license agreements; our ability to successfully execute on, and receive favorable results from, our proprietary drug development efforts; market acceptance of our drug candidates; retaining members of our senior management; and our ability to raise additional funds to finance our operations.








The forward-looking statements included 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. While we may elect to update these forward-looking statements in the future, we specifically disclaim any obligation to do so. These forward-looking statements should not be relied upon as representing our views as of any date subsequent to the date of this presentation.

For more information regarding risks and uncertainties that could affect the results of our operations or financial condition review our filings with the Securities and Exchange Commission (in particular, our most recent Annual Report on Form 10-K and subsequently filed Quarterly Reports on Form 10-Q).

Investment Highlights

- ▶ **Focused on best-in-class drugs for metabolic and endocrine diseases**
 - Two Phase 2 programs supported by positive clinical data
- ▶ **Metabolic Disease Program: VK2809, for hypercholesterolemia, NAFLD**
 - Novel, selective thyroid receptor- β (TR β) agonist
 - Phase 2 trial expected to complete in 2H18
- ▶ **Musculoskeletal Program: VK5211 for hip fracture recovery**
 - Non-steroidal selective androgen receptor modulator (SARM)
 - Phase 2 results demonstrate significant increases in lean body mass
- ▶ **Rare Disease Programs: GSD; X-ALD**
 - VK2809 in GSD Ia: PoC study expected to begin 2H18
 - VK0214 in X-ALD: Potential IND, PoC study to begin 2019

Pipeline Catalysts and News Flow

	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19
Metabolic Disease Program: VK2809						
Phase 2 Hypercholesterolemia NASH		 Complete enrollment, Phase 2 trial	 Top line data, Phase 2 trial			
Musculoskeletal Program: VK5211						
Phase 2 Hip Fracture Recovery			 Meet with FDA re: next steps			
Rare Disease Programs: VK2809, VK0214						
Phase 1b VK2809 in Glycogen Storage Disease Type Ia	 File IND		 Initiate PoC study		 Initial data, PoC study	
Preclinical VK0214 in X-ALD					 File IND Initiate PoC study	

Key VK2809 clinical data expected to read out in 2H18



Metabolic Disease Program

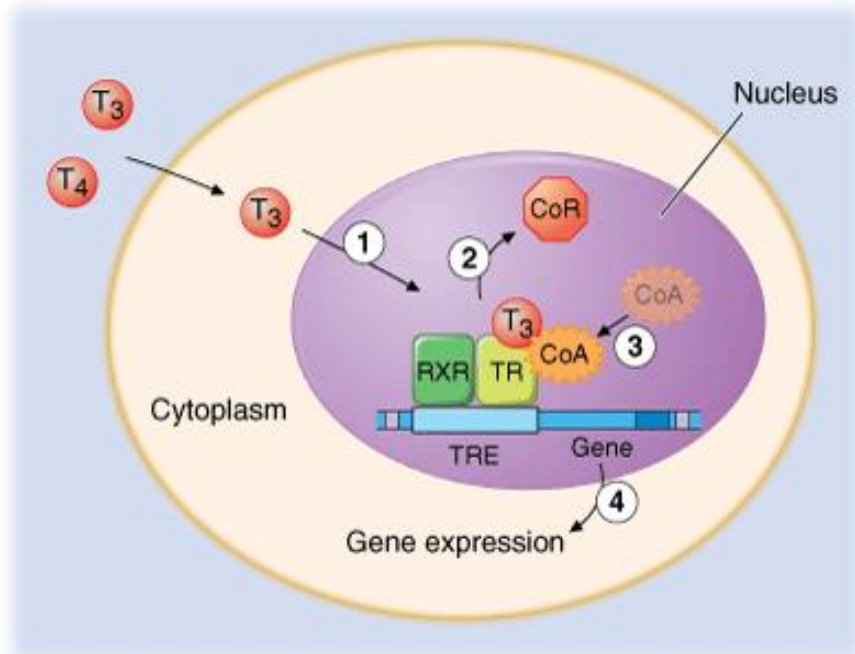
VK2809: Selective Thyroid Receptor- β Agonist

Liver Disorders

Metabolic Disease Program: Selective Thyroid- β Agonists

- ▶ **Proprietary platform for small molecule thyroid hormone mimetics**
 - Highly tissue and receptor selective
 - Produce potent lipid reductions in animals and humans
 - Unique chemical scaffolds, expected wider safety window vs. other approaches
- ▶ **Biological profiles suggest potential benefit in multiple indications**
 - Broad: NASH, hypercholesterolemia, dyslipidemia
 - Rare: Glycogen storage disease, type Ia (GSD Ia)
X-linked adrenoleukodystrophy (X-ALD)
- ▶ **Lead molecules VK2809, VK0214**
 - Oral, once-daily formulations
 - VK2809: Ongoing Phase 2 trial, fatty liver disease and hypercholesterolemia
 - Proof-of-concept study to begin 2H18, GSD Ia
 - VK0214: Preclinical, X-ALD

Thyroid Receptor Overview

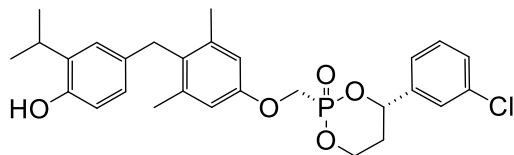


Key steps in receptor activation: Endogenous thyroid hormone T₃ crosses mitochondrial membrane (1) binding thyroid receptor TR, dissociating co-repressor CoR (2). Subsequent binding of co-activator CoA (3) results in altered gene expression (4). RXR: retinoid X receptor; TRE: thyroid response element.

- ▶ Nuclear hormone receptors
- ▶ Two major subtypes
 - **Thyroid beta receptor:**
Liver, brain; modulates cholesterol, triglyceride levels
 - **Thyroid alpha receptor:**
Cardiac tissue, modulates heart rate, contraction

Therapeutic goal, lipid setting: β -receptor selectivity;
minimize alpha-effects

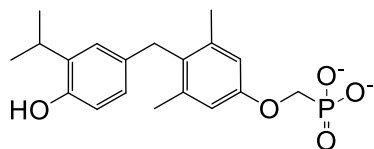
VK2809: Unique Liver-Targeted Characteristics



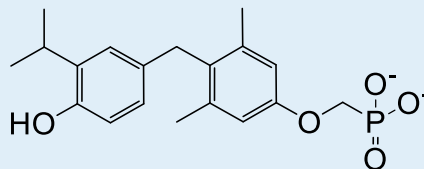
VK2809, Novel Prodrug

Following oral dosing:

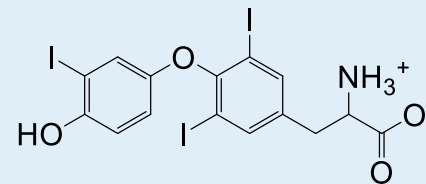
- Cyp3A4-mediated cleavage of prodrug
- 3A4 primarily expressed in liver
- Results in targeted delivery of drug to liver



VK2809A, Potent TR β Agonist,
2.2 nM Ki



VK2809A



T3 Thyroid Hormone

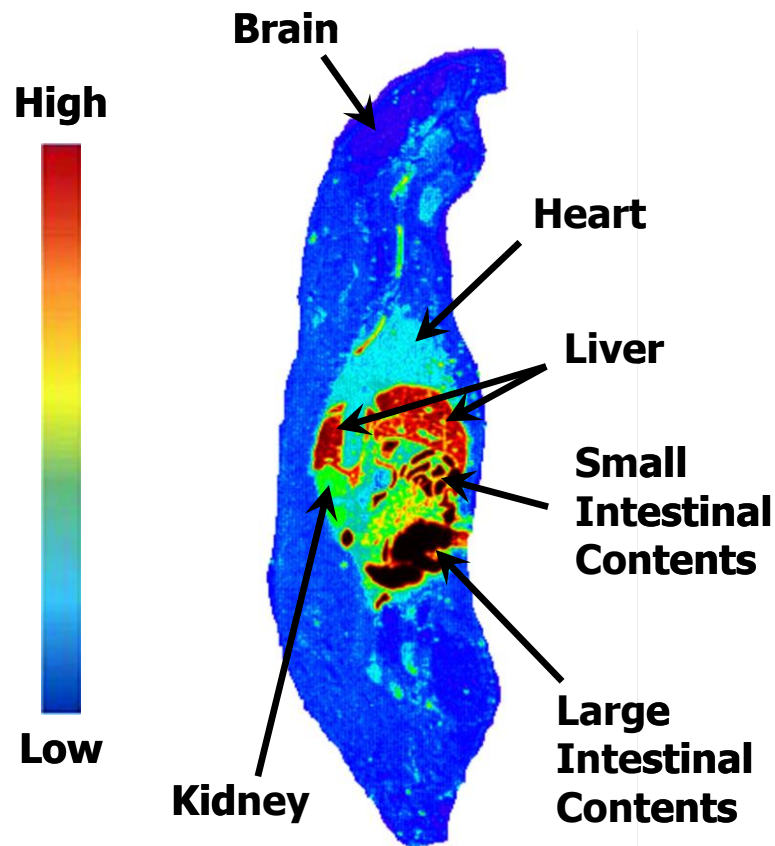
- ▶ 17:1 selective for β : α
- ▶ Highly negatively charged
 - Poor passive diffusion
- ▶ Not actively transported
 - Due to altered chemistry
- ▶ Targeted hepatic re-uptake
 - Selective liver re-absorption via hepatic OATP1B3 transporter

- ▶ 1:2 selective for β : α
- ▶ Effectively neutral charge
- ▶ Active uptake in multiple tissues via MCT8
- ▶ Broad systemic availability
- ▶ Impractical for development due to safety

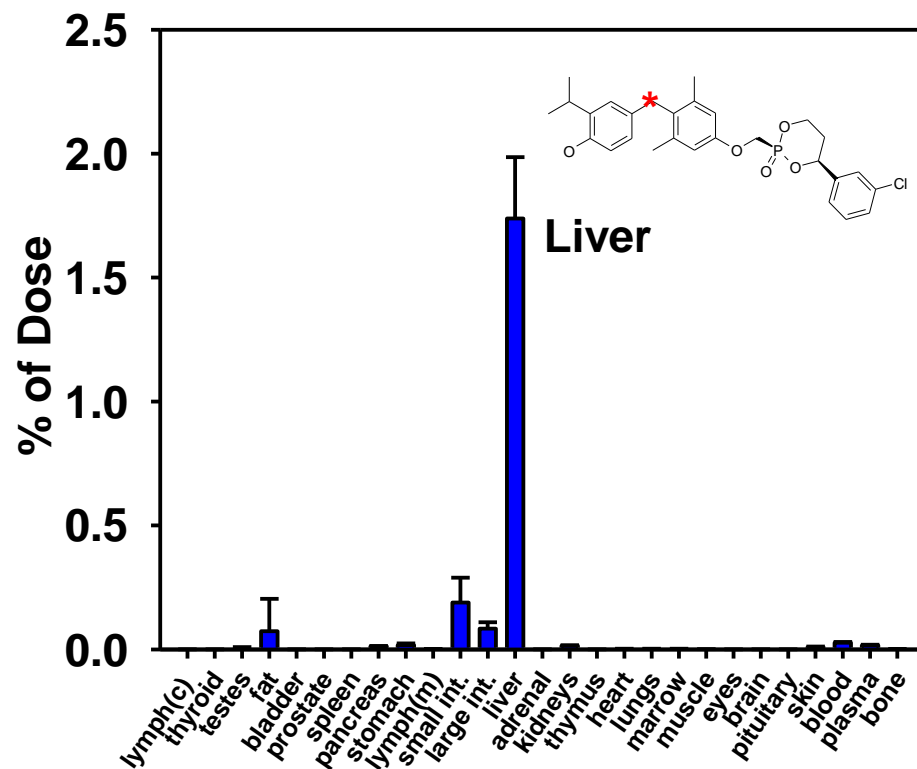
Selective activation, differentiated chemistry lends VK2809 liver selectivity; potentially minimizes risk of systemic effects

VK2809: Evidence of Liver Selectivity

¹⁴C QWBA (4 h)



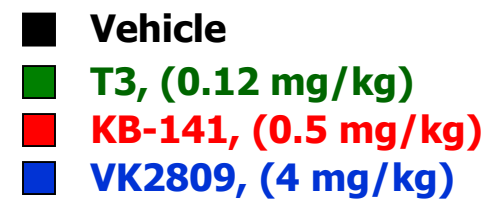
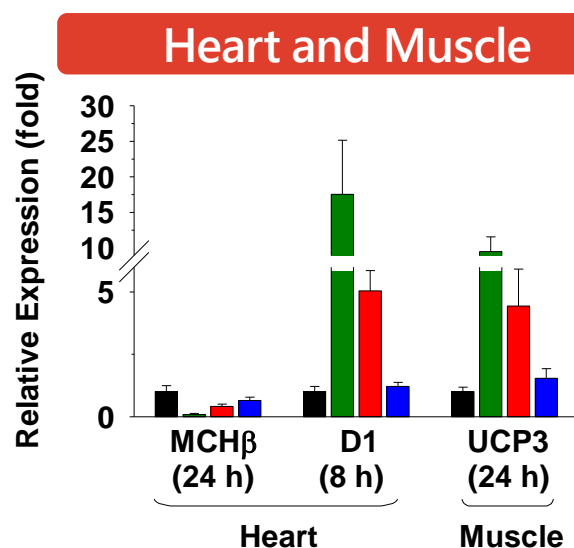
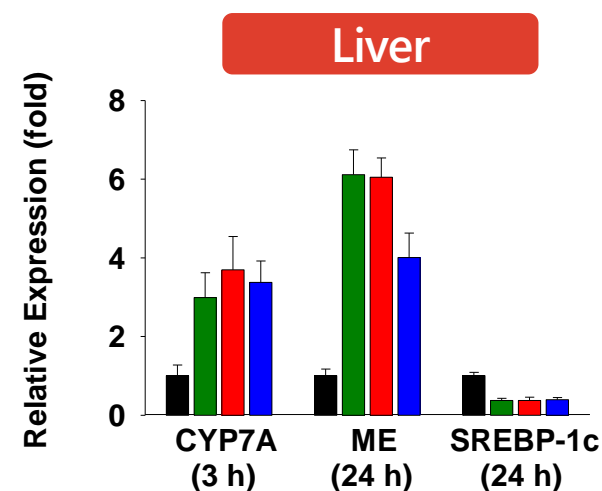
¹⁴C Tissue Distribution (24 h)



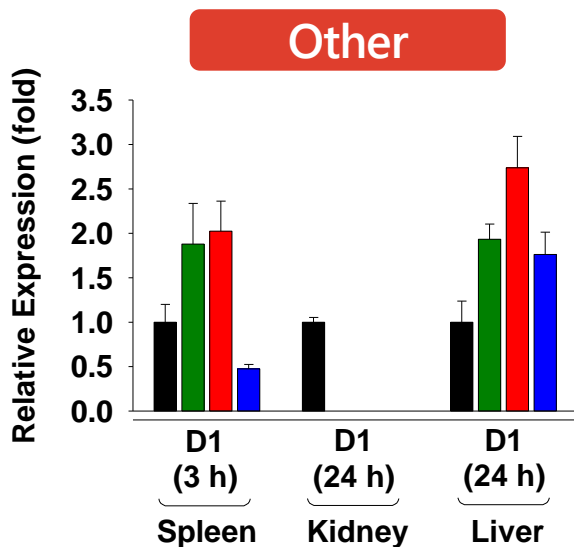
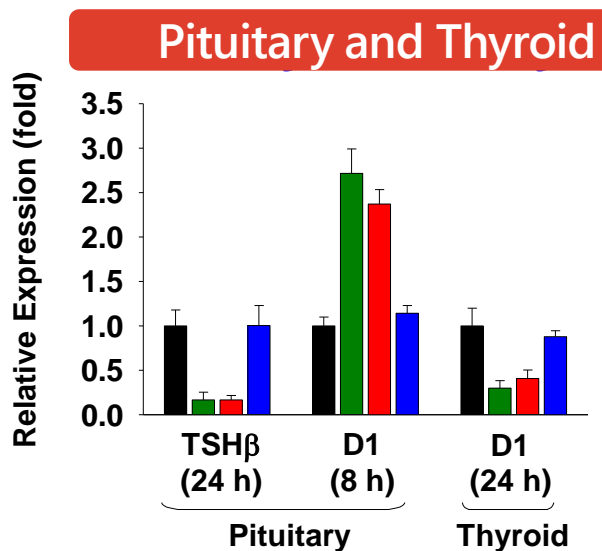
SD rat, 5mg/kg dose; approx. 30x anticipated human doses

Liver selectivity confirmed via radiologic analysis

VK2809: Liver-Selective Transcriptional Effects



All 10x ED₅₀



VK2809 shows minimal effects on gene expression in extrahepatic tissues

Rationale for Exploring TR β Agonists in NASH

Development of NASH:



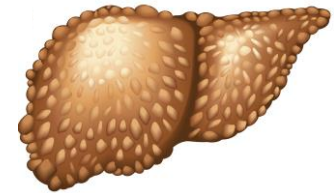
Healthy liver

First Hit:
Accumulation of
fatty acids,
triglycerides

Subsequent:
Oxidative stress,
inflammatory
response

NASH: Steatosis,
ballooning,
hepatocyte
damage

NAFLD Progression



- Cirrhosis
- HCC
- Liver failure

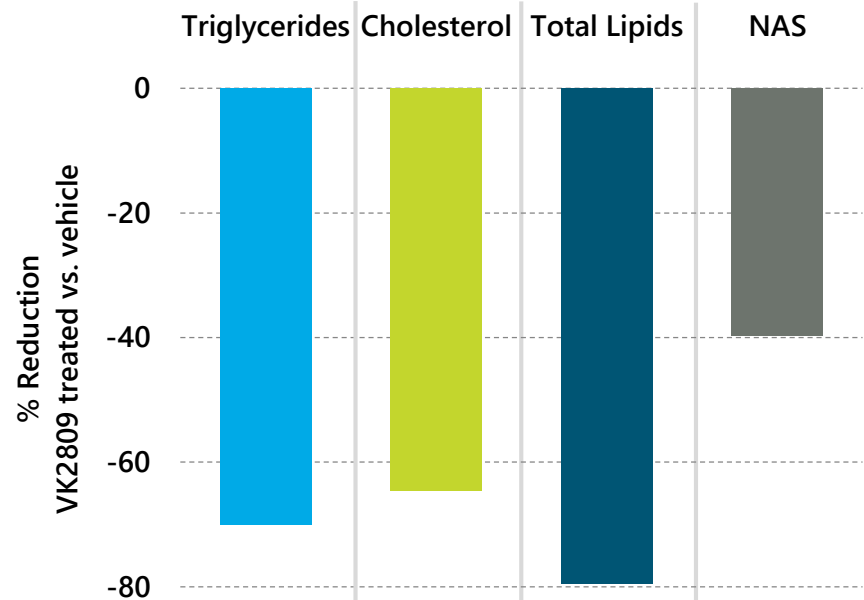
- ▶ TR β regulates multiple aspects of lipid metabolism; systemic and liver-specific effects
- ▶ Receptor is localized to liver, limited expression in other tissues
- ▶ Literature evidence suggests anti-fibrotic effects from TR β activation
- ▶ Clinical data indicate a correlation between reduced liver fat, improvement in NAS

An agent that reduces liver fat, improves systemic lipids, and antagonizes fibrotic signaling could provide multi-pronged benefits in NASH

VK2809 Significantly Reduces Steatosis in Diet-Induced NASH

- Evaluation in biopsy-confirmed diet-induced NASH model
 - Rodent model designed to reflect progression of disease in humans
 - Animals biopsied pre-study; only those with NASH *and* fibrosis selected
 - VK2809 dosed once-daily for 8 weeks

Change in Liver Lipids Following 8 Weeks Dosing With VK2809



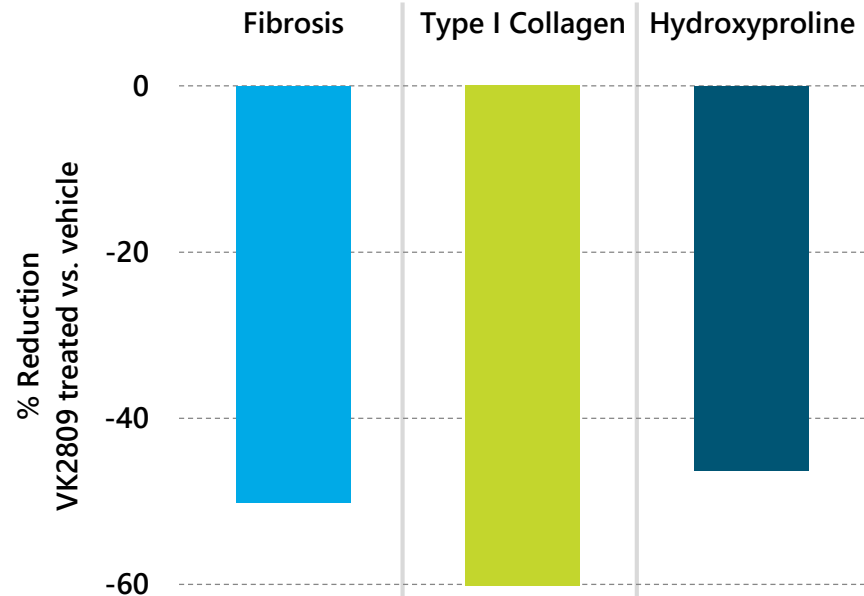
% Difference:	-70.0%	-64.6%	-79.5%	-39.7%
p-value:	<0.0001	<0.0001	<0.0001	<0.0001

Treatment with VK2809 significantly improves lipids, steatosis, NAS at 8 weeks; well-tolerated with no evidence of toxicity

VK2809 Improves Fibrosis in Diet-Induced NASH Model

- ▶ Significant reductions in fibrosis, collagen, hydroxyproline after 8 weeks
- ▶ Supports thesis that selective TR β activation produces broad metabolic benefits
- ▶ Gene expression data show improvements in genes related to lipid metabolism, insulin sensitivity, fibrogenic signaling

Change in Liver Fibrosis Following 8 Weeks Dosing With VK2809

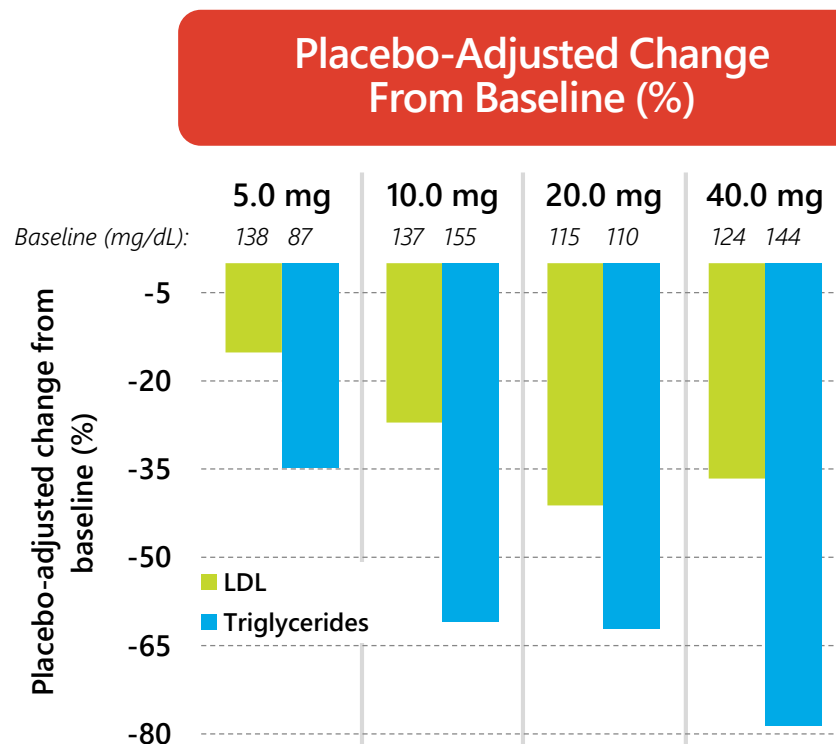


% Difference:	-50.2%	-60.2%	-46.3%
p-value:	<0.01	<0.005	0.01

VK2809 significantly improved NASH and fibrosis in this model

VK2809 Clinical Highlights: 14-Day Phase 1b Study

- ▶ Placebo-controlled trial (n=56), mild hypercholesterolemia
 - Enrollment criterion: LDL \geq 100 mg/dL
- ▶ Results: clinically, statistically significant reductions in LDL
- ▶ Up to 79% reduction in triglycerides
 - Major component of liver fat
- ▶ Encouraging safety and tolerability, no SAEs



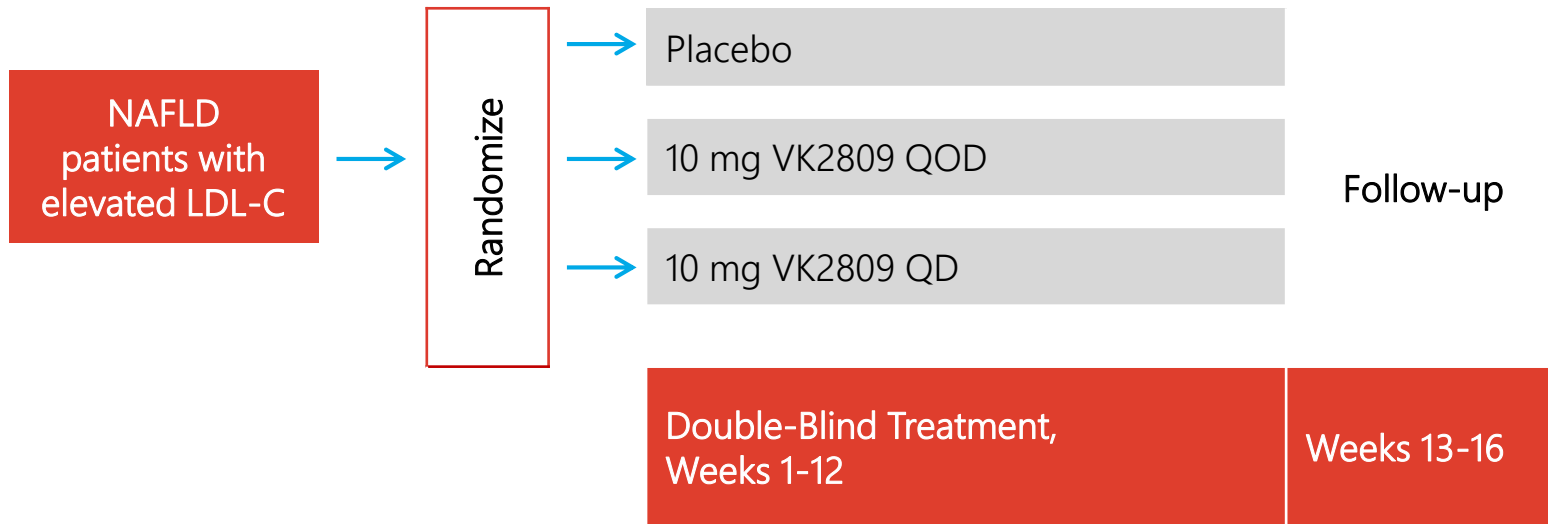
Placebo-adjusted reduction, LDL:

-15.2%	-27.1%	-41.2%	-36.6%
p=0.026	p=0.0003	p<0.0001	p<0.0001

Placebo-adjusted reduction, triglycerides:

-34.8%	-61.0%	-62.1%	-78.6%
p=0.052	p=0.0019	p=0.0007	p=0.0001

VK2809: Phase 2 Trial in Fatty Liver, Hypercholesterolemia



Phase 2 trial, patients with fatty liver disease, hypercholesterolemia

- ▶ Multi-arm, dose ranging, ~20 patients per arm
- ▶ Primary endpoint: Δ LDL-C
- ▶ Exploratory: Changes in liver fat (MRI), inflammatory markers, other
- ▶ Topline data expected 2H18



Musculoskeletal Program

VK5211: Selective Androgen Receptor Modulator

Hip Fracture

Musculoskeletal Program: VK5211 for Hip Fracture

- ▶ **Novel Selective Androgen Receptor Modulator (SARM), for hip fracture**
 - VK5211 is a potentially best-in-class small molecule SARM
- ▶ **Promising efficacy signals to date**
 - Significant improvements in lean body mass in animals and humans
- ▶ **Target indication: Rehabilitation post-hip fracture**
 - Population rapidly loses muscle, bone, function
 - >300,000 patients per year, U.S.; expect continued growth
 - Market opportunity potentially exceeds \$1B annually
 - No approved therapies, no known SARMs in development
- ▶ **Potential benefits in other fractures, joint replacements, and muscle wasting disorders**



VK5211: Potential Therapeutic Benefits of SARMs



- ↑ Muscle Mass
- ↑ Muscle Strength



- ↑ Bone Formation
- ↑ Bone Strength
- ↓ Bone Resorption

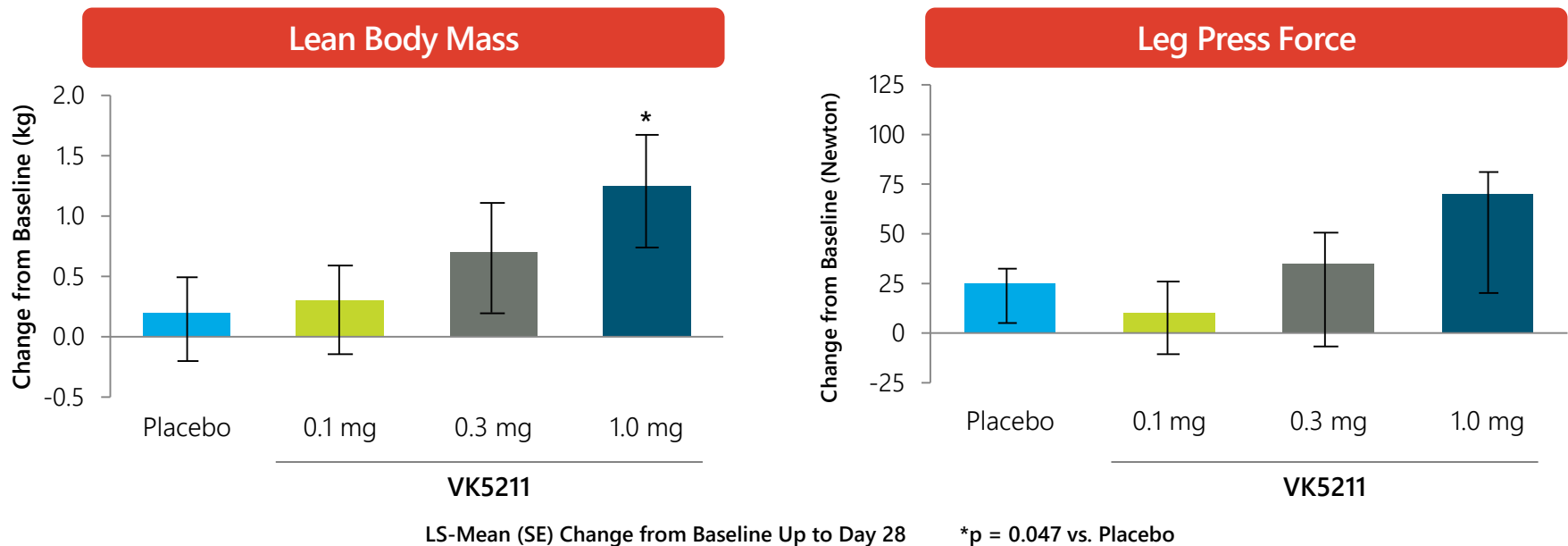


- ↑ Cognition
- ↑ Libido
- ↑ Energy

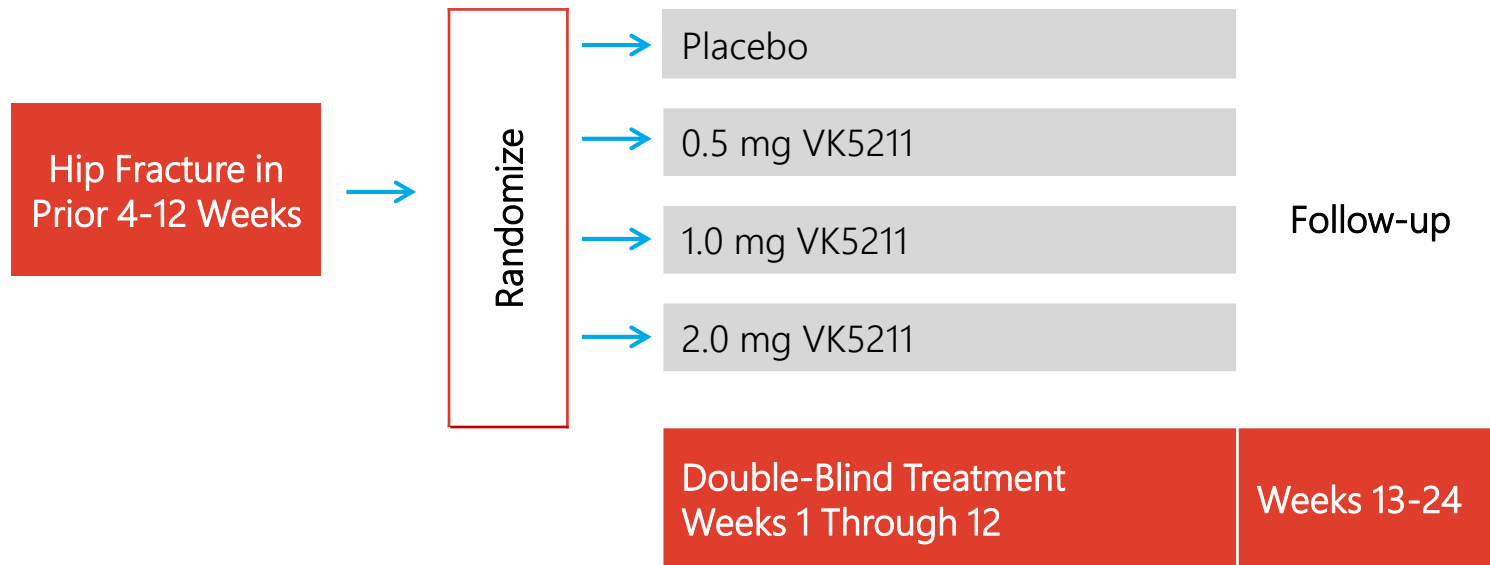
Goal: Retain beneficial properties of natural androgens with fewer side effects relative to anabolic steroids

VK5211: Preclinical and Early Clinical Highlights

- ▶ 0.9 nM Ki, AR; Positive effects on muscle and bone in animal models
- ▶ Three Phase 1 studies successfully completed¹⁻³
 - Multiple ascending dose study: Healthy men (n=76) dosed once-daily for 21 days²
 - Statistically significant improvement in LBM after 21 days
 - Encouraging safety and tolerability, no drug-related SAEs



VK5211: Phase 2 Trial, Hip Fracture

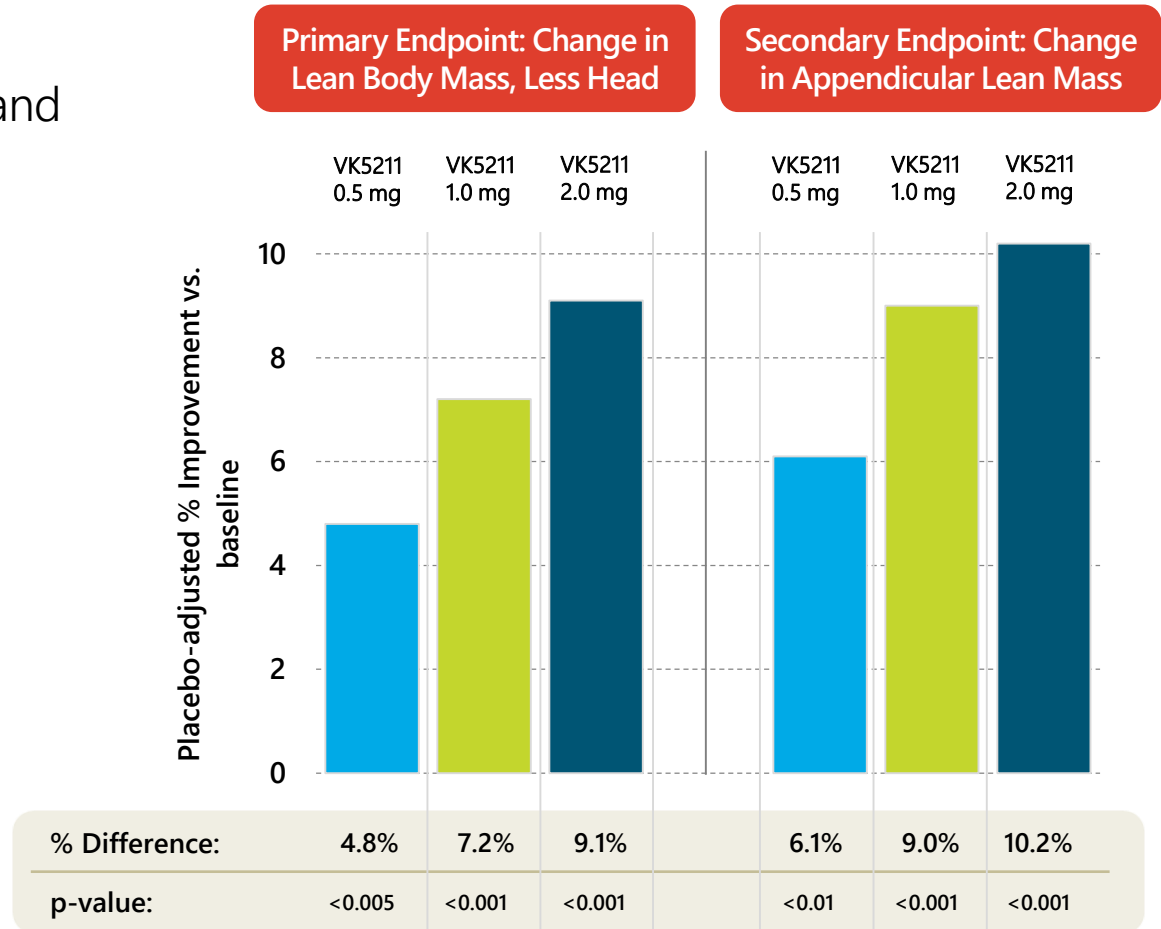


► 12-week Phase 2 trial in 108 patients

- Once-daily oral dosing
- Primary endpoint: Change in lean body mass
- Secondary and exploratory endpoints: Change in appendicular lean mass, total lean body mass, BMD, functional status, ADL, QOL

Phase 2 Results Show Significant Increases in Lean Body Mass

- ▶ Significant increases in LBM and appendicular lean mass following 12 weeks of daily dosing
- ▶ Consistent dose response observed across primary, secondary efficacy measures
- ▶ Encouraging safety and tolerability, no drug-related SAEs

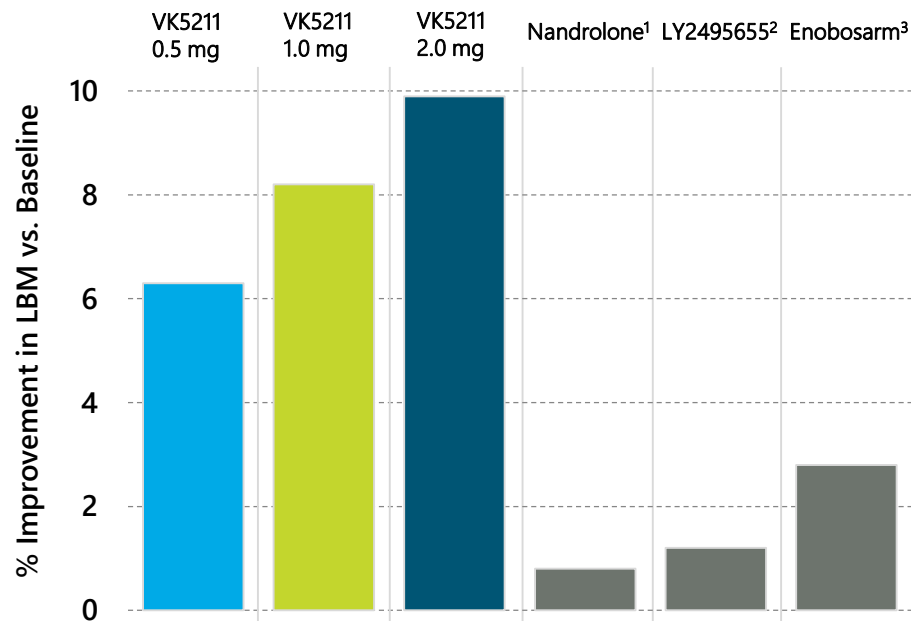


VK5211 produced robust dose-dependent effects on primary and all secondary measures of lean body mass

VK5211 Demonstrates Potency Advantages to Other Mechanisms

- ▶ Significantly greater potency relative to testosterone analogs
- ▶ Improved potency on muscle compared with myostatin-targeting approaches
- ▶ Competitive effect on total lean body mass relative to other clinical-stage SARMs

Reported Changes in Total Lean Body Mass in Older Adults



% Difference:	6.3%	8.2%	9.9%	0.8%	1.2%	2.8%
p-value:	<0.005	<0.001	<0.001	<0.05	0.02	<0.001

VK5211 in older adults provides increases in lean body mass that compare favorably to other developmental mechanisms

VK5211 Phase 2 Study: Overall Safety and Adverse Events

	Placebo (n=28)	0.5 mg (n=29)	1.0 mg (n=26)	2.0 mg (n=25)
Number reported adverse events	31	21	16	38
Number (%) of subjects with at least one reported:				
Serious TEAE	4 (14.3)	2 (6.9)	3 (11.5)	5 (20.0)
Drug-related TEAE	3 (10.7)	3 (10.3)	2 (7.7)	6 (24.0)
Drug-related serious TEAE	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
TEAEs leading to discontinuation	3 (10.7)	1 (3.4)	1 (3.8)	3 (12.0)

- ▶ Encouraging safety and tolerability
- ▶ Frequency of reported adverse events demonstrates no dose-relationship
- ▶ No drug-related treatment-emergent serious adverse events

VK5211: Next Steps and Future Plans

- ▶ Will seek FDA feedback regarding data, registration path
- ▶ Explore partnering and licensing opportunities
- ▶ Plan for next steps in orthopedic settings with partner



Rare Disease Programs

VK2809, VK0214

Glycogen Storage Disease
X-Linked Adrenoleukodystrophy

Rare Disease Program: VK2809 for GSD Ia

- ▶ Glycogen Storage Disease, Type Ia (GSD Ia)
 - Orphan metabolic disorder; von Gierke's disease
- ▶ Characterized by inability to convert glycogen to glucose
 - Patients experience hypertriglyceridemia, with hepatic adenomas in up to 75%
 - May progress to transplant or HCC
- ▶ Natural history studies: Lipid/metabolic control reduces adenoma risk
- ▶ High unmet medical need
 - ~2,000 U.S. patients
 - No approved therapy; slow release cornstarch is standard of care

TR β Agonists Uniquely Suited for GSD Ia

TR β modulates triglyceride, cholesterol metabolism

- ▶ VK2809 designed to selectively activate hepatic TR β

VK2809: Stimulates genes important for lipid control

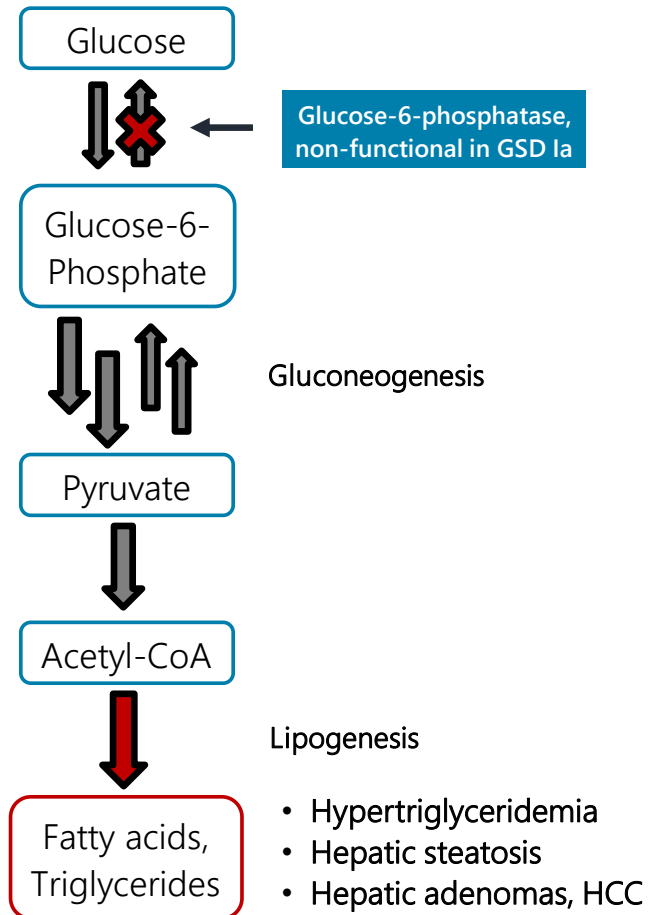
May provide efficient path for lipid metabolism and reduce steatosis, triglyceride burden

Potentially benefits overall lipid profile, reduce risk of adenomas, potential transformation to HCC

- Lowers triglycerides
- Reduces steatosis
- Improves lipid profile

Mitochondrial metabolism

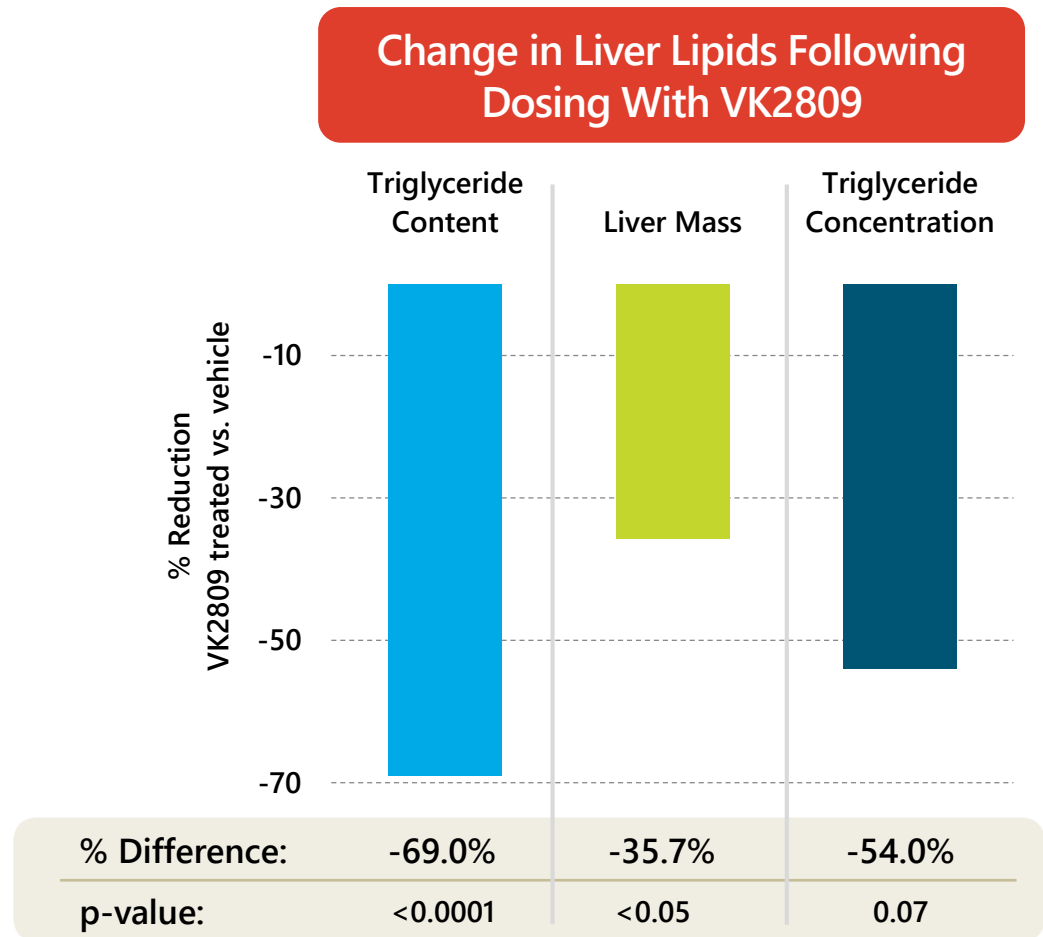
VK2809
TR β Activation



- Hypertriglyceridemia
- Hepatic steatosis
- Hepatic adenomas, HCC

VK2809 Significantly Reduces Liver Fat in GSD Ia Model

- ▶ Glucose-6-phosphatase KO mouse
 - Mimics human enzyme loss; hypertriglyceridemia, steatosis
- ▶ VK2809 leads to rapid improvement in hepatic fat content
- ▶ Next steps: POC study to begin 2H18



Suggests potential to improve liver lipids and metabolic control in patients with GSD Ia and potentially other GSDs

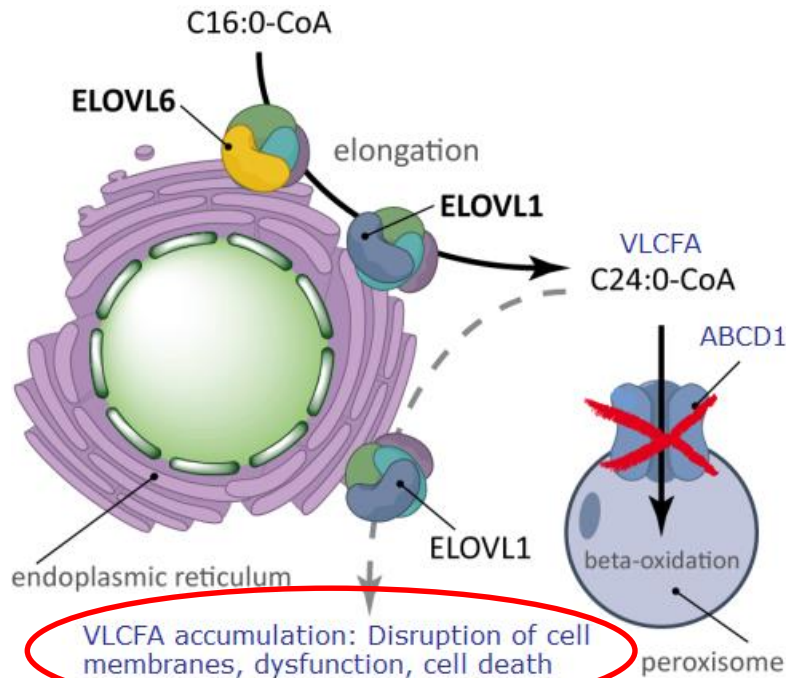
Rare Disease Program: VK0214 for X-ALD

- ▶ X-Linked adrenoleukodystrophy (X-ALD)
 - Orphan neurodegenerative disorder
 - X-linked: Carried by females, primarily manifesting in males
 - No cure, no approved therapy
- ▶ Most severe form: Cerebral ALD
 - Rapidly progressive inflammatory demyelination; disruption of BBB
 - Affects ~35% before age 12 (CCALD), ~20% between age 20 – 35 (CALD)
 - Deterioration in speech, cognition; vegetative state within 3-5 years
- ▶ Most common form: Adrenomyeloneuropathy (AMN)
 - Affects spinal cord, motor neurons; no inflammatory component or brain involvement
 - Affects nearly all adult patients; considered “default” manifestation of ALD
 - Progressive motor impairment; wheelchair confinement, leg paralysis common

TR β : X-Linked Adrenoleukodystrophy

Caused by mutation in gene for the ATP-Binding Cassette transporter D1 (ABCD1)

- ▶ Peroxisomal transporter of very long chain fatty acids (VLCFA)



ABCD1: Normal function to transport VLCFA into peroxisome for degradation

X-ALD: Defective ABCD1 leads to accumulation of VLCFA in tissues

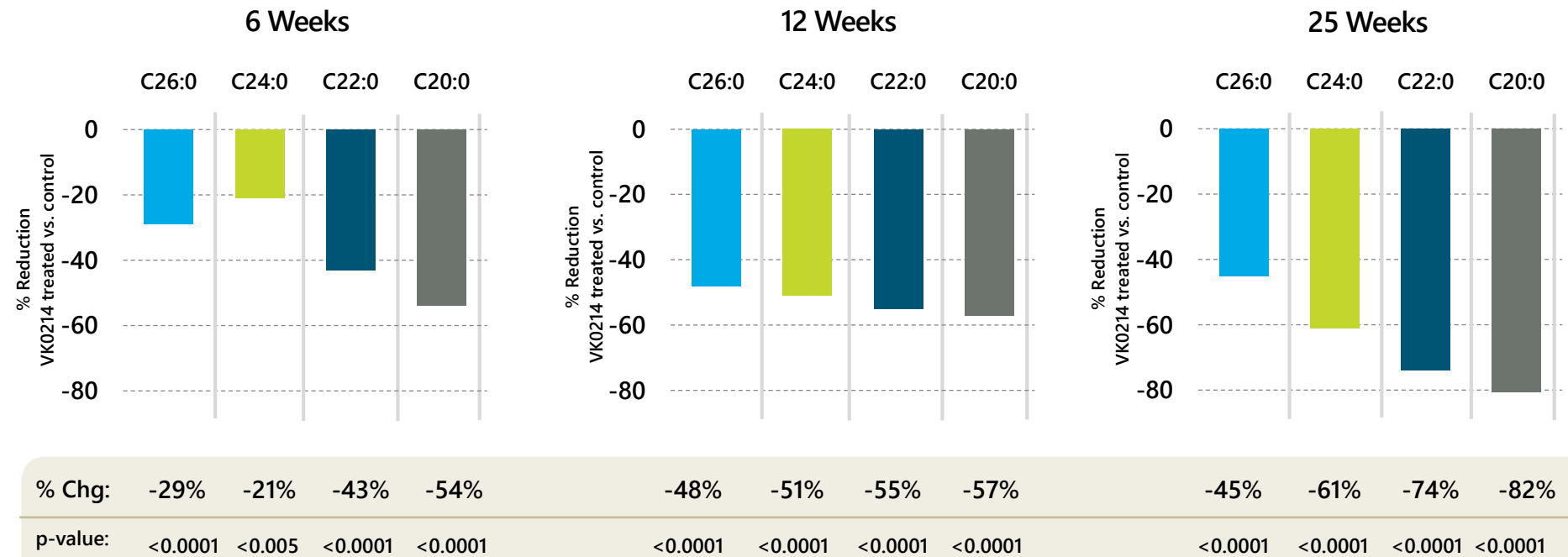
High VLCFA levels disrupt cell membranes; inflammatory demyelination in brain tissue; motor neuron deterioration

TR β Agonists: Stimulate expression of compensatory transporters ABCD2, 3; may mitigate VLCFA elevation

VK0214: *In Vivo* Proof-of-Concept Data, ABCD1 KO Mouse

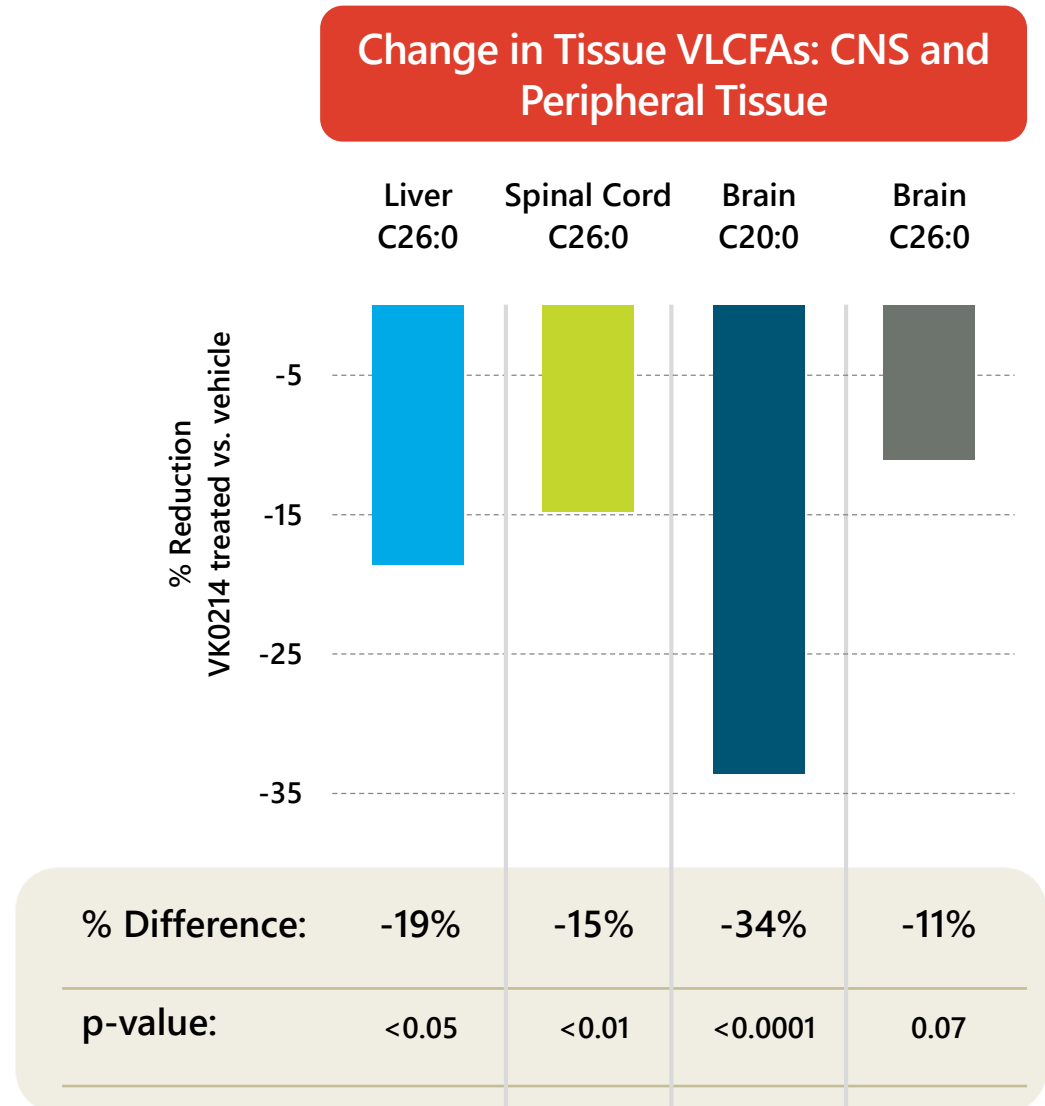
- ▶ ABCD1 Knockout model: Mimics biochemical features of human X-ALD
- ▶ VK0214: Durable and progressive reductions in plasma VLCFAs
 - Tissue effects suggest encouraging CNS activity following long-term exposure

Reductions in Plasma VLCFA-LPC, ABCD1 Knockout Model



VK0214: Reduces VLCFA Levels in Key Tissues

- ▶ Significant VLCFA reductions observed in multiple tissues
- ▶ Encouraging evidence of CNS activity
- ▶ Reductions in multiple VLCFAs consistent with plasma observations
- ▶ Suggests potential benefit in both cerebral and AMN forms of X-ALD
- ▶ Next steps: IND-filing, PoC study planned 2019



Financial Summary

► Capital structure and summary financials

Capital Structure ¹	In '000s
Shares outstanding	60,653
Options, RSUs	2,048
Warrants	7,855
Total shares, options, RSUs, warrants	70,556

Financials ¹	June 30, 2018 (\$'000s)
Cash, cash equivalents and short-term investments	\$142,166
Debt	-
Notes: 1) As of June 30, 2018.	

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 - VK2809 in GSD Ia: PoC study expected to begin 2H18
 - VK0214 in X-ALD: Potential IND, PoC study to begin 1H19

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NOVEL THERAPEUTICS
FOR **METABOLIC &**
ENDOCRINE DISORDERS

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