

**UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549**

FORM 8-K

**CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934**

Date of Report (Date of earliest event reported): April 3, 2020

AVROBIO, INC.

(Exact name of registrant as specified in its charter)

Delaware
(State or other jurisdiction
of incorporation)

001-38537
(Commission
File Number)

81-0710585
(I.R.S. Employer
Identification No.)

**One Kendall Square
Building 300, Suite 201
Cambridge, MA 02139**
(Address of principal executive offices, including zip code)

(617) 914-8420
(Registrant's telephone number, including area code)

Not Applicable
(Former Name or Former Address, if Changed Since Last Report)

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

- Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)
- Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)
- Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))
- Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading symbol(s)	Name of each exchange on which registered
Common Stock, \$0.0001 par value per share	AVRO	Nasdaq Global Select Market

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Item 7.01 Regulation FD Disclosure.

On April 3, 2020, AVROBIO, Inc. updated its corporate presentation for use in meetings with investors, analysts and others. A copy of the slide presentation is furnished as Exhibit 99.1 to this Current Report on Form 8-K.

The information in this Form 8-K shall not be deemed “filed” for purposes of the Securities Exchange Act of 1934, as amended (the “Exchange Act”), or otherwise subject to the liabilities of that section, nor shall it be deemed incorporated by reference in any filing under the Securities Act of 1933, as amended, or the Exchange Act, except as expressly set forth by specific reference in such a filing.

Item 9.01. Financial Statements and Exhibits.

(d) Exhibits

99.1 [AVROBIO, Inc. slide presentation, dated April 3, 2020.](#)

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned hereunto duly authorized.

AVROBIO, INC.

Date: April 3, 2020

By: /s/ Geoff MacKay
Geoff MacKay
President and Chief Executive Officer

AVROBIO

Company Presentation

April 3, 2020



Disclaimer

This presentation has been prepared by AVROBIO, Inc. ("AVROBIO") for informational purposes only and not for any other purpose. Certain information contained in this presentation and statements made orally during this presentation relate to or are based on studies, publications, surveys and other data obtained from third-party sources and AVROBIO's own internal estimates and research. While AVROBIO believes these third-party sources to be reliable as of the date of this presentation, it has not independently verified, and AVROBIO makes no representation as to the adequacy, fairness, accuracy or completeness of any information obtained from third-party sources. While AVROBIO believes its internal research is reliable, such research has not been verified by any independent source.

This presentation may contain forward-looking statements made pursuant to the safe harbor provisions of the Private Securities Litigation Reform Act of 1995. These statements may be identified by words and phrases such as "aims," "anticipates," "believes," "could," "designed to," "estimates," "expects," "forecasts," "goal," "intends," "may," "plans," "possible," "potential," "seeks," "will," and variations of these words and phrases or similar expressions that are intended to identify forward-looking statements. These forward-looking statements include, without limitation, statements regarding our business strategy, prospective products and goals, the therapeutic potential of our investigational gene therapies, the design, commencement, enrollment and timing of ongoing or planned clinical trials, clinical trial results, product approvals and regulatory pathways, potential regulatory approvals and the timing thereof, the potential impact of the COVID-19 outbreak on our clinical trial programs and business generally, as well as our plans and expectations with respect to the timing and resumption of any development activities that may be temporarily paused as a result of the COVID-19 outbreak, anticipated benefits of our gene therapy platform including potential impact on our commercialization activities, the

expected benefits and results of our implementation of the plato™ platform in our clinical trials and gene therapy programs, the expected safety profile of our investigational gene therapies, timing and likelihood of success, plans and objectives of management for future operations, future results of anticipated products, the market opportunity for and anticipated commercial activities relating to our investigational gene therapies, and statements regarding the Company's financial and cash position and expected cash reserves. Any such statements in this presentation that are not statements of historical fact may be deemed to be forward-looking statements.

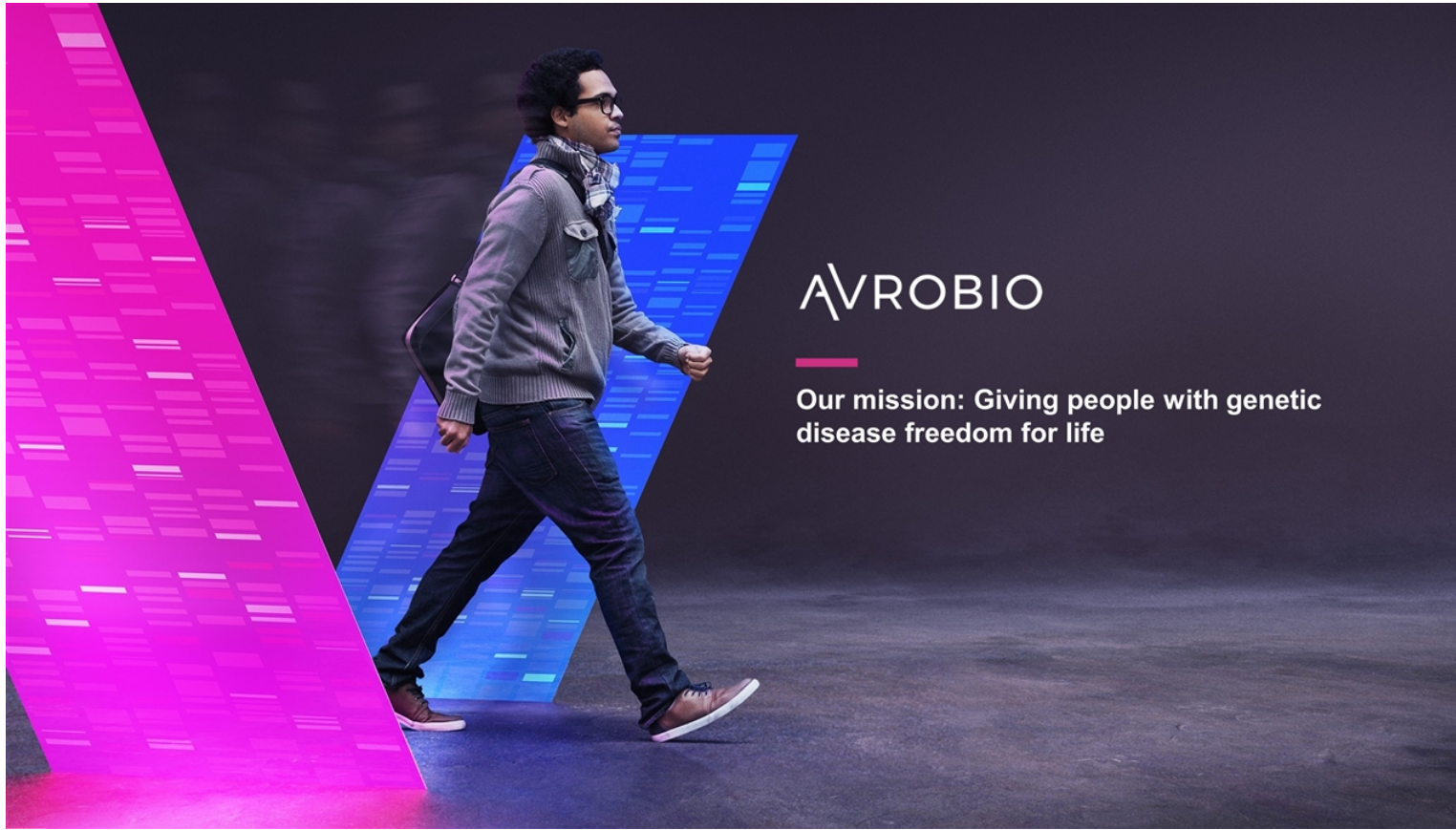
Any forward-looking statements in this presentation are based on AVROBIO's current expectations, estimates and projections about our industry as well as management's current beliefs and expectations of future events only as of today and are subject to a number of risks and uncertainties that could cause actual results to differ materially and adversely from those set forth in or implied by such forward-looking statements. These risks and uncertainties include, but are not limited to, the risk that any one or more of AVROBIO's investigational gene therapies will not be successfully developed or commercialized, the risk of cessation or delay of any ongoing or planned clinical trials of AVROBIO or our collaborators or of encountering challenges in the enrollment or dosing in such clinical trials, the risk that AVROBIO may not realize the intended benefits of our gene therapy platform, including the features of our plato platform, the risk that our investigational gene therapies or procedures in connection with the administration thereof will not have the safety or efficacy profile that we anticipate, the risk that prior results, such as signals of safety, activity or durability of effect, observed from preclinical or clinical trials, will not be replicated or will not continue in ongoing or future studies or trials involving AVROBIO's investigational gene therapies, the risk that we will be unable to obtain and maintain regulatory

approvals for our investigational gene therapies, the risk that the size and growth potential of the market for our investigational gene therapies will not materialize as expected, risks associated with our dependence on third-party suppliers and manufacturers, risks regarding the accuracy of our estimates of expenses and future revenue, risks relating to our capital requirements and needs for additional financing, risks relating to clinical trial and business interruptions resulting from the COVID-19 outbreak or similar public health crises, including that such interruptions may materially delay our development timeline and/or increase our development costs or that data collection efforts may be impaired or otherwise impacted by such crises, and risks relating to our ability to obtain and maintain intellectual property protection for our investigational gene therapies. For a discussion of these and other risks and uncertainties, and other important factors, any of which could cause AVROBIO's actual results to differ from those contained in the forward-looking statements, see the section entitled "Risk Factors" in AVROBIO's most recent Annual Report on Form 10-K, as well as discussions of potential risks, uncertainties and other important factors in AVROBIO's subsequent filings with the Securities and Exchange Commission. AVROBIO explicitly disclaims any obligation to update any forward-looking statements except to the extent required by law.

Note regarding trademarks: plato is a trademark of AVROBIO. Other trademarks referenced in this presentation are the property of their respective owners.

Note regarding future updates: The statements contained in this presentation reflect our current views with respect to future events, which may change significantly as the global consequences of the COVID-19 pandemic rapidly develop. Accordingly, we do not undertake and specifically disclaim any obligation to update any forward-looking statements.





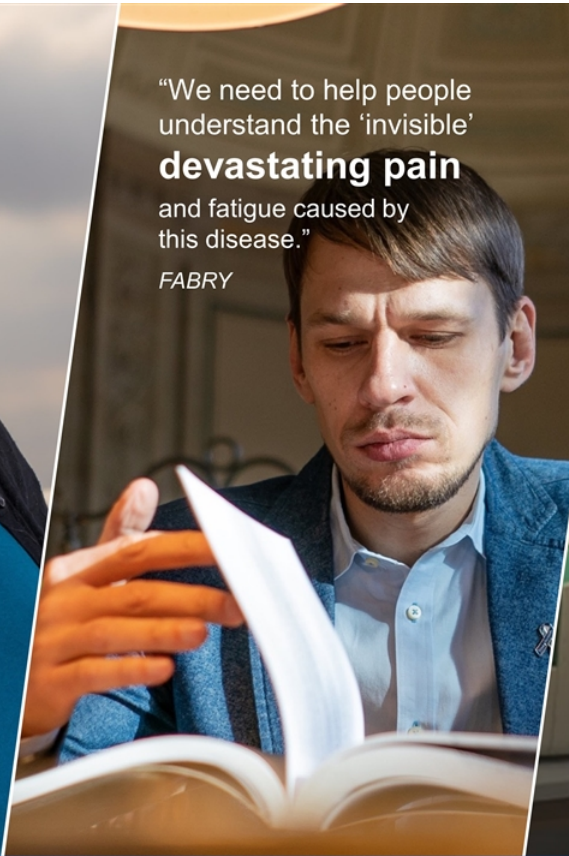
AVROBIO

—
Our mission: Giving people with genetic disease freedom for life



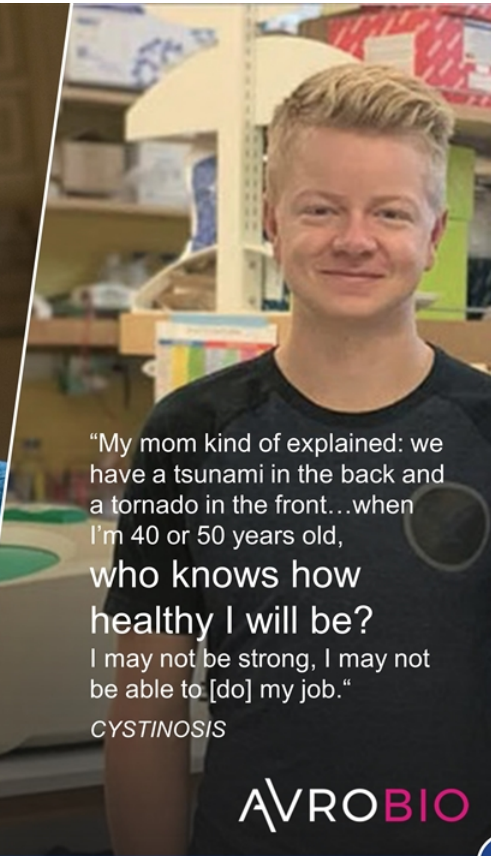
“Bone pain feels like
gut-wrenching spikes.
If I breathe, it goes away. But you
can't make a bone crisis go away.”

GAUCHER



“We need to help people
understand the ‘invisible’
devastating pain
and fatigue caused by
this disease.”

FABRY



“My mom kind of explained: we
have a tsunami in the back and
a tornado in the front...when
I'm 40 or 50 years old,
**who knows how
healthy I will be?**
I may not be strong, I may not
be able to [do] my job.”





CYSTINOSIS

AVROBIO



Multiple programs in the clinic

10 patients dosed to date

Investigational Gene Therapy	Proof-of-Concept	IND-Enabling	Phase 1/2	Commercial Rights
Fabry AVR-RD-01 	Phase 2			AVROBIO
Gaucher AVR-RD-02 	Phase 1/2			AVROBIO
Cystinosis AVR-RD-04 	Phase 1/2			AVROBIO
Pompe AVR-RD-03 				AVROBIO











IND: Investigational New Drug



Addressing multi-billion dollar market opportunity



CURRENT STANDARD OF CARE COSTS

Disease	Est. Cost Per Patient Per Year	Approx. 2019 Net Sales	Selected Companies
<i>Fabry</i>	\$320k	\$1.4B	SANOFI GENZYME   
<i>Gaucher</i>	\$250k-400k	\$1.4B	SANOFI GENZYME   
<i>Pompe</i>	\$500k	\$1.0B	SANOFI GENZYME 
<i>Cystinosis</i>	\$625k-700k*	\$0.2B	  

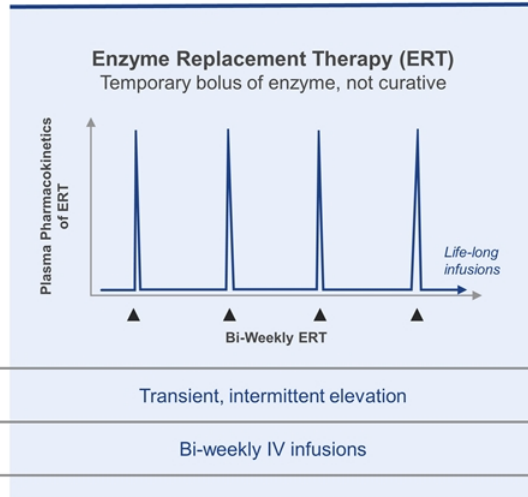
Sources: Rombach S et al, Orphanet J Rare Dis, 2013; van Dussen L et al, Orphanet J Rare Dis, 2014; WAC pricing from Redbook; 2019 Net Sales from company annual and other reports
 * for Horizon's Procysbi oral therapy (delayed release cysteamine bitartrate)
 Note: Shire acquired by Takeda in 2019

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AVROBIO 

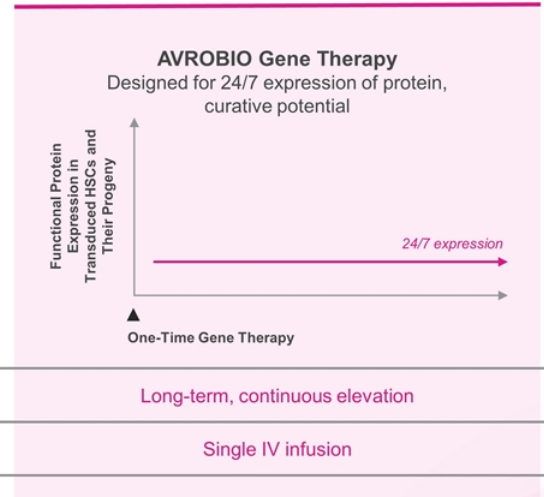
Lifelong treatments vs. potential single-dose therapy



DISEASE PROGRESSION CONTINUES



DISEASE PROGRESSION COULD HALT OR REVERSE



Enzyme or protein level

Transient, intermittent elevation

Long-term, continuous elevation

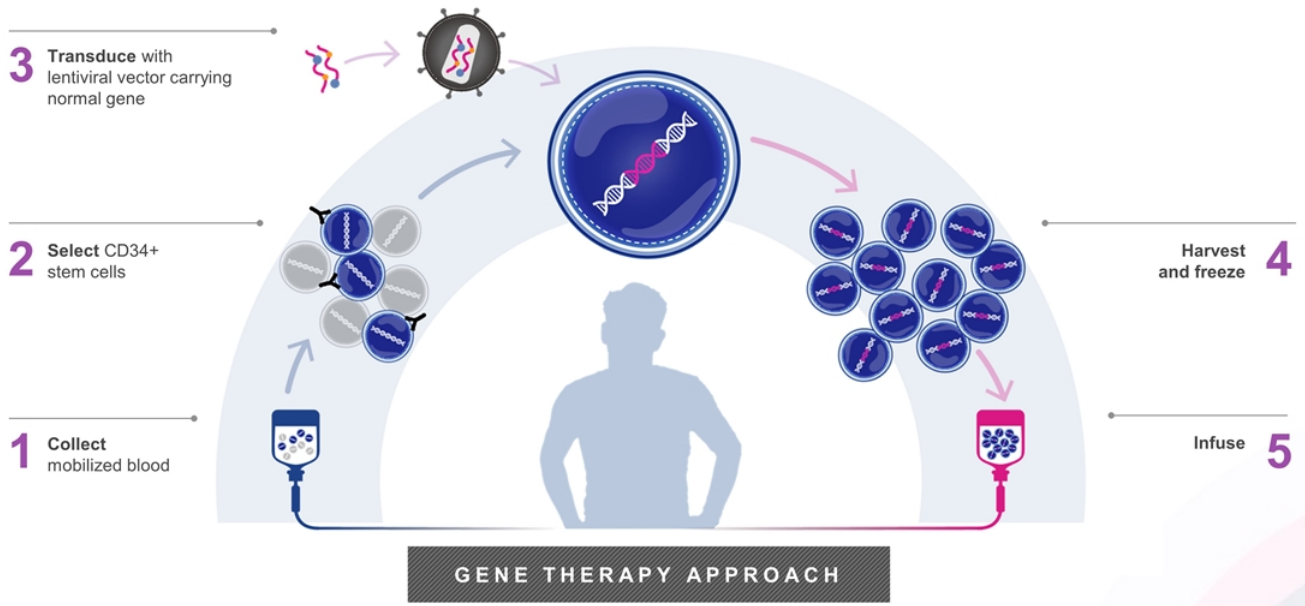
Treatment burden

Bi-weekly IV infusions

Single IV infusion

ERT: Enzyme Replacement Therapy; IV: Intravenous; HSC: Hematopoietic Stem Cells

Established *ex vivo* lentiviral approach





+

Fabry Disease

AVR-RD-01



Goals for gene therapy in Fabry disease

UNMET NEEDS:



Kidney function

Unmet needs: proteinuria, polyuria, kidney failure



Cardiac function

Unmet needs: left ventricular hypertrophy, fibrosis, heart failure



Neuropathic pain

Unmet needs: pain and burning sensations in hands and feet, pain crises



CNS complications

Unmet needs: TIA/stroke, depression, impaired executive function, white matter hyperintensities



Everyday burden of illness and life expectancy

Unmet needs: fatigue, inability to sweat, joint pain, abdominal pain, diarrhea, vomiting, cloudy vision, hearing loss, tinnitus, rash, angiokeratomas, biweekly infusions, shortened lifespan

Sources: Wanner C et al, *Med Genetics and Metab*, 2018; Burlina A, *JJEMS*, 2016
CNS: Central Nervous System; TIA: Transient Ischemic Attack



Two AVR-RD-01 Fabry clinical trials

9 patients dosed across Phases 1 and 2



PHASE 1

Investigator-Sponsored Trial*

Patients

n = 5 (fully enrolled)
On ERT > 6 months prior to enrollment
18 - 50 year-old males

Key Objective

Safety and preliminary efficacy

PHASE 2

AVRO – FAB-201 Trial

Patients

n = 8-12 (4 patients dosed to-date)
Treatment-naive
16 - 50 year-old males

Key Objectives

Safety and efficacy

July 2019 data presented, unless otherwise specified
* Sponsored by FACTs team (Fabry Disease Clinical Research and Therapeutics) in Canada

AVROBIO POWERED BY plate



Fabry FAB-201 Patient Characteristics

Treatment-naïve
Fabry patients

	PATIENT 1	PATIENT 2	PATIENT 3	PATIENT 4
Age of symptom onset / diagnosis	10 / 19 years	36 / 37 years	13 / 13 years	9 / 9 years
Age dosed with AVR-RD-01	21 years	46 years	40 years	26 years
Mutation	c.1021G>A (p.E341K)	c.644A>G (p.N215S)	c.639+1G>T	c.833dupA
Primary disease signs and symptoms	<ul style="list-style-type: none"> • Kidney disease • Chronic pain • GI symptoms • Decreased cold sensation 	<ul style="list-style-type: none"> • Cardiac disease • Peripheral neuropathy • Chronic pain • Increased tiredness • GI symptoms • Intermittent tinnitus • Mild high frequency hearing loss • Raynaud's syndrome 	<ul style="list-style-type: none"> • Kidney disease • GI symptoms • Peripheral neuropathy • Bilateral deafness • Tinnitus • Peripheral edema • Decreased cold sensation 	<ul style="list-style-type: none"> • Chronic pain • Peripheral neuropathy • Neuropathic shuffling gait • Lethargy • Temperature intolerance • Tinnitus • Hearing loss • GI symptoms
Leukocyte AGA enzyme activity at baseline (nmol/hr/mg protein)	0.10*	2.38**	0.58**	0.46**
Plasma lyso-Gb3 at baseline (nM)	202***	8***	147***	92***
Comment	IgA deposits in kidney biopsy	Cardiac variant, not a classic Fabry male		

* Mayo Lab, ref range ≥ 23.1 nmol/hr/mg

** Rupa Lab, ref range 24-56 nmol/hr/mg

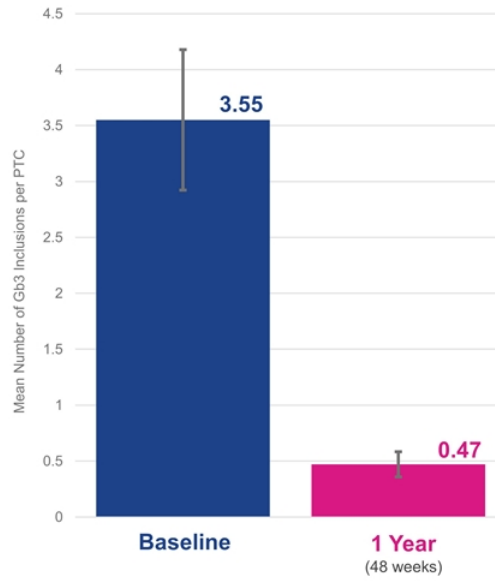
*** Reference value ≤ 2.4 nM

AGA: α -galactosidase A; Lyso-Gb3: Globotriaosylsphingosine; GI: Gastrointestinal; IgA: Immunoglobulin-A



Patient 1: 87% substrate reduction in kidney biopsy at 1 year

Average number of **Gb3** inclusions per peritubular capillary (PTC)



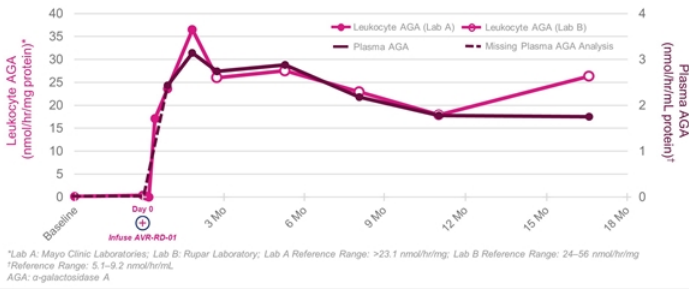
- Unpaired t-test for difference between $n=55$ PTCs at baseline vs. $n=101$ PTCs at 1 year; $p < 0.0001$
- Error bar represents the standard deviation

Baseline: The last available, non-missing observation prior to AVR-RD-01 infusion
 Note: With respect to Fabry disease, Gb3 inclusions per PTC is interchangeable with GL-3 inclusions per KIC
 FAB-201-1: First patient in FAB-201 clinical trial
 PTC: Peritubular Capillary; Gb3: Globotriaosylceramide; GL-3: Globotriaosylceramide; KIC: Kidney Interstitial Capillary

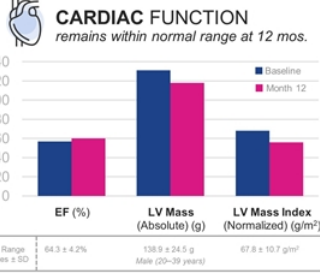
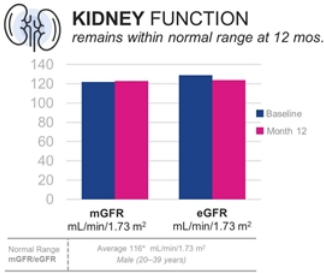
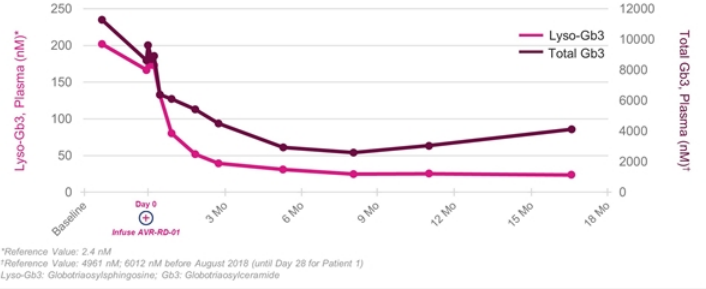


Patient 1: Multiple data trends sustained up to 18 months

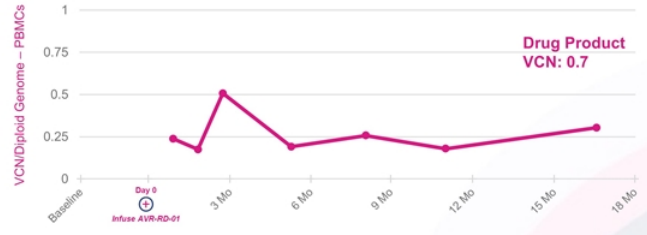
Leukocyte + Plasma AGA Enzyme Activity



Plasma Lyso-Gb3 and Total Gb3



Vector Copy Number (VCN)



*Source: <https://www.kidney.org/atoz/content/gfr>
 mGFR: Measured Glomerular Filtration Rate, eGFR: Estimated Glomerular Filtration Rate

Source: Altkirk K et al. J Magn Reson Imaging, 2003
 EF: Ejection Fraction; LV: Left Ventricular

VCN: Vector Copy Number; PBMCs: Peripheral Blood Mononuclear Cells

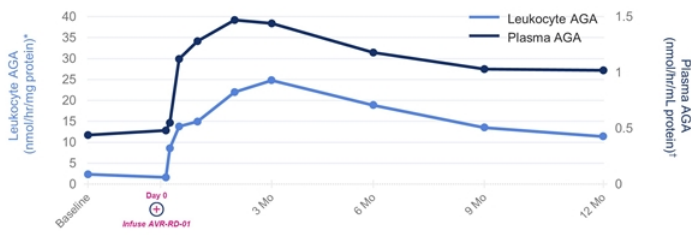


Note: Patient #1 had a skin biopsy score of 3 (severe accumulation) at baseline, a score of 2 (moderate accumulation) at 6 months and a score of 1 (mild accumulation) at 12 months



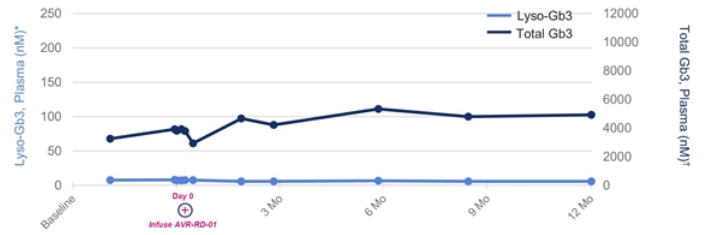
Patient 2: Multiple data trends sustained up to 12 months

Leukocyte + Plasma AGA Enzyme Activity



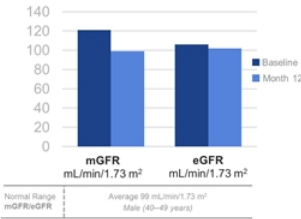
*Data from Rugar Laboratory; Reference Range: 24–56 nmol/hr/mg
 †Reference Range: 5.1–9.2 nmol/ml
 AGA: α-galactosidase A

Plasma Lyso-Gb3 and Total Gb3



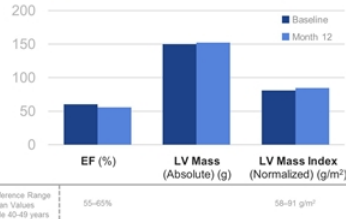
*Reference Value: 2.4 nM; †Reference Value: 4961 nM
 Note: Patient #2 has normal substrate, consistent with late-onset cardiac variant phenotype
 Lyso-Gb3: Globotriaosylsphingosine; Gb3: Globotriaosylceramide

KIDNEY FUNCTION remains within normal range



Source: <https://www.kidney.org/doc/booster/gfr>
 mGFR: Measured Glomerular Filtration Rate, eGFR: Estimated Glomerular Filtration Rate

CARDIAC FUNCTION remains within normal range



Source: Alkhalil K et al. J Magn Reson Imaging, 2003
 EF: Ejection Fraction; LV: Left Ventricular

Vector Copy Number (VCN)

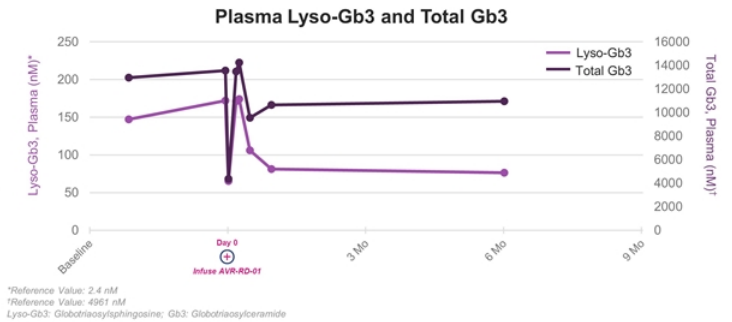
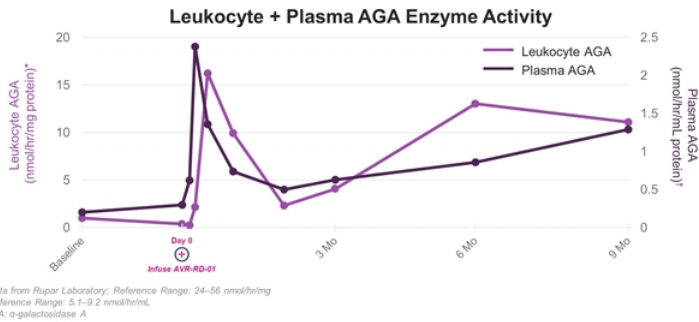


VCN: Vector Copy Number; PBMCs: Peripheral Blood Mononuclear Cells

Note: As patient #2 is a cardiac variant of Fabry disease, this patient had a skin biopsy score of 0 (trace or no accumulation) at baseline and at 6 months



Patient 3: Initial divergent profile with 9 month data trending toward anticipated long-term engraftment

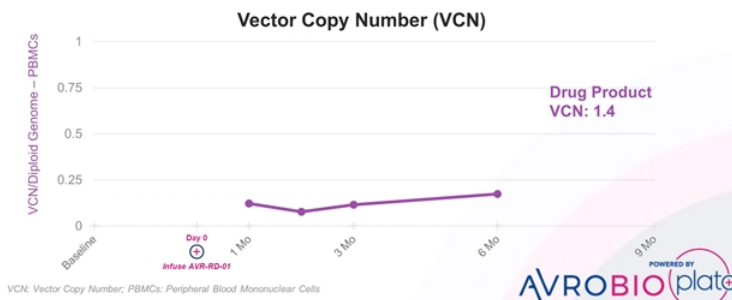
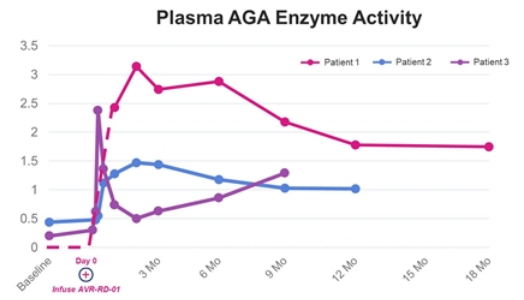


*Data from Rupa Laboratory; Reference Range: 24-56 nmol/hr/mg
 *Reference Range: 5.1-9.2 nmol/hr/ml
 AGA: α-galactosidase A

*Reference Value: 2.4 nM
 *Reference Value: 4961 nM
 Lyso-Gb3: Globotriaosylsphingosine; Gb3: Globotriaosylceramide

Skin Biopsy Score (Patient 3)

Baseline	2
6 months	2



VCN: Vector Copy Number; PBMCs: Peripheral Blood Mononuclear Cells





Two AVR-RD-01 Fabry clinical trials

9 patients dosed across Phases 1 and 2



PHASE 1

Investigator-Sponsored Trial*

Patients

n = 5 (fully enrolled)
On ERT > 6 months prior to enrollment
18 - 50 year-old males

Key Objectives

Safety and preliminary efficacy

PHASE 2

AVRO – FAB-201 Trial

Patients

n = 8-12 (4 patients dosed to-date)
Treatment-naive
16 - 50 year-old males



Key Objectives

Safety and efficacy

FAB-201 = AVRO-RD-01-201 Study
* Sponsored by FACTs team (Fabry Disease Clinical Research and Therapeutics) in Canada
ERT: Enzyme Replacement Therapy

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AVROBIO (plate)



Fabry Phase 1 Patient Characteristics

ERT-Treated Fabry Patients

	PATIENT 1	PATIENT 2	PATIENT 3	PATIENT 4	PATIENT 5
Age of symptom onset / diagnosis	18 / 37 years	9 / 29 years	10 / 0 years	7 / 4 years	10 / 14 years
Years on ERT	11 years	6 years	4 years	11 years	2 years
Age dosed with AVR-RD-01	48 years	39 years	40 years	37 years	30 years
Mutation	c.962A>G (p.Q321R)	c.1033T>C (p.S345P)	c.427G>C (p.A143P)	c.427G>C (p.A143P)	(p.Y134S)
Primary disease signs and symptoms	<ul style="list-style-type: none"> • Kidney disease • Cardiac disease • GI pain • GI diarrhea • Angiokeratoma • Insomnia 	<ul style="list-style-type: none"> • Kidney disease • Cardiomyopathy • Hypohidrosis • Corneal verticillata • Peripheral neuropathy • GI symptoms • Angiokeratoma • Lymphedema • Acroparesthesia 	<ul style="list-style-type: none"> • Cardiac Disease • Tinnitus • Headaches • Dizziness • Acroparesthesia 	<ul style="list-style-type: none"> • Cardiac Disease • Hypohidrosis • Tinnitus • Corneal verticillata • Angiokeratoma • GI symptoms 	<ul style="list-style-type: none"> • Kidney disease • Hypertension • Hypohidrosis • Tinnitus • Migraines • Impaired hearing • Angiokeratoma • Sleep apnea • Asthma • Depression
Leukocyte AGA activity at baseline (nmol/hr/mg protein)	2.1*	1.1*	0.6*	2.2*	1.0*
Plasma lyso-Gb3 at baseline (nM)	25**	26**	59**	29**	16**
ERT discontinuation status	18 months after gene therapy dose		Did not resume ERT after gene therapy dose	6 months after gene therapy dose	

* Rupa Lab, ref range 24-56 nmol/hr/mg

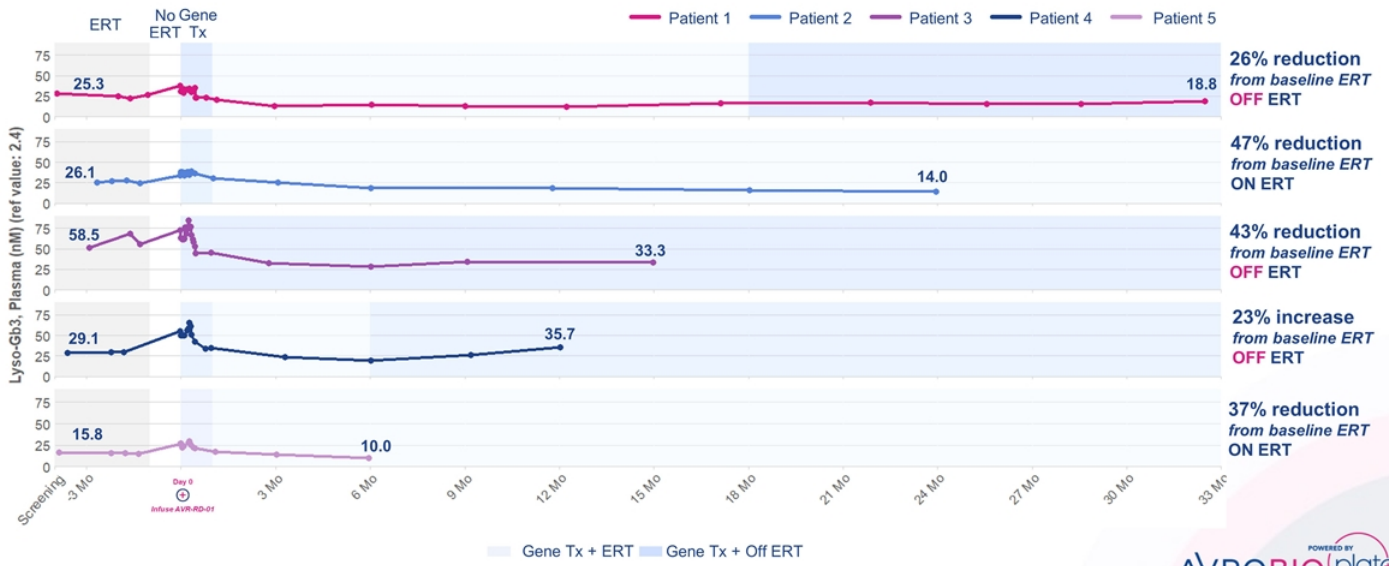
** Reference value ≤ 2.4 nM

Note: AGA: α-galactosidase A; ERT: Enzyme Replacement Therapy; GI: Gastrointestinal; Lyso-Gb3: Globotriaosylsphingosine



Patients 1-5: Plasma lyso-Gb3 reduction sustained up to 32 months

All patients who have discontinued ERT remain off ERT

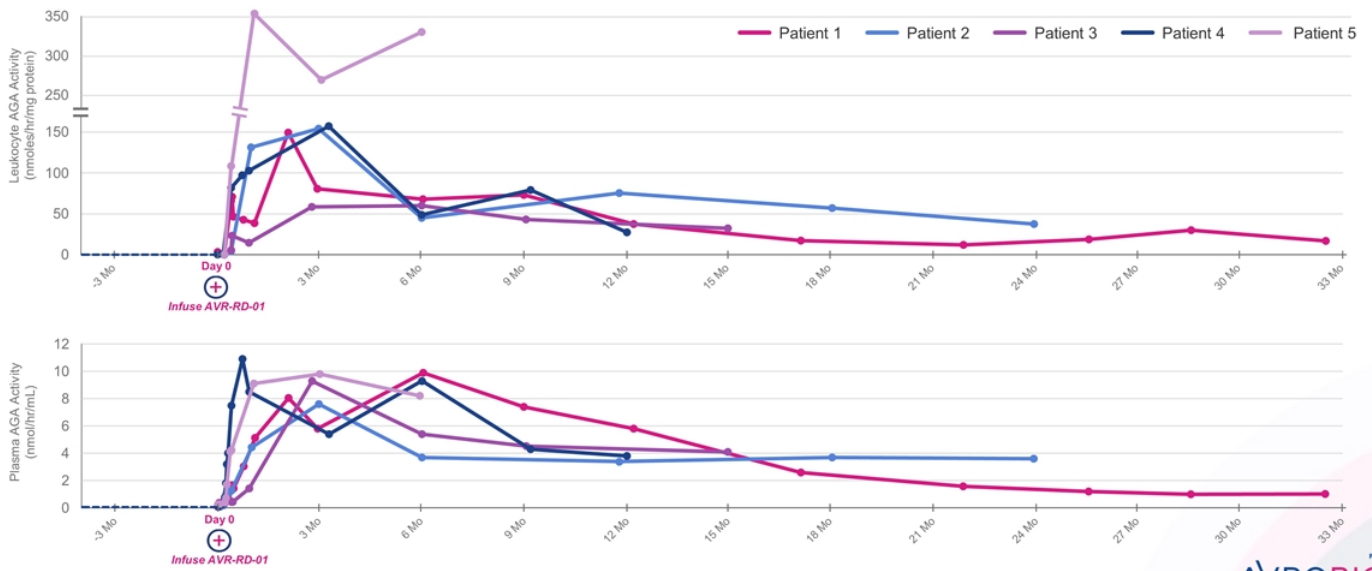


Lyso-Gb3: Globotriaosylsphingosine; ERT: Enzyme Replacement Therapy; Tx: Therapy



Patients 1-5: Leukocyte and plasma enzyme activity sustained up to 32 months

Consistent trends across all patients, 4 patients > 1 year

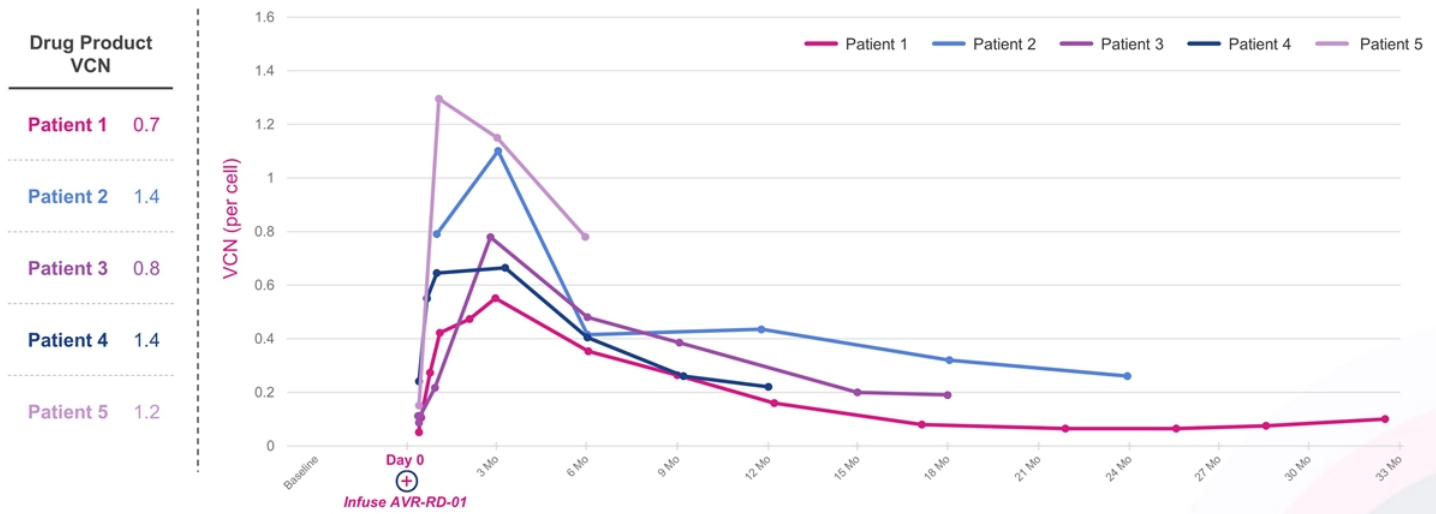


AGA: α -Galactosidase A



VCN stable at 32 months with consistent trend across all other patients

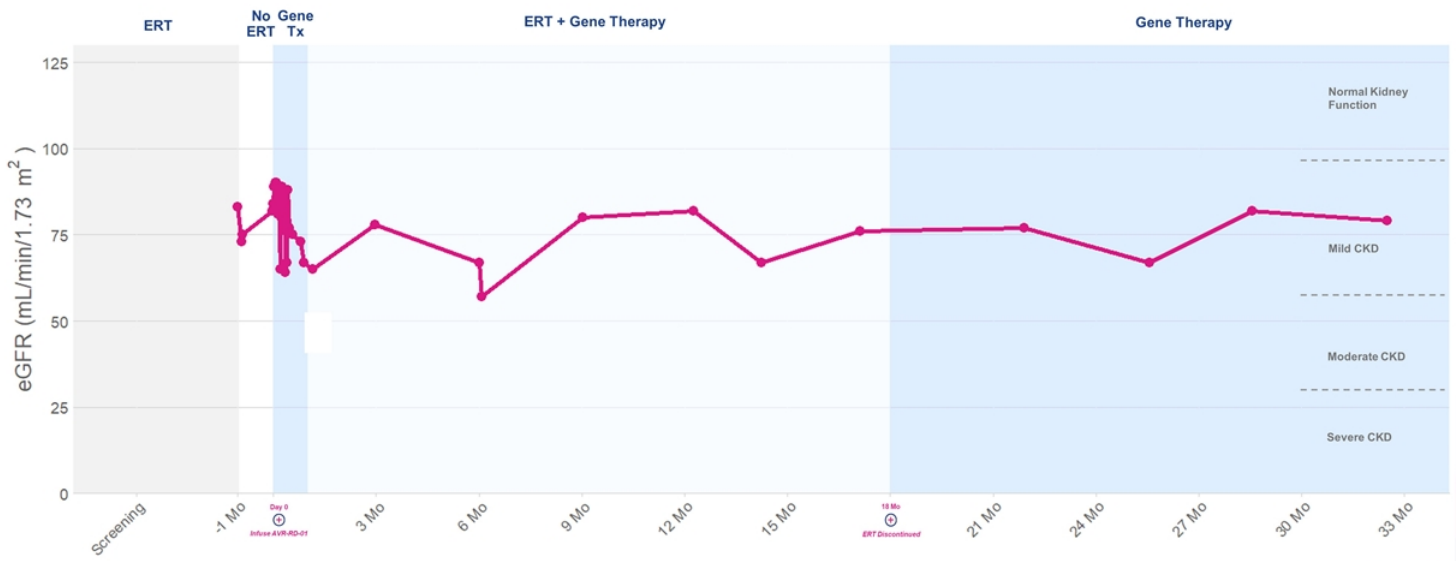
4 patients with 1+ years data



Note: 0.1 VCN is indicative of approx. 5-10% of all nucleated cells having an average of 1-2 copies of the transgene
 VCN: Vector Copy Number



Patient 1: Kidney function stable at 32 months



eGFR: Estimated Glomerular Filtration Rate; ERT: Enzyme Replacement Therapy; TX: Therapy; CKD: Chronic Kidney Disease



Phase 1 Fabry (5 patients) and
FAB-201 (4 patients)

**No unexpected
safety events
or trends
identified**



No SAEs related to AVR-RD-01 drug product



AEs and SAEs reported

Phase 1 AEs (n = 128):

- Generally consistent with myeloablative conditioning, underlying disease or pre-existing conditions

FAB 201 AEs (n = 98):

- Generally consistent with myeloablative conditioning, underlying disease or pre-existing conditions
 - Grade 1 or 2 (n = 72)
 - Grade 3 or 4 (n = 30)

Phase 1SAEs (n = 2):

- Febrile neutropenia (grade 3)
- Thrombophlebitis (grade 2)

FAB 201 SAEs: (n = 4)

Pre-treatment and prior to conditioning

- Seizure (grade 2)

Post-treatment

- Dehydration, nausea, vomiting (grade 3)
- Febrile neutropenia (2 patients, grade 3 & 4)



Anti-AGA antibodies

- Pre-existing low titers detected in 4 patients

Note: Safety data cut November 26, 2019
AE: Adverse Event; SAE: Serious Adverse Event
NOTE: AVR-RD-01 is an investigational gene therapy



Fabry disease target product profile (T.P.P.)

Potential attributes intended to support first-line use



ERT: Enzyme Replacement Therapy
Note: Potential attributes represent desired target product profile, and are not intended, and should not be interpreted, to be attributes of AVROBIO's current investigational gene therapies, which are being studied for safety and efficacy and have not been approved by the FDA or any other regulatory body.



Building commercial capabilities

55+ product launches, including 2 gene therapies

Holly May

Chief Commercial Officer



- Led commercial teams for LSDs at SanofiGenzyme
- Head of Commercial at SOBI, a rare disease company

Jose Gomez

SVP, Global Market Access & Value



- Led global strategic marketing and global market access functions at AveXis
- Led market access, global strategic pricing and reimbursement functions for LSDs at Shire

Sean Ring

VP, Head of Commercial Operations



- Extensive orphan drug commercial strategy and launch expertise
- Built out market development and commercial ops at Editas, Zafgen, Cubist, Shire, Biogen

Monique da Silva

SVP, Corporate Communications



- Led communications strategy through launch at Spark Therapeutics
- Led communications functions at Biogen and OgilvyPR





Cystinosis



AVR-RD-04



Goals for gene therapy in cystinosis

UNMET NEEDS:



Kidney function

Unmet needs: renal Fanconi syndrome, proteinuria, chronic kidney disease, kidney failure



Vision

Unmet needs: corneal cystine accumulation, photophobia, involuntary eyelid closure



Endocrine disorders

Unmet needs: softening/weakening of bones, bone pain, rickets, long bone deformations, hypophosphatemia, delayed growth, hypothyroidism, pancreatic insulin insufficiency, diabetes, infertility



CNS complications

Unmet needs: myopathy, hypotonia, tremors, difficulty swallowing, neurodevelopmental issues (speech and walking delay and cognitive impairment)



Everyday burden of illness and life expectancy

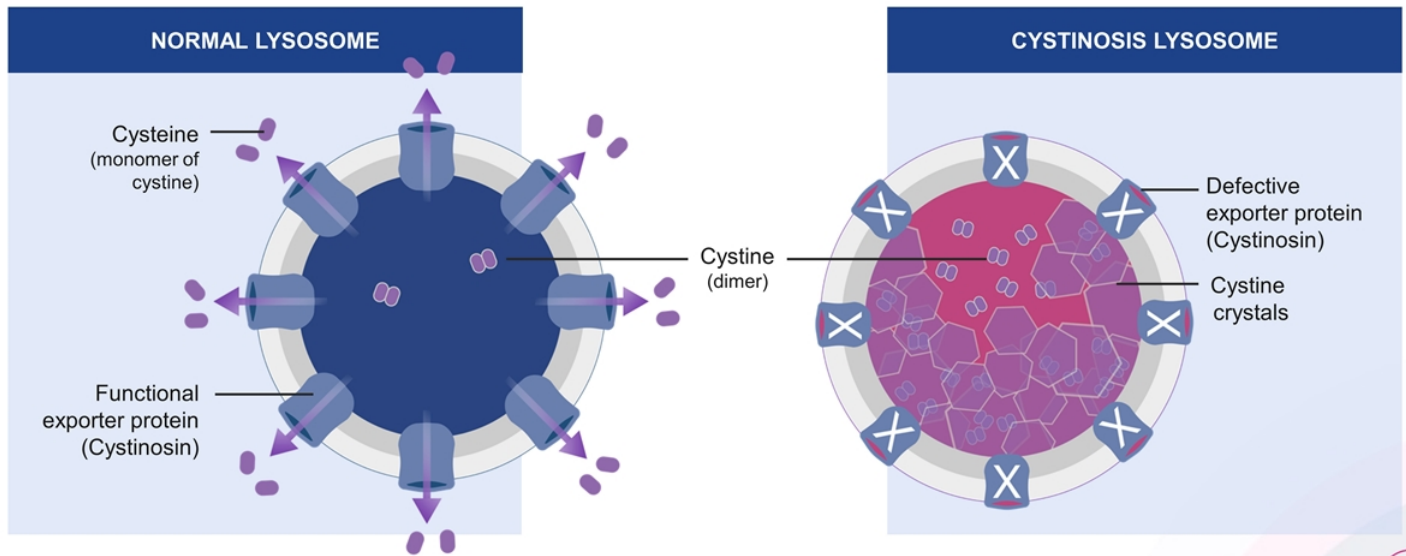
Unmet needs: medications multiple times per day that cause GI discomfort and sulfur body and breath smell, shortened lifespan

Sources: Ariceta G et al, *Nephrol Dial Transplant*, 2015; Elmonem M et al, *Orphanet Journal of Rare Diseases*, 2016; Gahl et al, *NEJM*, 2002; Bois et al, *J Med Genet*, 1976
CNS: Central Nervous System; GI: Gastrointestinal



Cystinosis caused by defective gene that encodes cystinosisin, an exporter protein

Cystine crystals build up in lysosomes causing tissue and organ damage



Source: Cherqui et al, Nat Rev Nephrol. 2017



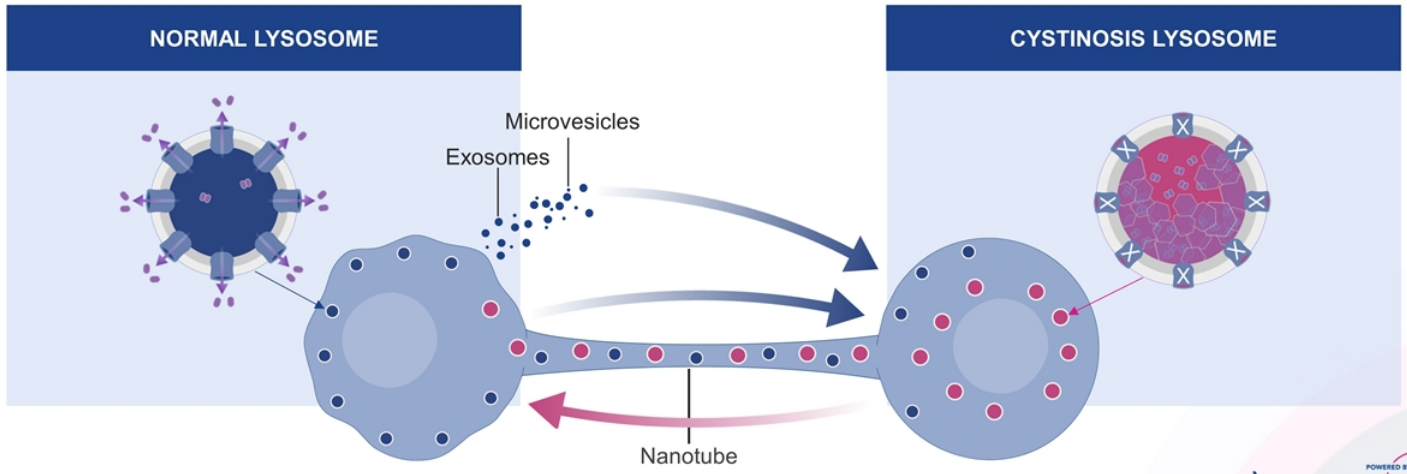
Drug product-derived macrophages restore normal cystine recycling

Mechanisms of action

Macrophages with CTNS transgene restore cystine recycling to CTNS^{-ve} cells via:

1. Tunneling nanotubes – transfer of corrected lysosomes, cystinosin, CTNS mRNA
2. Exosomes / Microvesicles – transfer of cystinosin, CTNS mRNA

Net result: Corrected lysosomes in cells throughout the body



Sources: Naphade, Stem Cells, 2015. Harrison, Molecular Therapy, 2013.
CTNS: cystinosin, lysosomal cystine transporter; mRNA: Messenger Ribonucleic Acid

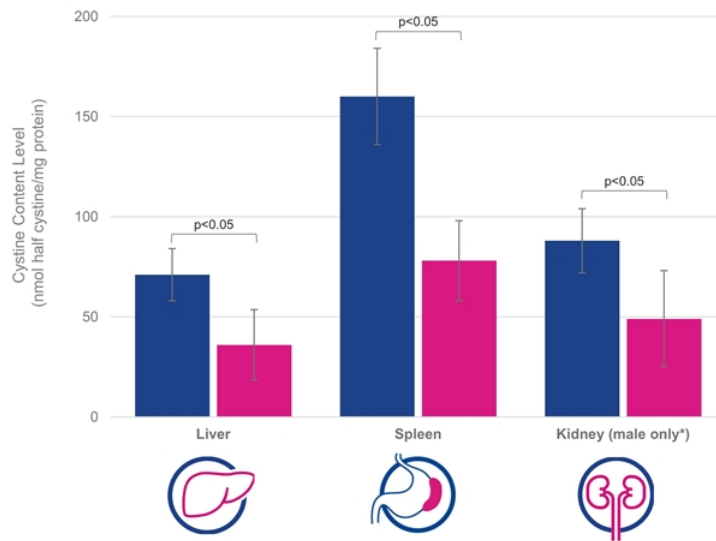


Preclinical cystinosis data

AVR-RD-04 preclinical proof-of-concept demonstrated¹

Significantly decreased cystine levels in multiple tissues

- Untreated cystinosis KO mice
- Cystinosis KO mice post AVRO gene therapy AVR-RD-04



- Cystinosis KO mice² with established disease
- 32 weeks post-treatment
- Cystinosis KO mouse Sca1⁺ BM cells
- Human cystinosis gene
- n = 8–12 mice/group/experiment
- Data bars at the 95% confidence interval for the group

Sources: ¹Harrison et al., *Molecular Therapy*, 2013; ²Cherqui et al., *Mol Cell Biol*, 2002;
Error bars represent means ±SD; Group comparisons of cystine content parameters were made with one-way analysis of variance, followed by t-test
Note: Females in CTNS^{-/-} mouse model excessively accumulate cystine crystals in kidneys compared to males, unlike cystinosis patients where there is no difference in males and females
KO: Knockout; BM: Bone Marrow;





Allogeneic transplant demonstrated stabilized renal function, corrected polyuria and improved photophobia

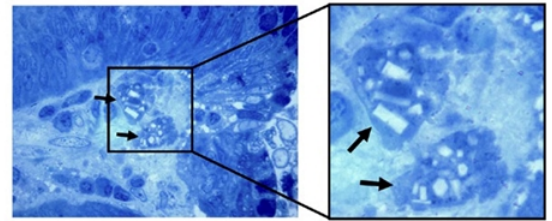
Allogeneic HSC Transplant

University Hospital Leuven

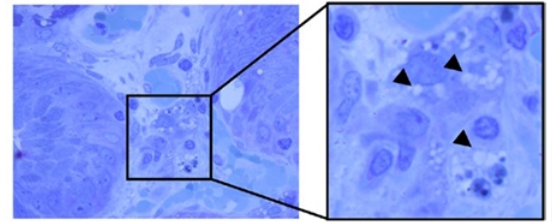
- 16 year old male
- Diagnosed at 2.7 years old, started on cysteamine
- Age 15 years – cysteamine toxicity
- Age 16 years – fully matched HLA transplant
- Acute GvHD
- **First few months**
 - Kidney function stabilized
 - Polyuria resolved
- **6 months**
 - Photophobia score reduced from 5 (unable to open eyes even inside dark room) to 0 (no photophobia)

Cystine crystal reduction (31%) in macrophages in gastric mucosa at 30 months post transplant

BEFORE
TRANSPLANT



30 MONTHS
POST
TRANSPLANT



Arrows/arrowheads point to tissue macrophages



Investigator-sponsored* study of AVR-RD-04 in cystinosis patients

First patient dosed



PHASE 1/2
Investigator-Sponsored Trial*

Patients

Up to 6 patients
Adults and adolescents
Cohorts 1-2 ≥ 18 years; Cohort 3 ≥ 14 years
Male and Female
On oral and ophthalmic cysteamine



Key Objectives

Safety and efficacy

* Sponsored by University of California, San Diego
Note: AVR-RD-04 aka CTNS-RD-04

AVROBIO POWERED BY plate



Cystinosis AVR-RD-04 Phase 1/2 Patient Characteristics

	PATIENT 1
Age of symptom onset / diagnosis	0 year / 8 months
Age dosed with AVR-RD-04	20 years
Gender	Male
Mutation	Allele 1: LDM, Allele 2: Nt1035 (insC)
Primary disease signs and SoC treatment related symptoms, including	<ul style="list-style-type: none">• Fanconi syndrome• Polyuria• Corneal abnormalities• Mild photophobia• Vomiting
Granulocyte Cystine levels at baseline (nmol half cystine per mg protein)*	7.8
Comments	NO kidney transplant <ul style="list-style-type: none">• Cysteamine 1125 mg p.o. every 12 h/day since 2009; discontinued prior to AVR-RD-04 infusion• Cysteamine eyedrops 4-5x/day• Concomitant medications not listed

Note: AVR-RD-01 aka CTNS-RD-04



Phase 1/2 Cystinosis
1 patient dosed

**No unexpected
safety events
or trends
identified**

+ No AEs or SAEs related to AVR-RD-04 drug product

+ No SAEs reported

+ AEs reported

- Consistent with myeloablative conditioning and underlying disease
- N = 22 (moderate = 9, mild = 13)

Pre-treatment and prior to conditioning (n = 6, not all events listed)

- Diarrhea, hypokalemia, dizziness
- Dehydration, vomiting

Post-treatment (n = 16, not all events listed)

- Alopecia, intermittent diarrhea, vomiting
- Mucositis, intermittent febrile neutropenia, intermittent epistaxis
- Intermittent blurry vision, intermittent hypokalemia, mucoceles
- Thrombocytopenia

Note: Safety database cut as of January 27, 2020
AE: Adverse Event; SAE: Serious Adverse Event

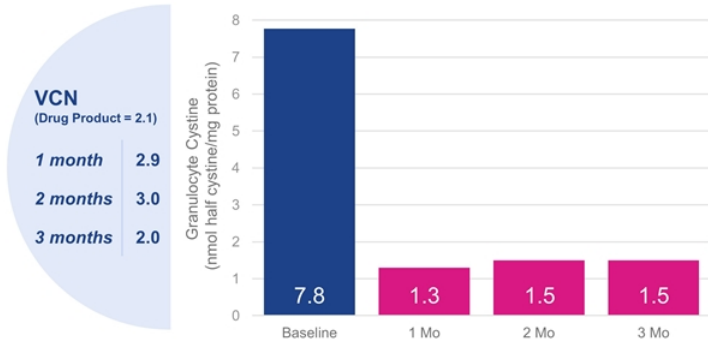
AVROBIO POWERED BY plato



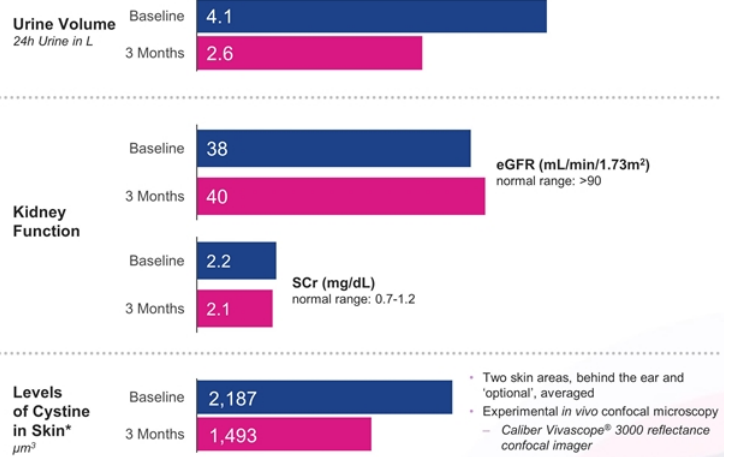
Patient 1: Initial data suggest positive trends across multiple measures

PRIMARY EFFICACY ENDPOINT

Average Granulocyte Cystine Levels



SECONDARY ENDPOINTS



- Two skin areas, behind the ear and 'optional', averaged
- Experimental *in vivo* confocal microscopy
 - Caliber Vivascope® 3000 reflectance confocal imager
 - Adapted for skin imaging; papillary dermis 16–40 μm
- Analysis and quantification
 - 3D Image-Pro software

Asymptomatic Heterozygous Carrier Granulocyte Cystine Range: 0.2 – 1.9 nmol half cystine/mg protein

Source: Gertsman I et al., Clinical Chemistry, 2016

VCN: Vector Copy Number; CTNS: Cystinosis, Lysosomal Cystine Transporter; mRNA: Messenger Ribonucleic Acid; eGFR: Estimated Glomerular Filtration Rate; SCr: Serum Creatinine

*Data obtained using a novel experimental methodology utilizing *in vivo* confocal microscopy, to image crystals in the skin behind the ear





Patient 1: Reduced treatment burden at 3 months

Number of Medications and Supplements

(max per day)

**Before
Gene Therapy**

ON Cysteamine



52

**After Gene
Therapy**

(at 3 months
post-gene therapy)

OFF Cysteamine



21

NOTE: Investigational gene therapy



Gaucher Disease



AVR-RD-02



Goals for gene therapy in Gaucher Type 1 Disease

UNMET NEEDS:



Bone-related manifestations

Unmet needs: bone pain, avascular necrosis, bone crisis, osteoporosis, fractures, joint destruction, skeletal abnormalities



Hemoglobin levels and platelet counts

Unmet needs: anemia, thrombocytopenia, easy bruising, bleeding



Hepatosplenomegaly

Unmet needs: enlarged liver, enlarged spleen



CNS complications

Unmet needs: Increased risk of GBA-Parkinson's disease



Everyday burden of illness, and life expectancy

Unmet needs: fatigue, pain, lung disease, biweekly infusions, shortened lifespan

Sources: Grabowski G et al, *Online Metabolic and Molecular Bases of Inherited Disease*, 2018; Weinreb N et al, *AJH*, 2008; Pastores G et al, *Semin Hematol*, 2004
CNS: Central Nervous System; GBA: gene coding for glucocerebrosidase

Long-term follow-up study highlights significant unmet need in Gaucher Type 1



Despite standard-of-care ERT, **disease progression** continues and **unmet need** remains.

Incomplete therapeutic response is common:

- **60%** of patients failed to achieve at least one of the six therapeutic goals evaluated after 4+ years of ERT¹
- A clinically significant percentage of patients continue to exhibit **bone pain, organomegaly and cytopenia** after 10 years of ERT²
- **25%** of patients continue to suffer from physical limitations after two years of ERT, primarily due to bone disease³

Persistence after 10 years ERT [†]	Non-splenectomized Patients	Splenectomized Patients
Anemia	12.4%	8.8%
Thrombocytopenia*	22.7%	0.7%
Splenomegaly*	38.3%	N/A
Hepatomegaly*	14.3%	18.8%
Bone Pain	42.9%	62.5%
Bone Crisis	7.4%	16.7%

* Higher persistence rates observed when more severe manifestations were present at baseline

[†] Persistence refers to the presence of anemia, bone pain, bone crisis, or at least moderate thrombocytopenia, splenomegaly, or hepatomegaly, present after 10 years of ERT among those with baseline involvement of these parameters (from a registry of 757 GD1 patients; Weinreb et al., 2013).

Following 10 years of treatment, ~26% of patients were receiving between 45-150 U/kg EOW, and 96% of these individuals were receiving doses between 45-90 U/kg EOW.

Sources: ¹Weinreb N et al. *Amer J Hematol*, 2008; ²Weinreb N et al. *J Inherit Metab Dis*, 2013; ³Giraldo P et al. *Qual Life Res*, 2005.
GD1: Gaucher Disease Type 1; SOC: Standard of Care; ERT: Enzyme Replacement Therapy; EOW: Every Other Week



GAU-201: Phase 1/2 study in Gaucher Type 1 patients



PHASE 1/2

AVR-RD-02 Trial

Patients

n = 8 - 16

Type 1 Gaucher

Treatment naïve or on ERT

16 - 35 year-old

Male and Female



Key Objectives

Safety, Engraftment, Efficacy,
ERT-independence



Pompe disease



AVR-RD-03



Pompe preclinical program advancing

Integrated three-part approach

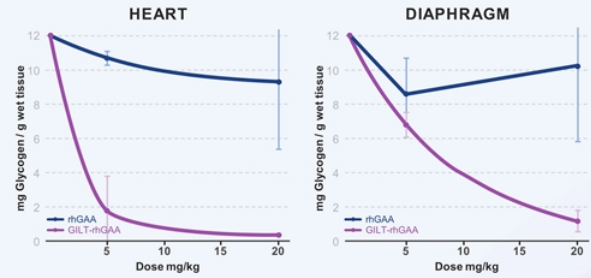
THE CHALLENGE

- Pompe requires **20x more ERT** than Fabry or Gaucher
- Requires GAA activity restored to **muscle and CNS**

AVROBIO's APPROACH

1. Potent transgene promoter
2. GILT uptake tag
3. plato™ for CNS impact

GILT-tagged Recombinant Human (rh)GAA impacts levels of stored glycogen compared to non GILT-tagged Recombinant Human (rh)GAA in a Pompe mouse model



GILT: Glycosylation-Independent Lysosomal Targeting
Sources: Burton B et al, J Pediatr, 2017; Ausems M et al, Eur J Hum Genet, 1999;
Gungor D et al, Orphanet J Rare Dis, 2011; Maga JA et al, J of Bio Chem, 2013

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AVROBIO plato



plato™

—
AVROBIO's foundation designed to
scale gene therapy worldwide

*State-of-the-art technologies including
automated manufacturing platform*

+ Optimized
for performance

+ Redefines manufacturing
best practices

AVROBIO POWERED BY plato





plato™: Three upgrades designed to optimize potency, safety and durability

UPGRADES	Increase enzyme activity	Increase transduction efficiency	Increase VCN	Increase marrow space / engraftment	Increase consistency and safety
1 Vector	+	+	+		
2 Conditioning			+	+	+
3 Automation	+				+

Upgrades designed to increase Vector Copy Number (VCN), enzyme activity, chimerism and durability

* TDM (therapeutic drug monitoring)



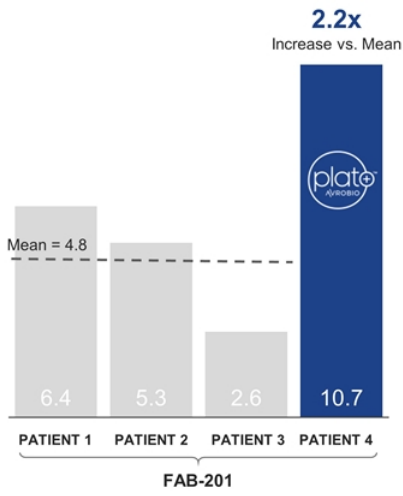
VECTOR UPGRADE:

Metrics compared to academic process

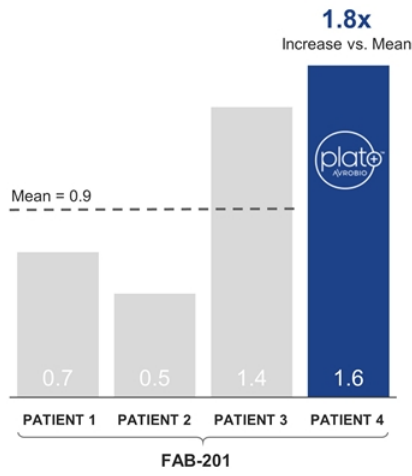
FAB-201 patient #4 drug product data with plato™



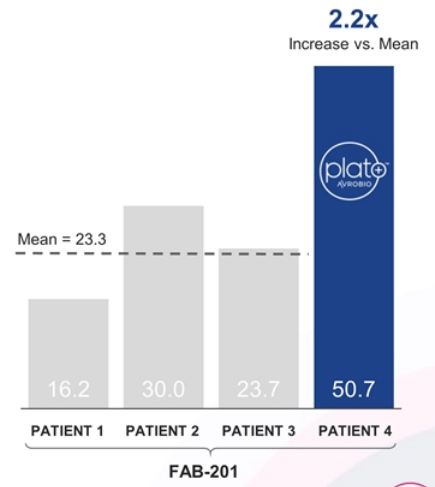
Enzyme Activity (nmol/hr/mL)



VCN (per diploid genome)



Transduction Efficiency (%)



VCN: Vector Copy Number; FAB-201: AVR-RD-01 Study
NOTE: Data is from drug product



VECTOR UPGRADE:

Metrics compared to academic process

FAB-201 and AVR-RD-04 drug product data



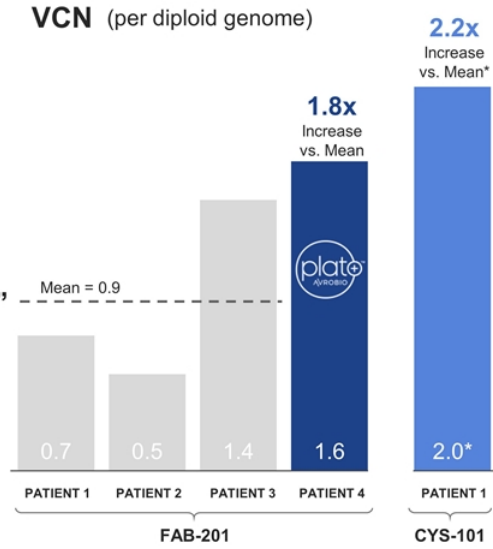
FAB-201 with plato™

- 4-plasmid vector (LV2)
- Bu TDM conditioning
- Automated manufacturing

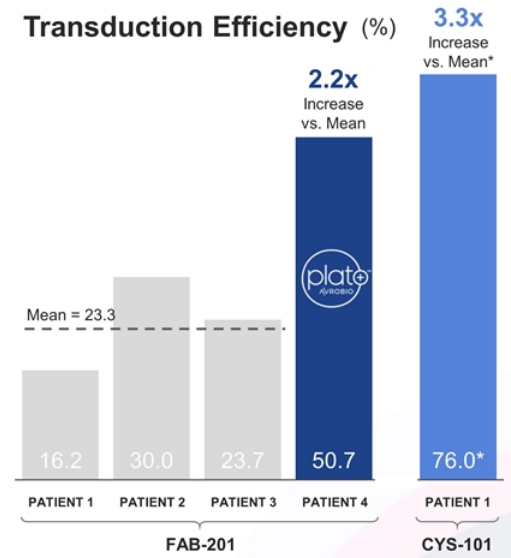
AVR-RD-04 with “plato™-like”

- 4-plasmid vector
- Bu TDM conditioning
- Manual manufacturing

VCN (per diploid genome)



Transduction Efficiency (%)

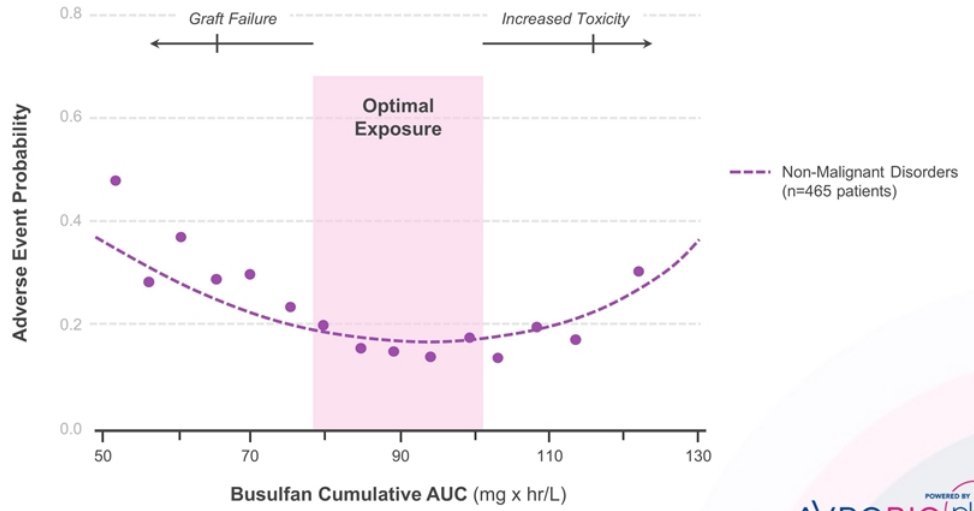


BU TDM: Busulfan Therapeutic Drug Monitoring; VCN: Vector Copy Number; FAB-201: AVR-RD-01 Study; CYS-101: AVR-RD-04 Study; LV: Lentiviral Vector
 * Manufactured at UCLA using UCLA's assays and methodologies
 NOTE: Data is from drug product

PRECISION CONDITIONING UPGRADE:
Targeted busulfan intended to balance optimal engraftment with enhanced safety
Meta-analysis of 465 patients identified optimal exposure

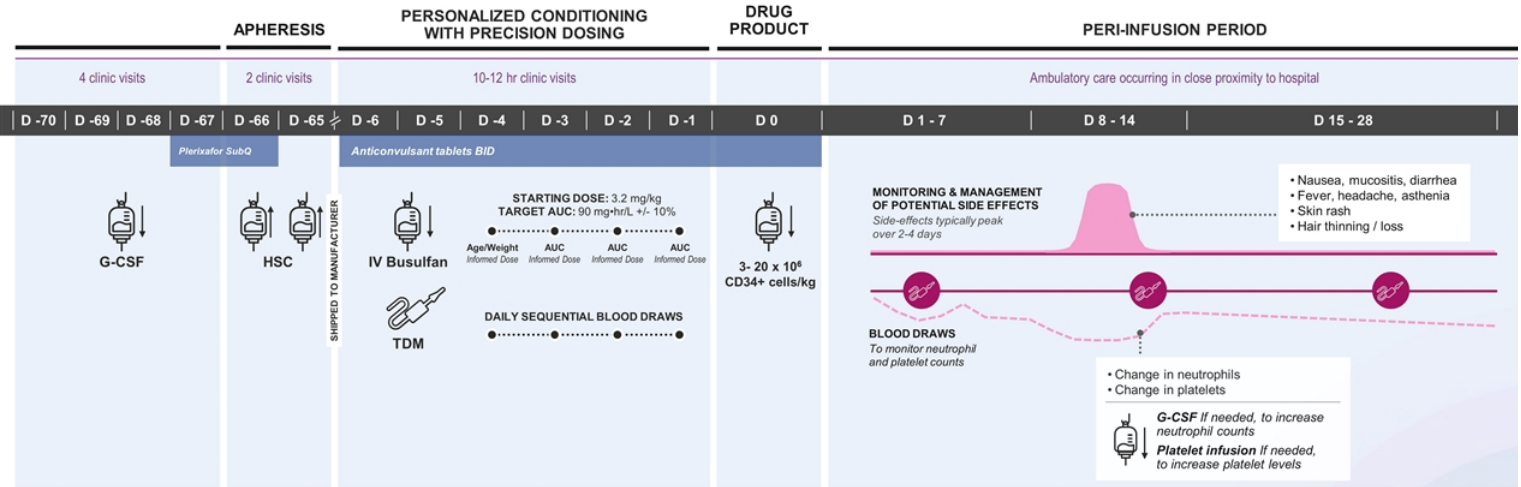
Optimized precision dosing designed to enhance tolerability

Lowest rate of adverse events in the Bu90 range



Bu: Busulfan; AUC: Area Under the Curve
 Sources: Bartelink LH et al, Lancet Haematol, 2016

PRECISION CONDITIONING UPGRADE: Precision dosing via state-of-the-art patient therapeutic drug monitoring (TDM)



G-CSF: granulocyte colony stimulating factor; PERI-INFUSION PERIOD: time from infusion to discharge; TDM: therapeutic drug monitoring; HSC: hematopoietic stem cell
Notes: Illustrative only. AEs will vary patient by patient, see busulfan label for a complete list of side-effects. Ambulatory care based on oncology setting with higher intensity conditioning

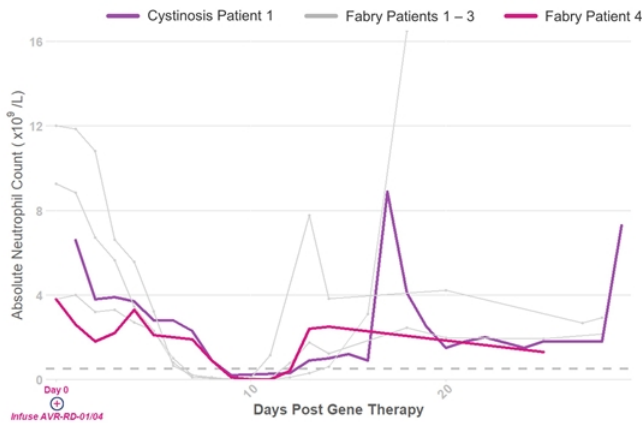
PRECISION CONDITIONING UPGRADE:

Rapid neutrophil and platelet count recovery

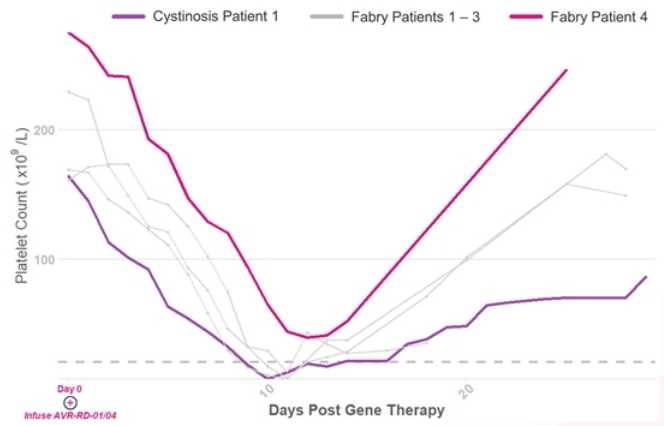
Similar for busulfan and melphalan across Fabry and cystinosis patients



Absolute Neutrophil Counts



Platelet Counts



Fabry: Patients #1-3 Melphalan 100mg/m²; Patient #4 Busulfan 'AUC 90'; Cystinosis: Patient #1 Busulfan 'AUC 90'

Dashed Lines: Threshold levels for prophylactic supportive care in HSC Tx: ANC <0.5 x 10⁹ per liter (AABB); Platelets <10 X 10⁹ cells/L (AABB)

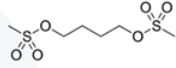
NOTE: Neutrophil counts - Cystinosis G-CSF administration post gene therapy: Pt 1: 5 Doses, Day 15 - 19; Fabry G-CSF administration post gene therapy: Pt 1: 7 Doses, Day 7 - 14, Pt 2: 11 Doses, Day 7 - 17, Pt 3: 6 Doses, Day 7 - 12, Pt 4: 5 Doses, Day 8 - 12

NOTE: Platelet counts - Cystinosis Platelet Transfusion: Pt 1: Day 17 & 18; Fabry Platelet Transfusion: Pt 1: Day 10; Pt 2, 3: Day 11, Pt 4: no transfusion

PRECISION CONDITIONING UPGRADE: Designed to access “hard-to-reach” compartments

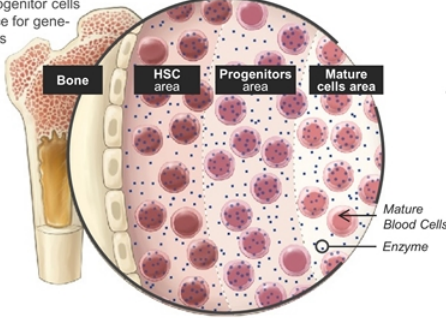
BRAIN

Busulfan crosses blood-brain barrier and eliminates resident microglia cells making space for gene-modified cells



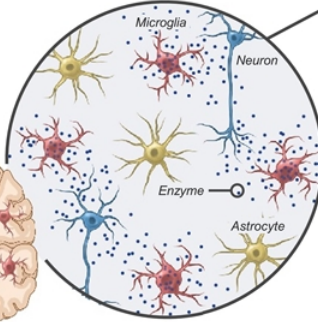
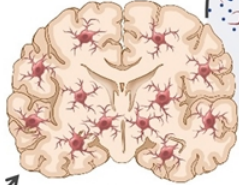
IN THE BONE MARROW

Busulfan eliminates hematopoietic (CD34+) stem and progenitor cells making space for gene-modified cells

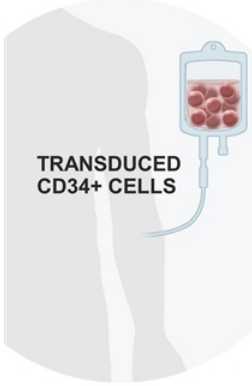
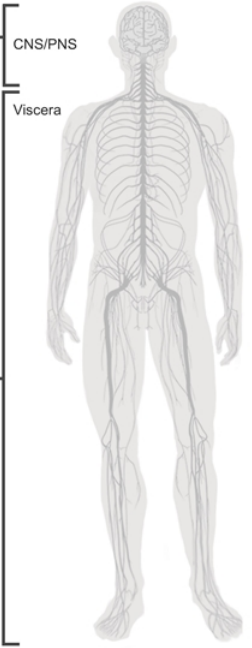
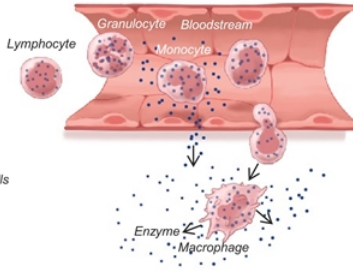


MICROGLIA

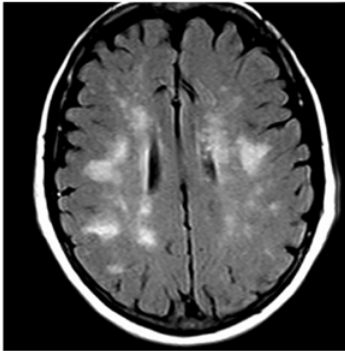
Potential for widespread microglia engraftment throughout the brain



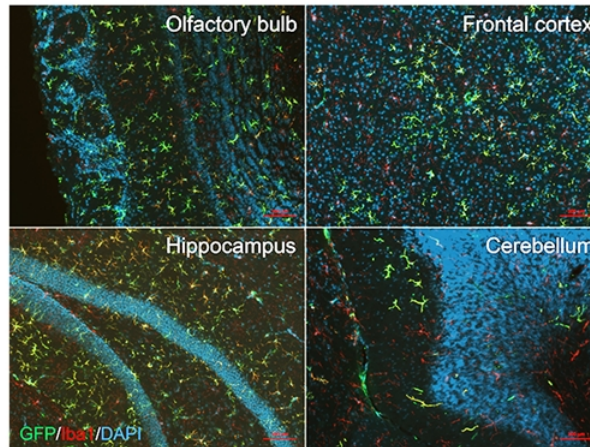
PERIPHERAL TISSUE



PRECISION CONDITIONING UPGRADE: Designed to access “hard-to-reach” compartments, including the brain



MRI: 54 year old with Fabry disease demonstrating white matter lesions (WMLs)



GFP: Marker of engrafted cells
Iba1: Marker of microglia cells
DAPI: Nuclear stain irrespective of cell type

Global microglial coverage of mouse brain at 4 months post gene-modified HSC transplantation

- Widespread engraftment in regions critical for cognitive, motor, olfactory, and visual function
- Engrafted microglia/microglia-like cells have comparable morphology and classical lineage markers with endogenous microglia

AUTOMATION UPGRADE:

Automated, scalable manufacturing system

Designed to elevate quality and overcome historic CMC bottlenecks



Expanded Scale

Potential to reach thousands of patients per year



Broader Reach

Portable platform designed for flexible global production using low grade clean rooms



High Quality

Automated, closed system designed to improve quality and consistency



Enhanced Convenience

Cryopreservation simplifies logistics and patient scheduling



Lower Costs

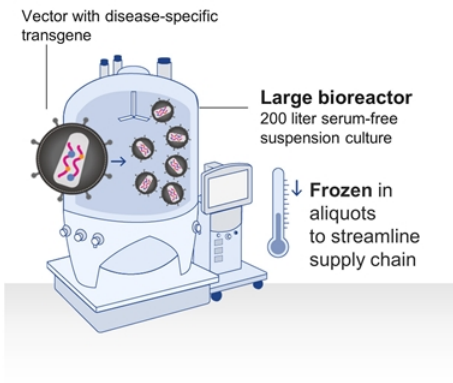
Designed to create efficiencies in vector design / scalable cell and vector production

AUTOMATION UPGRADE:
Designed to deliver large-scale manufacturing
Differentiated, cost-effective approach



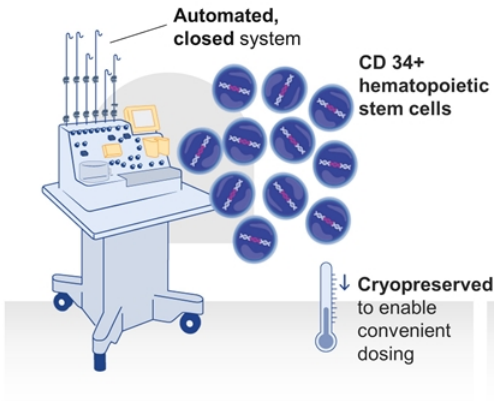
1 Vector production

HIGH VOLUME / TITRE



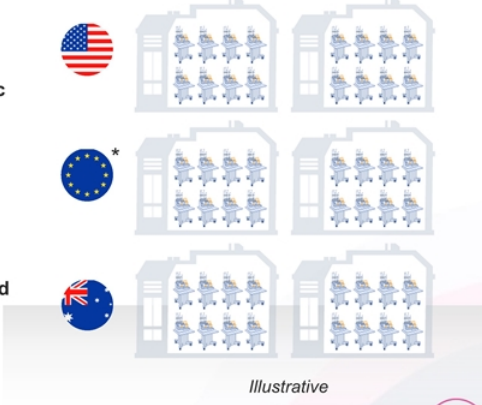
2 Drug product production

INCREASE CONSISTENCY



3 Scalable, global production suites

COST-EFFECTIVE SCALE-OUT



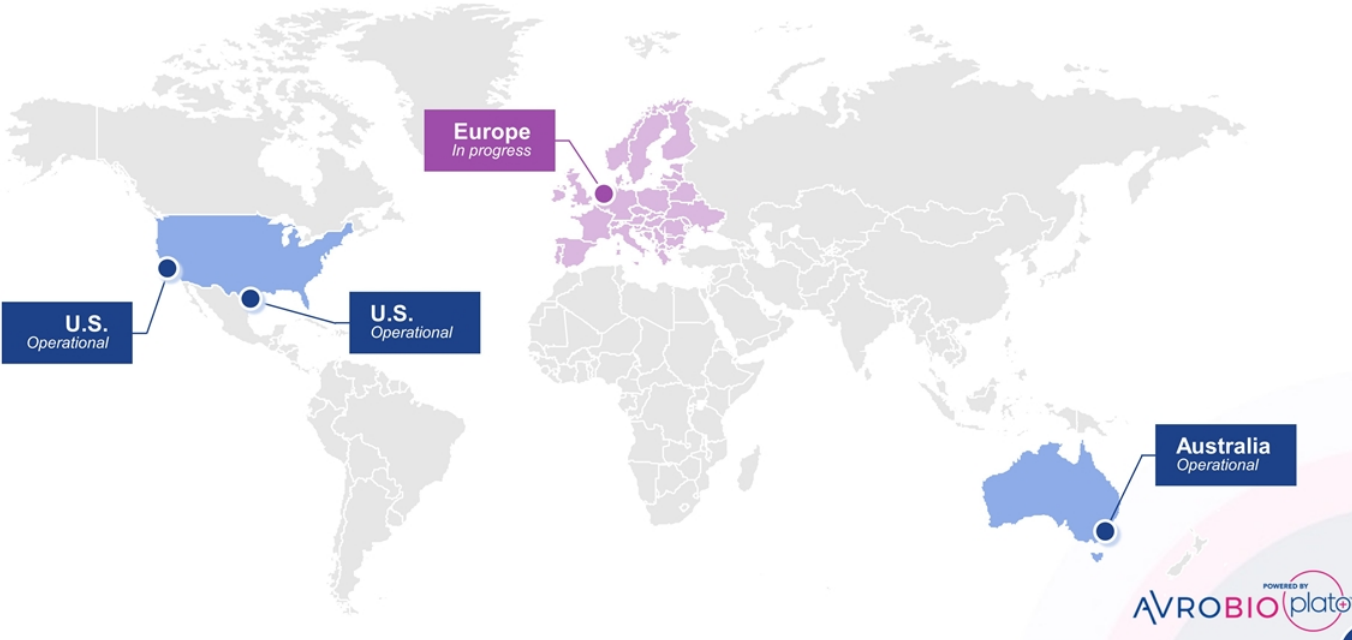
* European manufacturing capabilities planned for 2H 2020; manufacturing capabilities currently in place in U.S. & Australia



AUTOMATION UPGRADE:

Global manufacturing established

Automated systems operational in 3 sites with 4th in progress

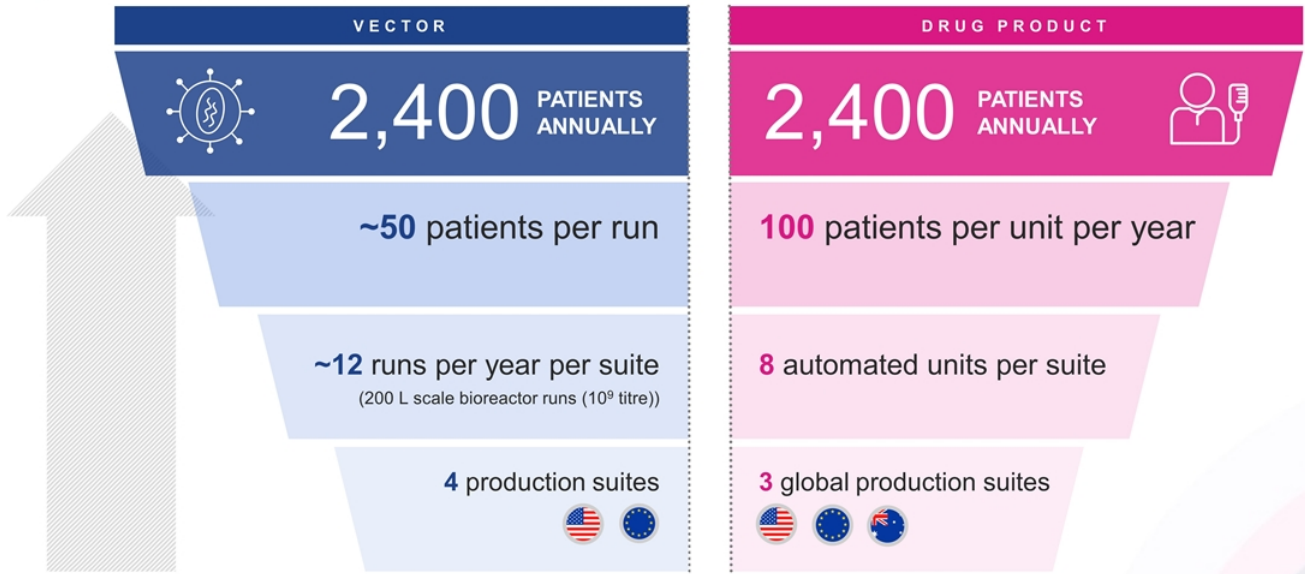


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AUTOMATION UPGRADE:

Poised to manufacture at scale

Designed to optimize potency and safety, and overcome historic CMC bottlenecks



Illustrative



3 UPGRADES IN PLACE:

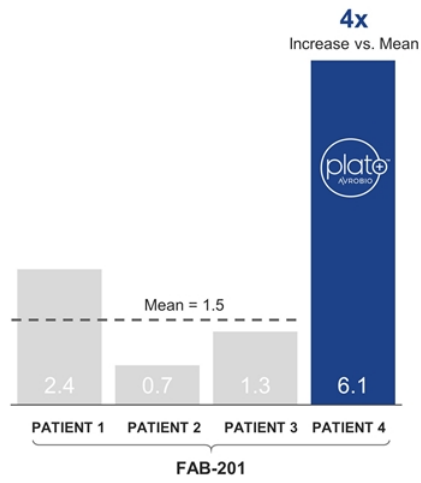
plato™ metric compared to academic process

FAB-201 ONE MONTH data for patient #4 with plato™ vs. patients #1-3



Plasma Enzyme Activity

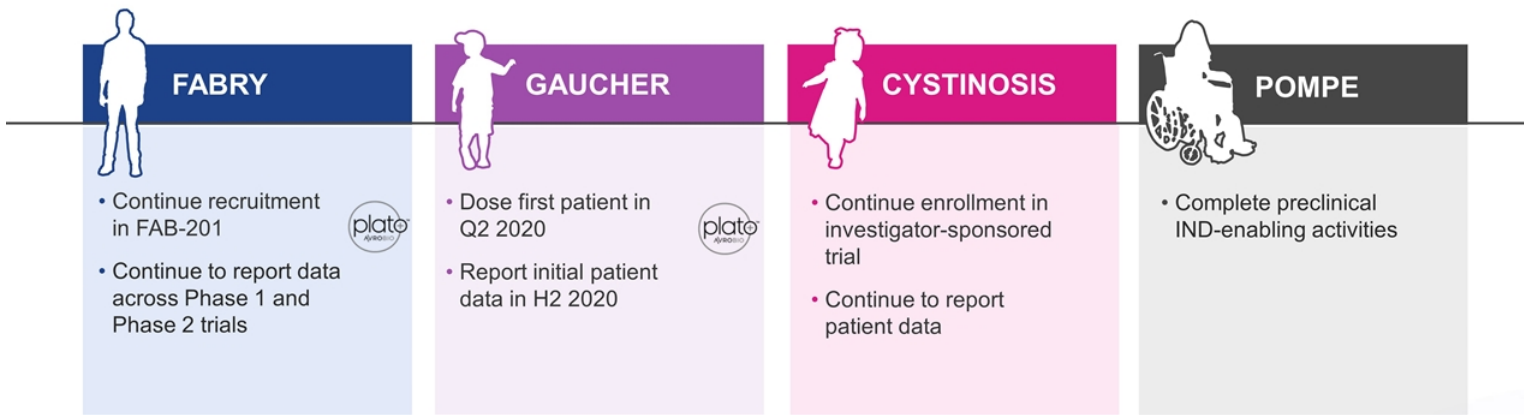
(nmol/hr/mL)





Milestones anticipated across the pipeline in 2020

Clinical activities and timelines subject in all respects to ongoing and evolving COVID-19 pandemic*



AVROBIO to hold first R&D Day in 2020

* For additional information, see the Company's Current Report on Form 8-K filed with the SEC on March 30, 2020, and the Company's risk factor related to COVID-19 in the Company's Annual Report on Form 10-K filed with the SEC on March 16, 2020.

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plato⁺™



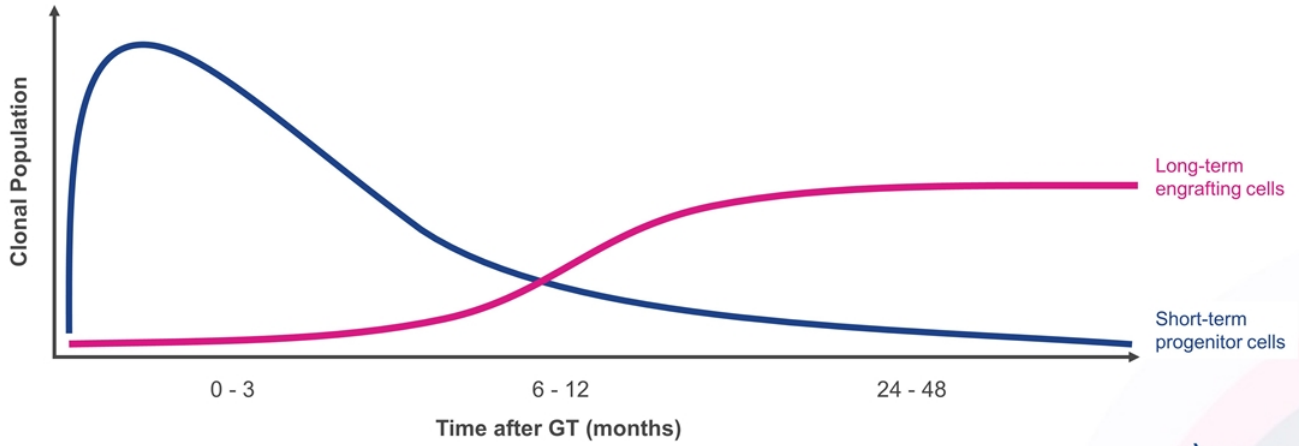


Appendix

Hematopoietic reconstitution occurs in two distinct phases

A few thousand long-term engrafting cells stably sustain levels of transgene product

First wave of short-term progenitor cells start to exhaust with progressive takeover by a smaller population of long-term engrafting cells



Source: Blasco L et al, Cell Stem Cell, 2016



Precedent for use of kidney biopsy data for FDA approval of drug candidate for Fabry disease

Migalastat approved on % reduction in GL-3 inclusions per KIC as compared to placebo



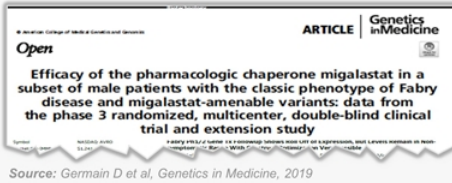
45 Amenable patients* (16 males / 29 females)

Group	Migalastat (BL -M6)	Placebo (BL -M6)
Males (N=16)	5/7 (71%) -1.19 (-1.94, -0.02)	4/9 (44%) -0.03 (-1.00, 1.69)
Patients with baseline GL-3 ≥ 0.3 (N=17; 9 males, 8 females)	7/9 (78%) -0.91 (-1.94, 0.19)	2/8 (25%) -0.02 (-1.00, 1.69)
Patients with baseline GL-3 < 0.3 (N=28; 7 males, 21 females)	6/16 (38%) -0.02 (-0.10, 0.26)	7/12 (58%) -0.05 (-0.16, 0.14)

7/9 males ≥ 50% reduction
(at 6 months from baseline)

Treatment Group	n	Baseline Median (min, max)	Month 6 Median (min, max)	Change from Baseline Median (min, max)
Average number of GL-3 inclusions per KIC (N=13)				
GalaFold	7	3.6 (0.2, 6.0)	2.6 (0.1, 6.0)	-0.7 (-1.7, 1.2)
Placebo	6	1.8 (0.1, 2.8)	2.0 (0.05, 4.3)	-0.04 (-0.5, 1.5)

28% average reduction
(at 6 months from baseline)



Classic Fabry patient level data

0-6 months randomized clinical trial and 6-12 months open label extension

	Male Patients with the Classic Phenotype													
	Migalastat (Months 0-24)							Placebo (Months 0-6) → Migalastat (Months 6-24)						
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14
PTC GL-3 inclusions at BL	0.16	0.03	n/a	5.69	1.22	n/a	2.88	2.41	1.55	0.16	0.03	0.11	0.94	0.88
Change in PTC GL-3 inclusions from BL to M6	-0.08	0.01	n/a	-1.77	-1.10	n/a	-1.25	1.21	-0.21	0.01	0.09	-0.07	1.94	-0.83
Change in PTC GL-3 inclusions from BL/M6 to M12	-0.12	n/a	n/a	-1.92	n/a	n/a	-0.81	-0.94	-1.13	-0.09	-0.05	n/a	-2.28	0.06

46% average reduction
(average of patients with 12 month data)

- Classic Fabry disease (AGA activity <1%)
- NOTE: For informational purposes; differences exist between trial designs and subject populations; AVROBIO has not conducted any head-to-head trials comparing migalastat to AVR-RD-01

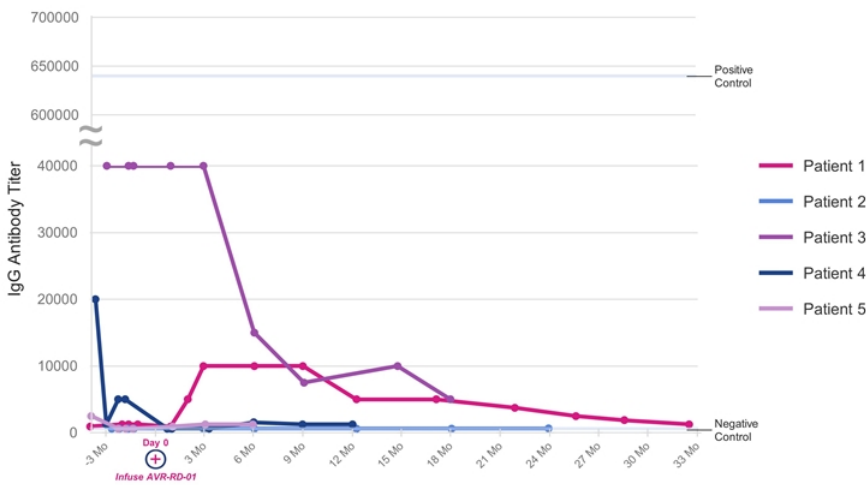




Reduction of pre-existing anti-ERT drug IgG antibodies following AVR-RD-01

Suggests potential as a therapeutic option independent of pre-existing antibodies

Fabry Disease Phase 1 IgG Antibody Titer



ERT: Enzyme Replacement Therapy; IgG: Immunoglobulin G; MPS-1: Mucopolysaccharidosis Type 1; IDUA: Iduronidase; SR-TIGET: San Raffaele Telethon Institute for Gene Therapy; LV: Lentiviral; rhIDUA: Recombinant Human alpha-L-Iduronidase

Similar Results Observed in Other Studies

San Raffaele Telethon Institute for Gene Therapy (SR-TIGET)

Change in pre-existing antibodies reported for Hurler disease (MPS-1)

- Ex vivo LV-CD34+ gene therapy with conditioning
- N = 6
- Evaluable patients (5/6) demonstrated sustained, supraphysiologic blood IDUA activity
- 4/5 prior ERT (rhIDUA) exposure (5-28 months)
- 4/5 pre-existing ERT-induced IgG antibodies
- 6/6 anti-rhIDUA IgGs undetectable 2 months post gene therapy

Source: Gentner B et al., Blood, 2019