NASDAQ: LIFE

Translating New Immune Pathways into Meaningful Medicines

The Cowen & Co. 39th Annual Health Care Conference 2019

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March 11, 2019

aTyr Pharma

Forward-Looking Statements

The following slides and any accompanying oral presentation contain forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995 and other federal securities laws. The use of words such as “may,” “might,” “will,” “should,” “expect,” “plan,” “anticipate,” “believe,” “estimate,” “project,” “intend,” “future,” “potential,” “opportunity,” or “continue,” and other similar expressions are intended to identify forward-looking statements. For example, all statements we make regarding the potential therapeutic benefits of proteins derived from tRNA synthetase genes and our product candidates, including ATYR1923 and any other product candidates, the ability to successfully advance our product candidates, the timing within which we expect to initiate, receive and report data from, and complete our planned clinical trials, our ability to receive regulatory approvals for, and commercialize, our product candidates, our ability to identify and discover additional product candidates, and the ability of our intellectual property portfolio to provide protection are forward-looking statements. All forward-looking statements are based on estimates and assumptions by our management that, although we believe to be reasonable, are inherently uncertain. All forward-looking statements are subject to risks and uncertainties that may cause actual results to differ materially from those that we expected. These risks, uncertainties and other factors are more fully described in our filings with the U.S. Securities and Exchange Commission, including our Annual Report on Form 10-K, our Quarterly Reports on Form 10-Q, and in our other filings. The forward-looking statements in this presentation speak only as of the date of this presentation and neither we nor any other person assume responsibility for the accuracy and completeness of any forward-looking statement. We undertake no obligation to publicly update or revise any forward-looking statement, whether as a result of new information, future events or otherwise, except as required by law.

Accelerating Value Creation from Novel Biology

Platform of New Biology:

Discovery pipeline of novel therapeutic candidates based on proprietary knowledge of extracellular functions of tRNA synthetases (~300 protein compositions patented)

Lead Product Candidate: ATYR1923

Engineered, long acting, protein therapeutic, derived from the HARS gene, for the treatment of pulmonary sarcoidosis and other interstitial lung diseases

$2-3b[1] global opportunity

Financials:

Cash, cash equivalents and investments at
$56.0m as of 9/30/2018

Clinical Milestones:

- ✓ Initiated P1b/2a Trial – 4Q 2018
- ❑ Interim Results – 4Q 2019
- ❑ Final Results – mid-2020[2]

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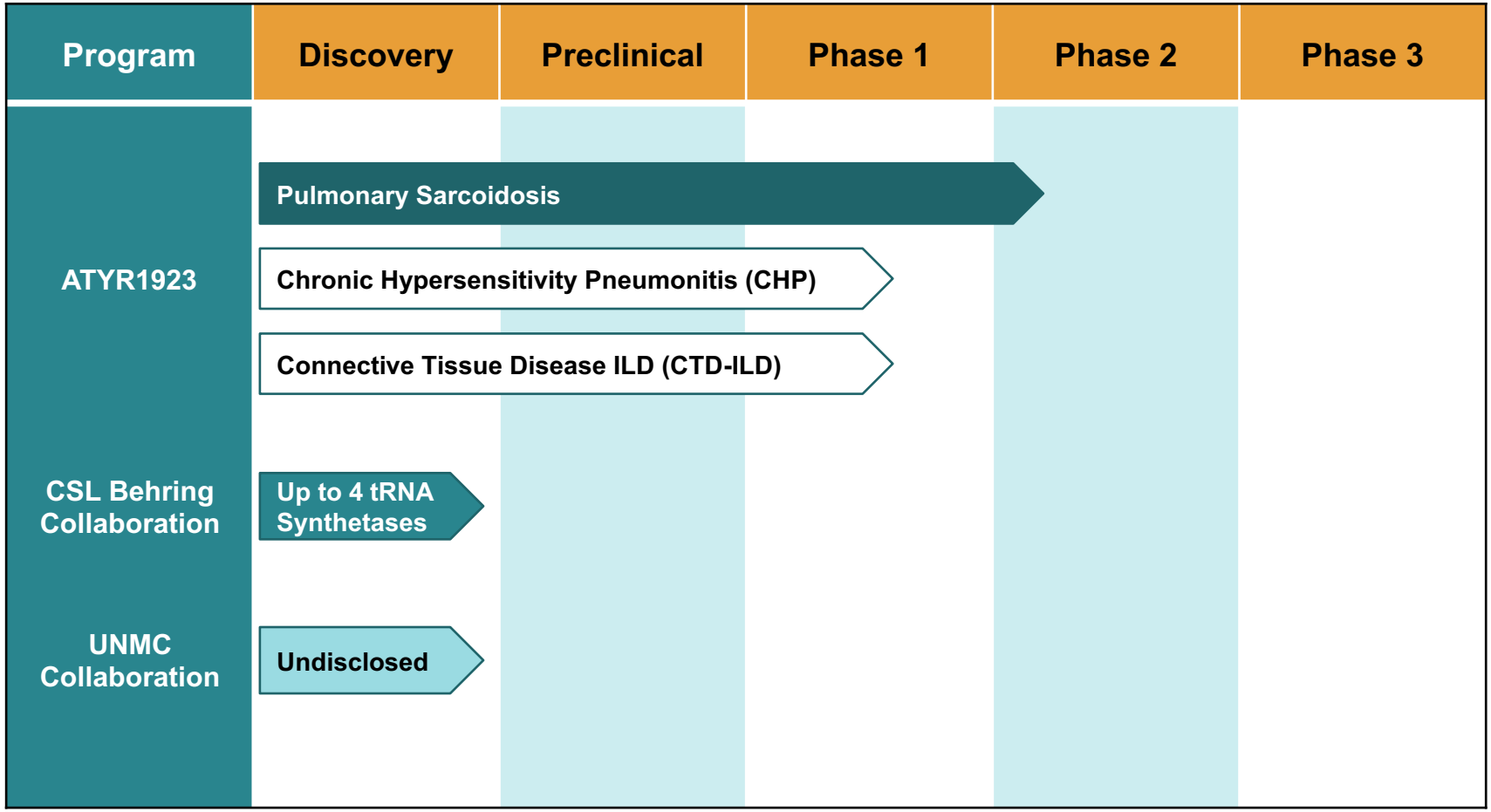
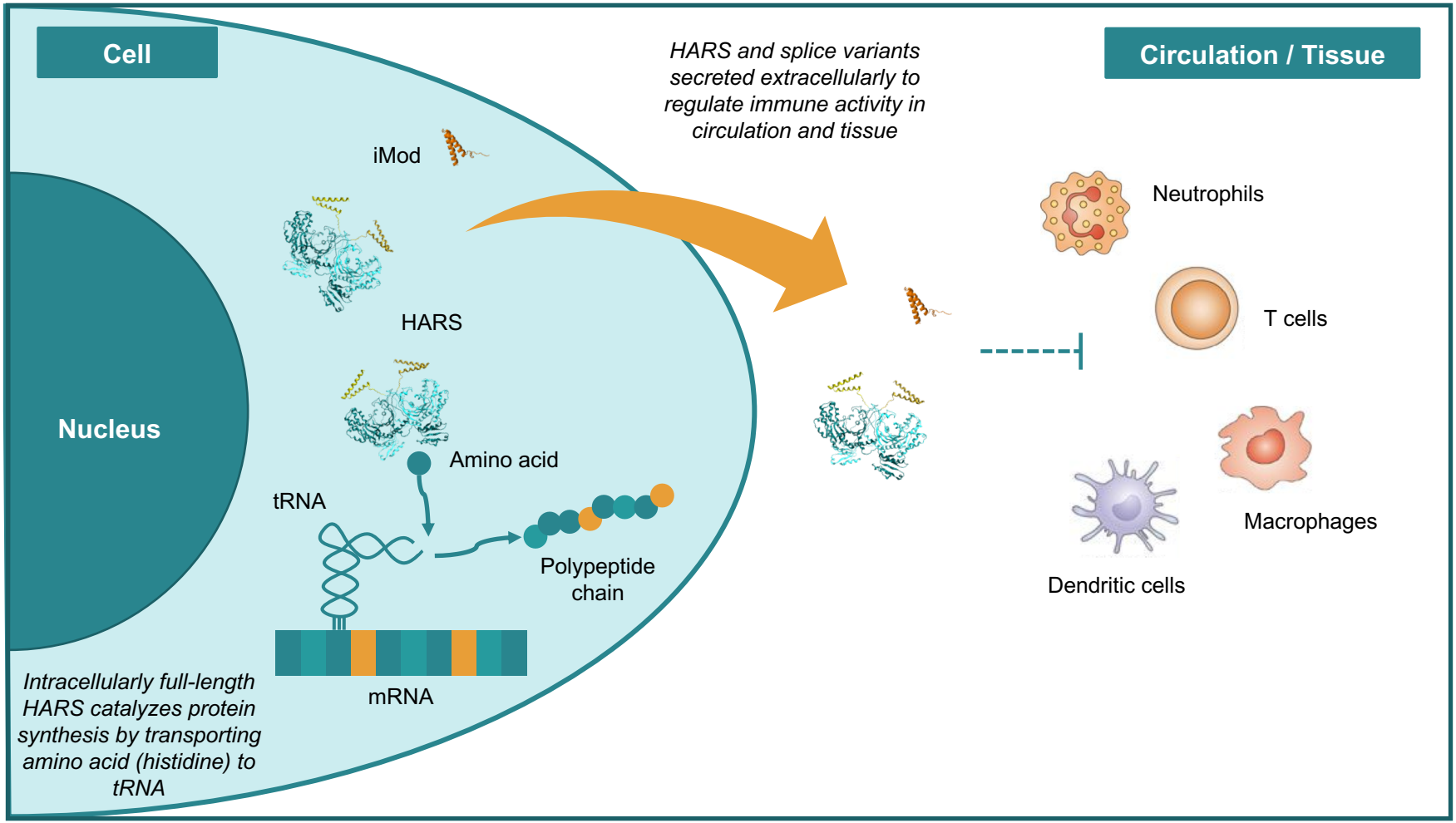
(1) aTyr estimates for inflammatory ILD: Pulmonary Sarcoidosis, CHP, CTD-ILD; excludes IPF
(2) Dependent on patient enrollment

Development Pipeline



Novel tRNA Synthetase Domains Secreted Extracellularly with Non-Catalytic Functions



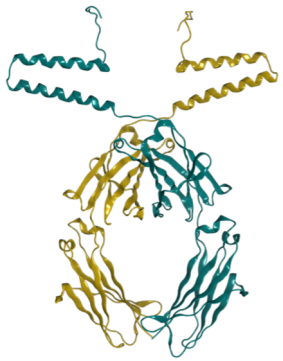
Extracellular tRNA Synthetase Biology Associated with Disease in Multiple Tissues

tRNA Synthetase Gene Families

AARS	**HARS**	RARS
CARS	IARS	SARS
DARS	KARS	TARS
EPRS	LARS	VARS
FARS	MARS	WARS
FARSB	NARS	YARS
GARS	QARS	

aTyr patents cover >300 protein compositions

aTyr's current R&D focus



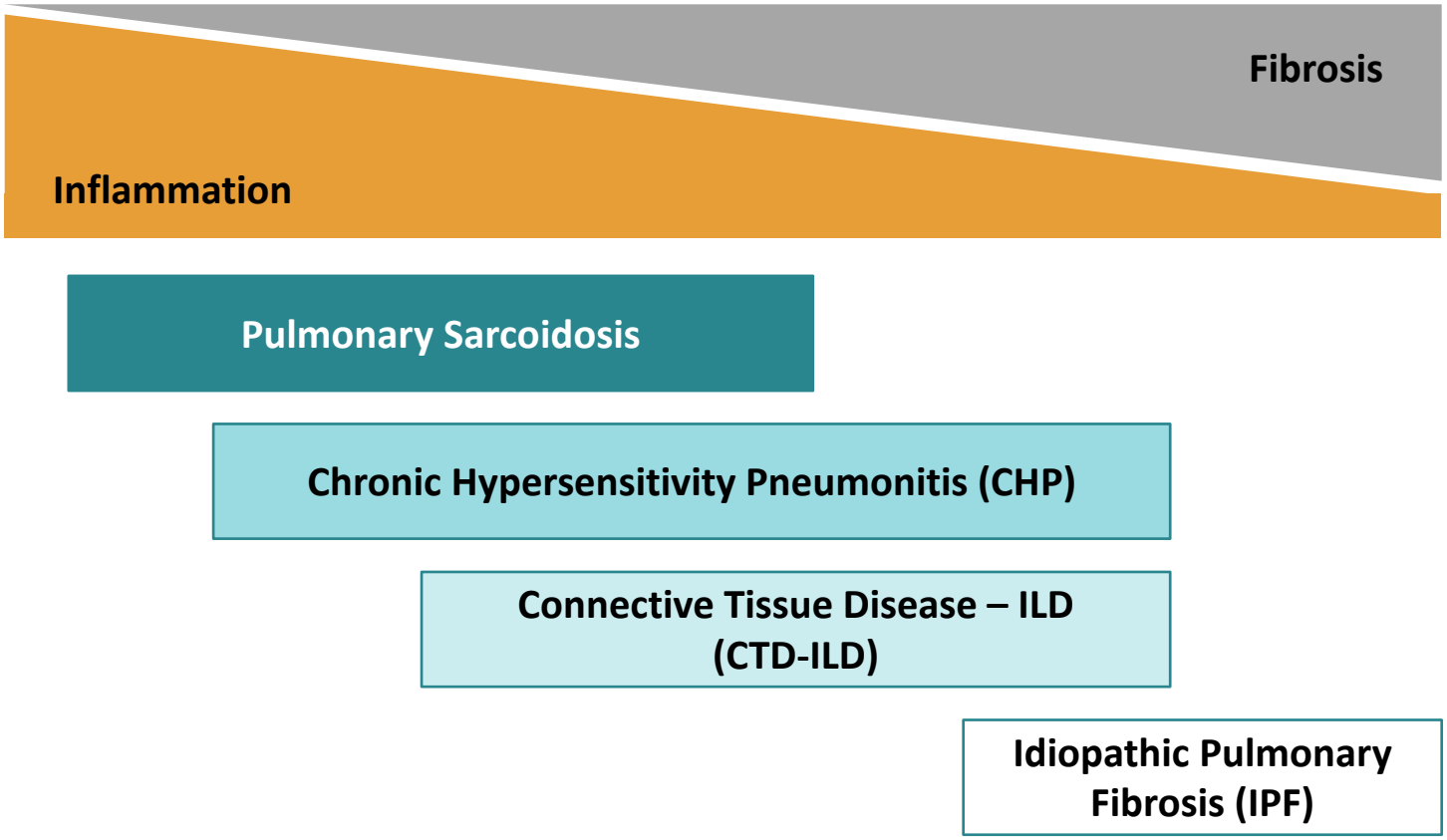
Drug: ATYR1923
Function: Immuno-modulatory
Disease: Interstitial Lung Disease

Pipeline opportunities

Known disease connections:
- Cancer
- Autoimmune disease
- Liver disorders
- Inflammatory disorders
- Neurological disorders
- Mitochondrial disorders

CSL Behring Collaboration:
- Potential new drug candidates from up to 4 tRNA synthetase families

Interstitial Lung Diseases Share Persistent Immune Engagement



Slide adapted from Dr. Steven Nathan, Medical Director, Advanced Lung Disease and Transplant Program at Inova Fairfax Hospital, Falls Church, VA

High Unmet Need in Interstitial Lung Disease

Pulmonary Sarcoidosis

- Systemic inflammatory disorder characterized by non-caseating granulomas (CD4+ T cell driven)
- US prevalence: ~200k
- ~30% of patients have chronic progressive disease, unresponsive to steroid treatment
- Current SOC: steroids - cytotoxic agents - TNF inhibitors (as disease progresses)

Chronic Hypersensitivity Pneumonitis (CHP)

- Exaggerated immune response to environmental antigen
- US prevalence: ~60k
- 5-year mortality: ~20%
- No effective therapeutic options

Connective Tissue Disease-ILD (CTD-ILD)

- Common manifestation in CTD: Clinically relevant ILD in 10% of Rheumatoid Arthritis and >50% of Scleroderma patients
- US prevalence: ~150k
- 5-year mortality: ~20%
- Current SOC: Mycophenolate mofetil or cyclophosphamide for Ssc-ILD; no SOC for RA-ILD

Idiopathic Pulmonary Fibrosis (IPF)

- Irreversible, progressive fibrotic disease of unknown cause
- US prevalence: ~135k
- 5-year mortality: 60-80%
- Current SOC: Nintedanib or pirfenidone (>$2b combined 2017 sales)

Pre-Clinical Translational Estate Supports Clinical Development in ILD

Bleomycin-Induced Lung Injury (Mouse)	• ATYR1923 vs. pirfenidone(1) • ATYR1923 reduced fibrosis and inflammation • Presented at ATS, May 2017
Bleomycin-Induced Lung Injury (Rat)	• ATYR1923 vs. nintedanib(2) • ATYR1923 returned lung function to normal and reduced fibrosis and inflammation • Presented at ATS, May 2018
Sclerodermatous chronic-graft vs host disease (Mouse)	• ATYR1923 vs. nintedanib(2) • ATYR1923 reduced lung and skin fibrosis • Presented at Scleroderma Foundation Patient Conference, July 2018

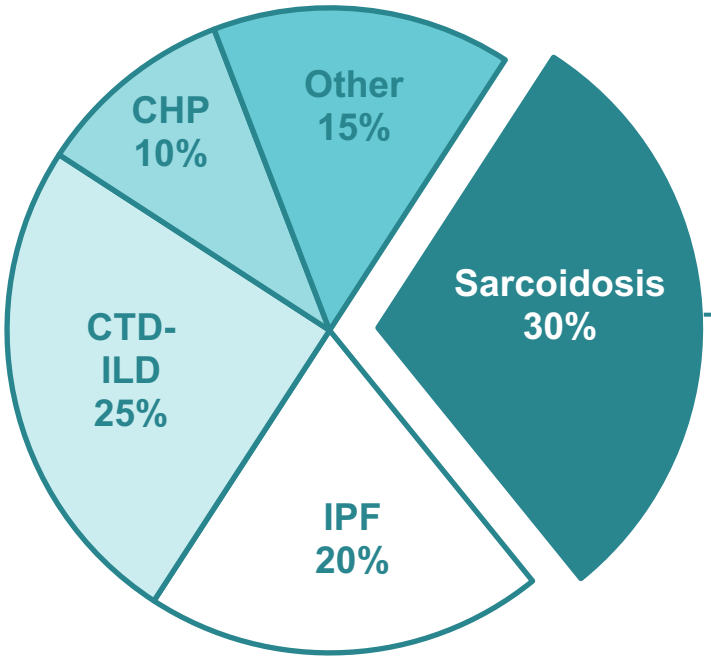
(1) 2017 annual sales of Esbriet® (pirfenidone) ~869M CHF, 13% increase YoY
(2) 2017 annual sales of Ofev® (nintedanib) ~920M Euros, 52.3% increase YoY

ATYR1923

For the Treatment of Pulmonary Sarcoidosis

Sarcoidosis: The Most Common Form of Interstitial Lung Disease

Interstitial Lung Diseases



$2-3b[(1)] Global Opportunity

50% require systemic therapy

30% with chronic progressive disease despite currently available treatment

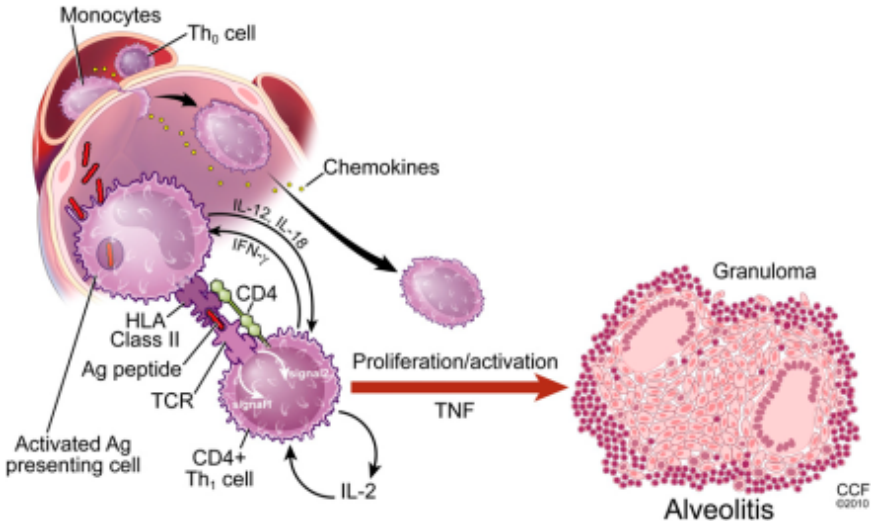
(1) aTyr estimates for inflammatory ILD: Pulmonary Sarcoidosis, CHP, CTD-ILD; excludes IPF

First-in-Patient Population: Pulmonary Sarcoidosis

- Systemic inflammatory disorder characterized by the formation of granulomas (clumps of inflammatory cells) in one or more organs of the body
- CD4+ (Th1 / Th17) T-cell driven
- Usually begins in the lungs, skin or lymph nodes
- Sarcoidosis in the lungs is called pulmonary sarcoidosis and occurs in ~90% of patients

Unmet needs[1]:

- Better understanding of pathogenesis
- Prognostic stratification and targeted management
- Better therapies, with quicker onset of action and less toxicity

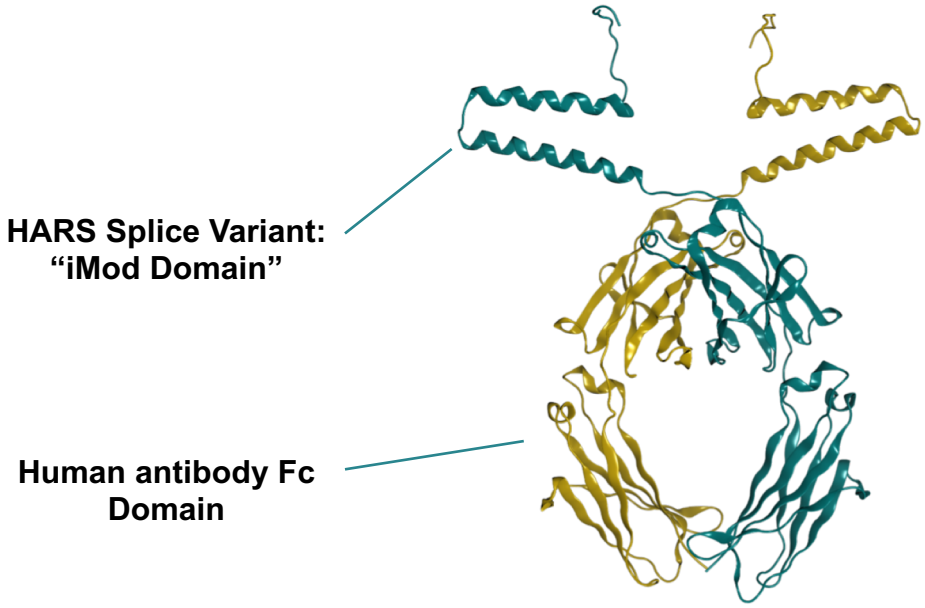


Baughman RP, Culver DA, Judson MA. AM J Respir Crit Care Med 2011

(1) Dr. Dan Culver, Cleveland Clinic

ATYR1923: Novel Engineered Protein Therapeutic

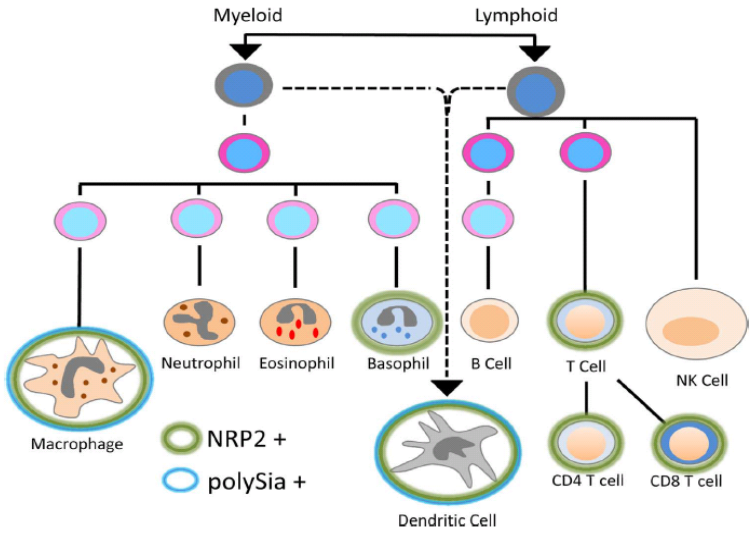
- Active domain (iMod) is naturally occurring splice-variant of HARS that is enriched in the human lung
- Binds selectively to Neuropilin-2 (NRP2)
- Regulates a number of immune cell-types, including: T cells, Neutrophils, Macrophages, Dendritic cells



Receptor: Importance of NRP-2 as a Binding Partner for ATYR1923

- Pleiotropic receptor that can bind to a number of different ligands
- Well-established role in the development of the neural and lymphatic systems
- Emerging role in the immune system; present on a number of immune cell types
- Expressed on alveolar macrophages; may play role in regulating lung inflammation (1)

Immune cells where NRP-2 is expressed (2)



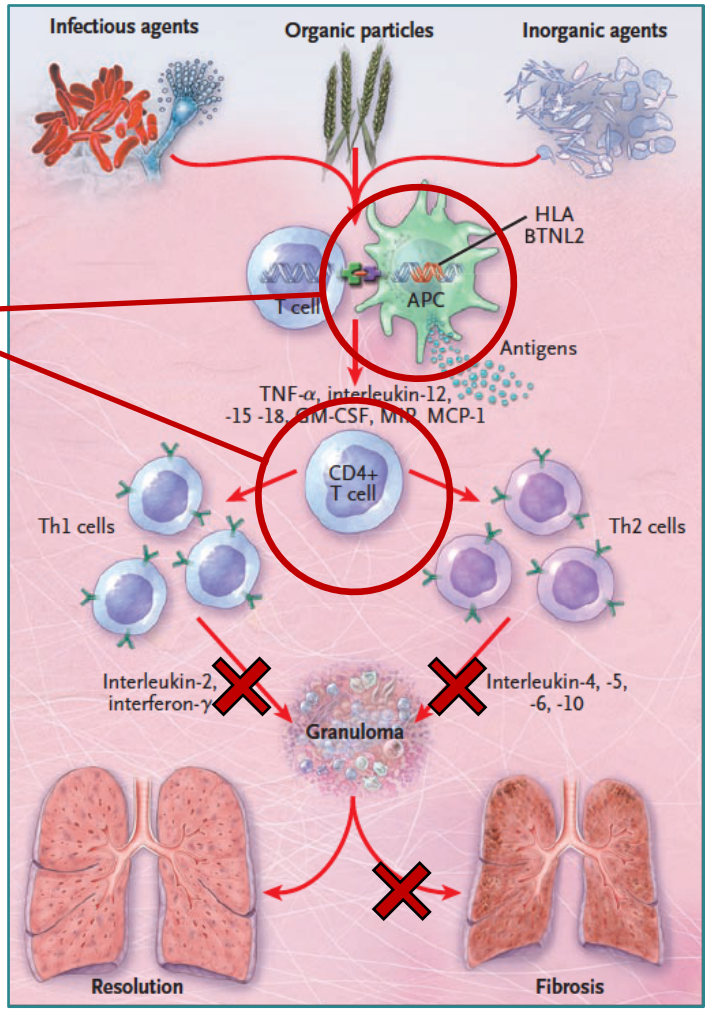
(1) Immormino et al. *Neuropilin-2 regulates airway inflammatory responses to inhaled lipopolysaccharide.* Am J Physiol Lung Cell Mol Physiol 315: L202-L211. 2018.

(2) Schellenberg et al. *Role of Neuropilin-2 in the immune system.* Mol. Immunol. 90, 239-244, 2017.

ATYR1923 Intervention in Pulmonary Sarcoidosis

ATYR1923 Therapeutic Hypothesis[1]:

Downregulates inflammatory insult and prevents progression to fibrosis

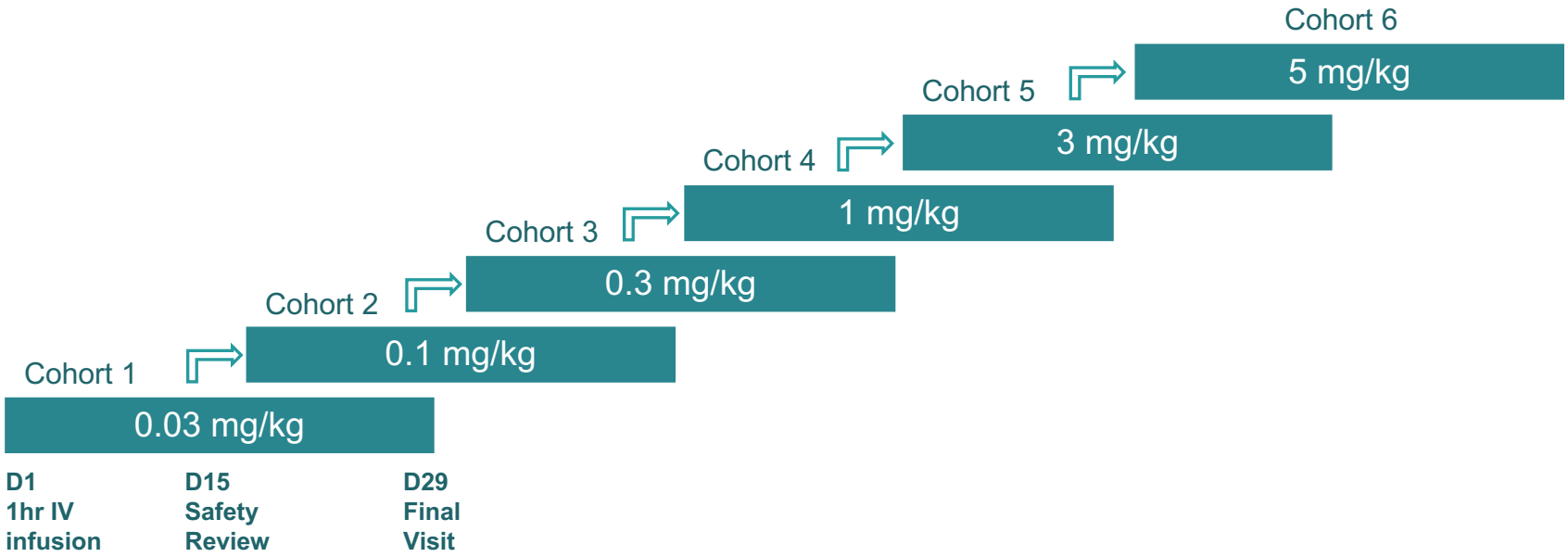


(1) Hypothesized Immunopathogenesis of Sarcoidosis adapted from Iannuzzi et al, NEJM, 2007.

PK Profile Supports Potential Once-Monthly Dosing

Phase 1 Healthy Volunteer Study Completed

- Positive data announced in June 2018
- Randomized, double-blind, placebo-controlled, single ascending dose (N=36 HVs)
- ATYR1923 was generally well-tolerated with no significant adverse events



ATYR1923 Phase 1b/2a Study in Pulmonary Sarcoidosis

Objectives	• Evaluate safety, tolerability, PK, and immunogenicity of multiple ascending doses of ATYR1923 • Evaluate signals of drug activity through steroid dose reduction and FDG-PET/CT changes
Design	• Randomized, double-blind, placebo-controlled, multiple ascending dose
Population	• Histologically confirmed pulmonary sarcoidosis • Requiring ≥10 mg prednisone (steroid) treatment; capable of steroid taper • Symptomatic/active disease at baseline by ^{18F}-FDG-PET/CT, Pulmonary Function Tests
Dosing	• 3 sequential cohorts, 12 patients each • 2:1 randomization • ATYR1923 doses: 1.0, 3.0, and 5.0 mg/kg
Duration	• 24-week study period • Steroid taper phase down to 5 mg by week 8 • 16-week maintenance phase
Sites	• Up to 15 leading pulmonary sarcoidosis centers in US • Collaboration with the Foundation for Sarcoidosis Research

ATYR1923 Phase 1b/2a Study Endpoints

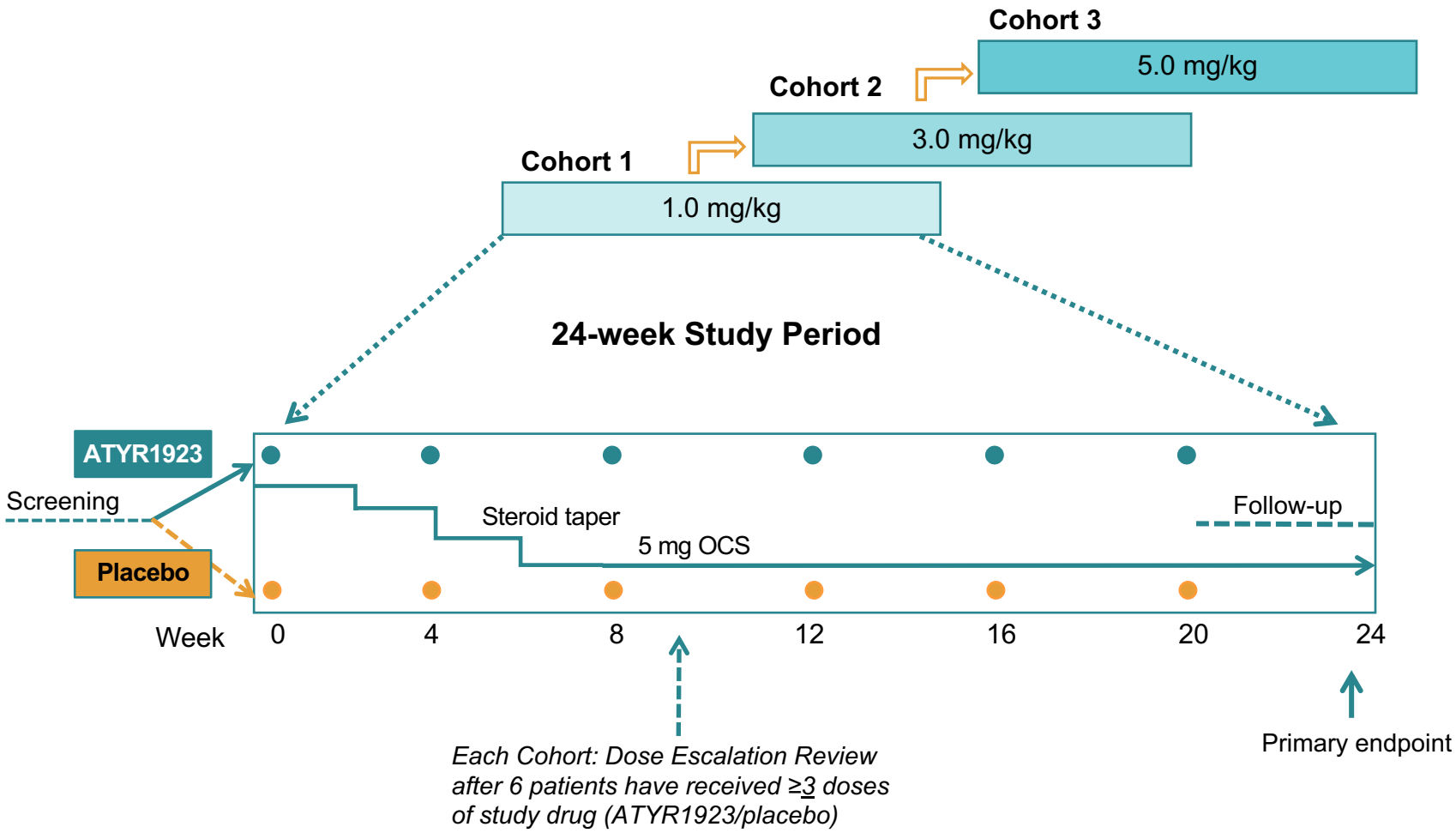
Primary

- Safety and tolerability of multiple ascending IV ATYR1923 doses

Secondary

- Steroid-sparing effect
- Immunogenicity
- Pharmacokinetics (PK)
- Exploratory efficacy measures: FDG-PET/CT imaging; Lung function (FVC); Serum biomarkers; Health-related quality of life scales

ATYR1923 Phase 1b/2a Study Schema



ATYR1923 Phase 1b/2a Study in Pulmonary Sarcoidosis Initiated

Status	• Up to 15 leading Pulmonary Sarcoidosis centers in US • Site initiation activities ongoing • Recruiting activities initiated
Timelines	• Interim data: 4Q 2019 • Study completion: mid-2020(1)
Possible Future Development	• Registrational trial in Pulmonary Sarcoidosis • Initiate P2 studies in other types of interstitial lung disease (e.g. CTD-ILD; CHP)

(1) Dependent on patient enrollment

CSL Behring Collaboration

Goal	Identify new IND candidates from up to four tRNA synthetases from aTyr's proprietary pipeline of novel proteins (non-HARS derived)
Terms	• CSL Behring to fund all R&D costs • aTyr eligible for up to $17m in option fees if CSL Behring advances all four programs ($4.25m per synthetase program) • aTyr grants CSL Behring an option to negotiate licenses for worldwide rights to each IND candidate that emerges from the collaboration
About CSL	• CSL Behring is a global biotherapeutics leader specializing in immunology, hematology and other rare and serious medical conditions • CSL Behring employs >22,000 people globally, and delivers its therapies to more than 60 countries

Mission: Generate Value for Patients and Shareholders

- ✓ aTyr owns IP estate directed to a potential pipeline of proteins derived from 20 tRNA synthetase genes
- ✓ ATYR1923 *in-vitro* and *in-vivo* studies support clinical development in ILD
- ✓ Identification of NRP-2 receptor for ATYR1923 elucidates greater understanding of MOA
- ✓ Positive Phase 1 data for ATYR1923
- ✓ Initiated Phase 1b/2a study of ATYR1923 in patients with pulmonary sarcoidosis
- ❑ Goal is to demonstrate safety and preliminary clinical activity in ATYR1923 pulmonary sarcoidosis trial
- ❑ Potential to expand ATYR1923 into other ILD indications
- ❑ Potential new pipeline opportunities through academic (UNMC) and industry (CSL Behring) collaborations

Thank You