

**Fiscal Year 2020 written testimony of
Daniel Paul Perez, Co-founder, FSH Society before
U.S. Senate Appropriations Subcommittee on Labor, HHS, Education and Related
Agencies for U.S. DHHS National Institutes of Health (NIH) funds
for \$40 million towards research grants and programs on
facioscapulohumeral muscular dystrophy (FSHD) June 3, 2019**

Agency: National Institutes of Health (NIH) and other federal agencies as appropriate. FY2020 report language: Scientific opportunities alongside community research defined priorities in facioscapulohumeral disease (FSHD) call for far more funding on the disorder. The Committee strongly encourages the NIH to increase its FSHD grant portfolio to at least \$40 million for basic and exploratory research and clinical trials readiness efforts.

Honorable Chairman Blunt, Ranking Member Murray, and distinguished members of the Subcommittee, thank you for the opportunity to testify.

Facioscapulohumeral Disease (FSHD) is a heritable disease and one of the most common neuromuscular disorders with a prevalence of 1:8,000.¹ It affects 934,000 children and adults of both sexes worldwide. FSHD is characterized by progressive loss of muscle strength that is asymmetric and widely variable. Muscle weakness typically starts at the face, shoulder girdle and upper arms, often progressing to the legs, torso and other muscles. In addition to affecting muscle it can bring with it breathing issues, hearing loss, eye problems and cardiac arrhythmias. FSHD causes significant disability and death.

FSHD is associated with epigenetic changes at chromosome 4q35 in the D4Z4 DNA macrosatellite repeat array region leading to an inappropriate gain of expression (function) of the D4Z4-embedded double homeobox 4 (DUX4) gene². DUX4 is a transcription factor that kick starts the embryonic genome during the 2- to 8-cell stage of development³⁻⁵. Ectopic expression of DUX4 in skeletal muscle leads to muscle death. DUX4 is never expressed in ‘healthy’ muscle. FSHD has had few clinical trials⁶⁻¹⁰, and currently there is no cure or therapeutic option available to patients. DUX4 requires and needs to activate its direct transcriptional targets for DUX4-induced gene aberration and muscle toxicity¹¹⁻²⁴. Blocking DUX4’s ability to activate its targets has profound therapeutic relevance²⁵.

NIH-supported basic research on muscle disease and muscular dystrophy over the past 25 years has improved health outcomes. Small molecule and genetically engineered therapies are now in the works for FSHD and on the market for several neuromuscular diseases!²⁶⁻³² Each year, the non-profit, private and public investment in research yields critical advances in FSHD. Together we foster new treatments, diagnostics, and intervention strategies that affect the health of our nation. Meticulous efforts by FSHD researchers/clinicians working with funding from FSH Society, the NIH and others have brought forth significant advancements in epigenetic diseases. FSHD is the only human disease known to be caused by the contraction of repetitive “junk” DNA. The Society has funded approximately \$11 million in seed grants for research.

Let me now turn your attention to how together we can contain health care costs and improve outcomes via three initiatives: the FSH Society Industry Collaborative Workshop (hereafter

called '*FSHS NIH/FDA Collaborative*'), the NIH supported FSH Society annual International Research Congress (hereafter called '*FSHS NIH IRC*') and the *NIH Action Plan for the Muscular Dystrophies* (hereafter called '*DHHS NIH MD Plan*') (See https://mdcc.nih.gov/Action_Plan).

On March 12, 2019, in Silver Spring, the *FSHS NIH/FDA Collaborative* assembled 10 academic thought leaders, 17 industry representatives (8 companies), 5 NIH officers and scientists (EP/IP: NCATS, NIAMS, NINDS), 6 FDA scientists and regulators (CDER, CBER, DNP), and 9 patient advocates and organizations to discuss clinical trial readiness and accelerated approval process for therapies. We assessed disease tractability in four directions: natural history^{33 34}, pharmacodynamic biomarkers^{36 37}, imaging biomarkers^{37 38 39}, and clinical trial design/readiness^{40 41 42}. A journal publication/manuscript (in process) will detail roadblocks that need rapid mitigation in seven areas: diagnostics, molecular biomarkers, imaging biomarkers, functional outcome measures, patient reported outcomes, biorepository and animal models.

In June 2018, over 135 researchers from around the world gathered at the *FSHS NIH IRC* meeting, co-funded by the U.S. DHHS NIH, in Las Vegas to present the latest data and discuss research strategies. The FSHD scientific community listed 2019-2020 priorities as:

Table II. 2019 IRC Research Priorities (Source: <https://www.fshsociety.org/events/international-research-conference/> for full version)

1. Therapeutics

Therapeutics Trial Toolkit, including biological biomarkers, imaging markers, and clinical outcome assessments;
Non-DUX4-centric therapies that ameliorate some of the major pathological drivers in FSHD, and/or augment muscle repair;

2. Pathophysiology

Pathophysiology, such as the role of DUX4 in fibrosis, inflammatory infiltrates, and fatty infiltration; temporal analysis of disease models; and novel model systems;

3. Molecular Mechanisms

Molecular mechanisms of DUX4 pathology and function;

4. Genetics and Epigenetics

Genetics and epigenetics around harmonizing diagnostics, disease continuum and genotyping, and understanding genetic modifiers and drivers of genetic variability.

Last, but not least, this Subcommittee and **Congress in partnership with NIH, patients and scientists have made truly outstanding progress in understanding and treating the nine major types of muscular dystrophy through the** Muscular Dystrophy Community Assistance, Research and Education Amendments of 2001 (MD-CARE Act, Public Law 107-84). The federal advisory committee mandated by MD CARE Act, called the MDCC, along with working groups of outside scientific experts in the field assembled the '*2015 NIH Action Plan for the Muscular Dystrophies*.' It was presented by the Director of NIH to Congress. It specifies 81 objectives, in six sections (mechanism, screening, treatments, trial readiness, access to care, infrastructure including workforce) in need of funding and further development.⁴³ The genetics that give rise to FSHD are so remarkable, NIH Director Dr. Francis Collins emphasized its significance on the front page of the *New York Times*, saying "If we were thinking of a collection of the genome's greatest hits, this [FSHD] would go on the list."⁴⁴ We understand this Subcommittee seeks evidence of translating research spending into tangible improvement in health status and patient care. The *FSHS NIH/FDA Collaborative*, '*FSHS NIH IRC*' and the

‘*DHHS NIH MD Plan*’ demonstrate the solid gains and show the rate of change in care.

Honorable Chairman, these advances in scientific understanding and epidemiological surveillance come at a significant cost. Since passing the MD CARE Act in 2001, NIH funding for FSHD has been unbalanced given the growth in discoveries and needs to be set right.

FSHD Research Dollars (in millions) & FSHD as a Percentage of Total NIH Muscular Dystrophy Funding
Sources: NIH/OD Budget Office & NIH OCPL & NIH RePORT RCDC (e=estimate, a=actual)

Fiscal Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
All MD (\$ millions)	\$47.2	\$56	\$83	\$86	\$75	\$75	\$76	\$78	\$77	\$79	\$81	\$85ea	\$80e
FSHD (\$ millions)	\$3	\$3	\$5	\$6	\$6	\$5	\$5	\$7	\$8	\$9	\$12.8	\$13.7a	\$17a
FSHD (% total MD)	5%	5%	6%	7%	8%	7%	7%	9%	10%	11%	16%	16%	21%

The NIH is the principal worldwide source of funding of research on FSHD. Currently active projects are \$17.037 million FY2019 (actual), a portion of the estimated \$80 million spent on all muscular dystrophies. FY2019 projects cover 1 F31, 1 K22, 1 K23, 13 R01, 1 R13, 4 R21, 1 P01, 4 P50, 3 U01, 1 ZIC grants. There are 30 active projects NIH-wide totaling \$17.037 million as of March 21, 2019, versus 28 active projects NIH-wide totaling \$13.654 million as of April 18, 2018; and 28 active projects NIH-wide totaling \$12.751 million as of March 3, 2017. (source: NIH Research Portfolio Online Reporting Tools (RePORT) keyword ‘FSHD or facioscapulohumeral or landouzy-dejerine’).

Without research on muscle disease, supported by the FSHD patient-advocacy groups in concert with the NIH biomedical research funding -- families with FSHD would be living shorter, less productive, and far less hopeful lives. Nearly 41,000 Americans have FSHD, a disease that can cause damage to skeletal muscle, hearing, vision, breathing and lead to death.

What we need. Viewing at the current portfolio alongside the areas in need of bolstering in FSHD the NIH needs to fast expand its portfolio. Specifically, NIH needs to increase funding by adding R01 and R21 style grants in areas outlined by hundreds of experts in the *FSHS NIH/FDA Collaborative*, the *FSHS NIH IRC* and the *DHHS NIH MD Plan*. The engine of federal research runs on the basic building blocks of workforce training, exploratory/developmental research grants (parent R21) and research project grants (parent R01). NIH can issue targeted funding announcements covering FSHD. A request for applications (RFA) on FSHD will yield results. These efforts will help convey to FSHD patients and allied researchers that NIH encourages more grant applications coming through its front door.

We request for FY2020, a doubling of the NIH FSHD research portfolio to \$40 million. We are very appreciative of the slow but steady year-to-year increases and thank NIH and Congress. At this moment in time, FSHD needs an infusion of NIH grants both submitted and funded -- investments in centers, collaborative research grants – and, most importantly, a rapid ramp up of basic/exploratory, preclinical and therapeutic research awards along with moderate expansion of post-doctoral and clinical training fellowships. FSHD research calls for and needs this additional funding in order to succeed. Honorable Chairman, thank you again for your help and efforts.

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