[EXTERNAL]

--- Today's Date ---

07/14/2025

--- Name of 501(c)(3) Organization ---

Grayson Jockey Club Research Foundation

--- Federal Tax-Exempt ID# ---

61-6031750

--- Year Established ---

1940

--- Amount Requested ---

18,629

--- Name of Executive Director ---

Jamie Haydon

--- Mailing Address ---

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Lexington, KY

40503

US

--- Email address ---

hwhite@jockeyclub.com

--- Work Phone # ---

+15857399676

--- Organization's website ---

<https://www.grayson-jockeyclub.org/default.asp>

--- Upload all supporting documents required for your application and your organization’s most recent filed IRS Financial Statements (#990): ---

<https://www.terfusa.org/wp-content/uploads/wpforms/809-a07c4cb3463c1ac16da216b7fda5277e/2023-990-31357084fd63f531750ef1cf61c3b359.pdf>

--- 1. Brief mission statement and describe the distinguishing features of your organization that supports the mission of TERF and the relevance to this proposal. ---

Grayson-Jockey Club Research Foundation exists solely to fund veterinary research beneficial to promoting the health and soundness of horses.

--- 2. Briefly outline 3-5 goals for the requested funds and how these goals support your mission. ---

1: This research is important because, SDFT injuries continue to be a common cause of wastage in Thoroughbred racehorses. Although cumulative microdamage (chronic damage to the tendon microstructure) pathogenesis leads to clinical SDFT injury, mechanisms responsible tendon injury are largely unknown. At present, ex-vivo destructive tendon mechanical testing remains the gold standard method to understand tendon tensile properties and tendon injury development.

2: Constructing a non-invasive computational technique that considers SDFT’s complex hierarchical structure and non-uniform matrix composition, will be invaluable to gain insights on tendon microdamage and injury development mechanisms. This research will address this unmet clinical, and research need by constructing multi-scale finite element models (FEM) representing the complex hierarchical structure ECM composition and study equine SDFT mechanical behavior, for which currently there is no information.

3: This computational methodology (that has been beneficial to understand bone fracture risk and predilection sites) holds the potential for combining with magnetic resonance-based fiber tractography and enable functional tendon imaging efforts. This research builds on our (1) prior GJCRF-funded research and (2) laboratory’s overarching goal of understanding tendon microdamage mechanisms causing Thoroughbred racehorse SDFT injuries. The ability to predict SDFT mechanical behavior through FEM (1) will pave the way for equine distal limb dynamic modeling and subsequently be beneficial for reducing injury incidence and associated economic losses, (2) can evaluate the efficacy of novel and existing tendon therapeutics, and (3) improve tendon rehabilitation strategies.

4: With Multi-scale finite element models (FEM) that predict equine superficial digital flexor tendon (SDFT) mechanical behavior are essential to delineate microdamage mechanisms preceding clinical injury.

--- 3. Provide a detailed description of the proposed project, how it is related to the mission of TERF and how it will impact the health and welfare of the horse. (Note: research applications should be understandable to a non-scientific audience and include sufficient detail and rigor for the scientific reviewers.) ---

Superficial digital flexor tendon (SDFT) injuries are common career-ending injuries in racehorses; are due to tendon overstrain from cumulative damage to tendon microstructure (microdamage). The elastic strength of equine SDFT is mainly due to the sliding motion between type I collagen-rich fascicles that are separated and connected by elastin-rich interfascicular matrix (IFM). This complex hierarchical structure as well as the non-uniform matrix distribution in the fascicles and IFM impart SDFT its elastic strength. Even though cumulative microdamage has been linked to SDFT injuries, the precise changes at the tendon fascicle-IFM and collagen-elastin levels are largely unknown. Our prior GJCRF-funded research has demonstrated that fascicle size decreased and IFM thickness increased in 3-year-old Thoroughbred racehorses compared to 2-year-olds in response to athletic training; tendon tensile strength increased even though IFM elastin decreased. These findings provide a strong premise to develop noninvasive tools to study tendon microdamage and for gaining insight on tendon injury mechanisms, since, at present, destructive methods like ex-vivo tensile mechanical testing remain the gold standard means to understand tendon loading. For finite element analysis (FEA), any given structure is segregated into smaller, simple, interconnected structures, each with assigned mechanical properties. We will leverage our expertise in fascicle, IFM and whole tendon histomorphology and experimental tendon mechanics to develop computational finite element models (FEM) that can predict equine SDFT mechanical behavior. Equine bone FEM have proven to be useful to understand distal third metacarpal bone and P1 fracture predilection sites as well as determine load-induced risk factors for fracture. To date, finite element analyses (FEA) of equine tendon have not been conducted; specifically, multi-scale FEM that take into account the complex SDFT hierarchical structure and its non-uniform ECM composition will facilitate evaluation of SDFT internal loading as it is difficult to measure in-vivo.

Fresh cadaveric metacarpal SDFT will be used for the proposed foundational equine SDFT FEA. Intact and elastase-digested specimens will be used to parse out the contributions of collagen and elastin to tendon function. In AIM 1, the dimensions, and tensile properties of fascicles and IFM measured via confocal histology and tensile testing, respectively, will be used to construct fascicle and IFM FEM such that stress-strain properties can be calculated. These results will be used to develop non-uniform constitutive models that consider both the fascicles and the IFM. Such a model would account for the tendon''''s tensile and recoil

(elastic) properties, providing a more comprehensive representation of SDFT load bearing function. In AIM 2, the entire SDFT (quantified via MRI and 3D scan) will be used to estimate fascicle and IFM directionality and construct a multi-scale FEM through optimization methods while also measuring fascicle-IFM frictional properties. A few published human Achilles tendon FEM describe simple models that only account for the collagen fibers or rely on macro models that predict muscle to tendon force transfer.

Therefore, this research proposes FE² (Finite Element squared) method where this multi-disciplinary team will use advanced multiscale models to determine how interactions between fascicles and the IFM influence SDFT mechanics. This foundational FEA are vital not only for further research investigating how SDFT micro- and macro-damage can impact tendon tensile strength, but also for evaluating the efficacy of tendon therapeutics and improve tendon rehabilitation strategies

--- 4. Provide a timeline detailing the expected progress of the project and specific milestones. ---

Time Line for Investigation

Year 1

Mar: Awards Announced

Apr: SDFT tendon harvest, MRI Isolate fascicle, IFM Begin FEA and modeling from collected tensile tests

May: Assess SDFT histology, isolate fascicle- IFM Optimize elastase- digestion Begin tensile testing of intact fasicle-IFM

June: SDFT tendon harvest, MRI (complete n=4) Fascicle IFM Whole tendon tensile testing

Jul: Optimize and standardize fascicle and IFM FEA Elastin quantification and immunofluore scnece for elastase digestion

Aug: (8/1) 2nd of three funding installments Optimize and standardize fascicle and IFM FEA distal limb MRI

Sep: Fascicle IFM Whole tendon tensile testing Elastin quantification IFM elastin immunofluore scnece

Oct: Optimize and standardize fascicle and IFM FEA Optimize and standardize whole SDFT FEA SDFT histology

Nov: (11/1) 1st year report due, 3rd of three funding installments FEA from n=3 intact fascicle- IFM, whole SDFT

Dec: FEA from n=3 elastase- digested intact fascicle- IFM, whole SDFT SDFT histology distal limb MRI

Year 2

Jan: FEA from n=3 elastase- digested intact fascicle- IFM, whole SDFT distal limb MRI

Feb: FEA from n=4 intact fascicle- IFM, whole SDFT Finalize SDFT histology data distal limb MRI

Mar: (3/1) Progress report due on Two-year grants Stats on FEA from n=4 intact fascicle- IFM, whole SDFT

Apr: SDFT tendon harvest, MRI (complete n=6- 8) Stats on FEA from n=4 intact fascicle- IFM, whole SDFT

May: Complete all tensile tendon testing experiments at VORL Submit ACVS abstract

June: Complete data analyses for n=4 intact and elastase- digested fascicle IFM specimens

Jul: Complete data analyses for n=4 intact and elastase- digested whole tendon specimens

Aug: (8/1) Abstracts 2-year grants, Manuscript due 1-year grants, 2nd of three funding installments

Sept: Prepare manuscript for FEM model development for equine SDFT fascicle and IFM

Oct: Complete all tensile testing experiments Determine if additional SDFT samples will be needed Submit VOS abstract

Nov: (11/1) 1st year report due, 3rd of three funding installments

Year 3

Feb: Complete data analyses for n=8 intact and elastase- digested fascicle IFM specimens

Apr: Complete data analyses for n=8 intact and elastase- digested whole tendon specimens

Aug: (8/1) Abstracts 2-year grants, Manuscript due 1-year grants

Year 4

Aug: (8/1) Manuscript due 2-year grants

--- 5. Provide a detailed budget for the projected use of the funds. (Note: no funds will be provided for administrative overhead or capital spending; TERF reserves the right to modify funding based on Foundation requirements). Attach budget to submitted proposal as needed. ---

AMOUNT REQUESTED:

1st YEAR: $78,246 2nd YEAR: $18,629 TOTAL FUNDS: $96,875

--- 6. Provide a list of all other sources of funding and the amount(s) received. ---

The balance of the project will be fulfilled through donor funded dollars, Grayson has secured through private donors, family foundations, corporate partners and grants.

--- 7. Briefly summarize your charity's past public education and research efforts. ---

Please follow this link to our 2024 Awareness Guide: <https://www.grayson-jockeyclub.org/resources/2024Media.pdf>

--- 8. If you received funding from TERF previously, describe how these funds were used and outcomes achieved. Include any relevant publicity your charity received relating to the funding. (i.e.: media coverage, such as news articles, scientific publications, provide links to copies, as appropriate). ---

Please fine the publication of your previously funded research by Sue Stove on Motion of the proximal sesamoid bones on uneven footing - <https://www.vetmed.ucdavis.edu/sites/g/files/dgvnsk491/files/inline-files/ShafferMotionsPSBsfractureconfigurationsJBiomech2022.pdf>

--- 9. List other organizations or major contributors that have provided funding to your organization in the last calendar/fiscal year. For research grant applications, provide a list of all current funding relating to your current proposal. ---

John William Pope Foundation

Jacqueline B. Mars

Robert T. Manfuso

Mrs. Joseph V. Shields Jr.

Spendthrift Farm

The McMichael Family Foundation

Great American Insurance

Mr. & Mrs. John M.B. O'Connor

Isabelle H. de Tomaso

Lucy Y. Hamilton

Klein Family Foundation

Mr. & Mrs. Michael Simpson

Vincent Viola

Jockeys' Check-Off Program

Elizabeth Locke Jewels

Bourbon County Equine Festival Inc

Austin Lang Testamentary Trust

Joseph Allen

Barbara Banke

Ramona & Lee Bass

Peter Brant

Jeffrey Brodsky

Alexander G. Campbell Jr.

Celeste M. Neuman Foundation at Blue Grass Community Found.

Adele B. Dilschneider

Donald R. & Irene Dizney

Mr. & Mrs. Bertram R. Firestone

Hugh A. Fitzsimons Jr.

Hagyard Equine Medical Institute

Dell Hancock

Mr. & Mrs. Seth W. Hancock

Ian Highet

Mr. & Mrs. Summerfield K. Johnston Jr.

Sen. & Mrs. John Magnier

Robert E. Meyerhoff

Mt. Brilliant Family Foundation

Oak Tree Racing Association

Oaklawn Jockey Club

Mr. & Mrs. Paul F. Oreffice

Audrey W. Otto

John C. Oxley

Dr. Hiram C. Polk Jr.

Carl Pollard

Rood & Riddle Equine Hospital

Richard & Peggy Santulli

Mr. & Mrs. Barry Schwartz

Summer Wind Equine

Tampa Bay Downs

Taylor Made Sales Agency

The Perry R. Bass II Foundation

Vincent Viola

Charlotte C. Weber

William M. Backer Foundation

Woodland Foundation

Thomas W. Bachman

Everett Dobson

Miller Charitable Lead Annuity Trust

R. Alex Rankin

--- 10. Name a responsible person with whom TERF may communicate regarding specific questions and who will be responsible for follow-up information regarding the project. ---

Holly White

--- 11. Provide appropriate references to support the proposed research. ---

"This project is potentially ground breaking if successful. We have produced many finite element models of bone structures and associated problems, however soft tissue, such as tendons present a challenge. As with other finite element models, this would accelerate studies of soft tissue problems by allowing in vitro replication of conditions being researched".

Please feel free to contact us if you would like to discuss this project further or see the entirety of the grant details.

Johnny Mac Smith D.V.M.

Veterinary Consultant – A. Gary Lavin Research Chair Grayson Jockey Club Research Foundation jsmith@jockeyclub.com

859-224-2850

Cell 859-361-1351

--- 12. How many Executive Staff and Board of Directors does your organization have? ---

24

--- 1. Name - Job Title ---

Jamie Haydon, President, Administrator and Fund Raising

--- 1. Salary ---

see 990

--- 1. Duties ---

Execute all activities, including interfacing with chairman and other board members to plan and implement short- and long-term strategies for the foundation and assess those strategies to ensure they are in support of the foundation’s mission statement. Develop and manage the foundation’s operating budget. Provide leadership for the foundation and oversee the foundation’s operations to ensure goals are met in support of the foundation’s business plan.

--- 2. Name - Job Title ---

Dr. Johnny Mac Smith, A. Gary Lavin Research Chair

--- 2. Salary ---

see 990

--- 2. Duties ---

Execute all activities of the Research Advisory Committee, including determining composite reviewer, designing primary review teams, determining conflicts, enforcing reviewer deadlines, identifying ad-hoc reviewers, and recruiting and orienting new members. Assist RAC chairman in presentation of recommended research projects to the board. Upon approval of funding, collect all final paperwork including the IACUC permit, track each of the grants including the collection of first-year reports, manuscripts, abstracts, and all published peer reviewed journals featuring Grayson-funded research.

--- 3. Name - Job Title ---

Holly White, Director of Development

--- 3. Salary ---

see 990

--- 3. Duties ---

Responsible for the vision, development and implementation of all fundraising initiatives, including developing and managing marketing/solicitation plans and collateral, online marketing solicitations and stewardship and donor recognition, grant writing and corporate partnerships, developing and managing volunteer structures and integrating the Grayson brand into external events and programs whenever possible.

--- 4. Name - Job Title ---

Resia Ayres, Operations Manager

--- 4. Salary ---

see 990

--- 4. Duties ---

Execute all activities related to the production of foundation promotional items, including website maintenance, brochures, annual reports, newsletters, stewardship mailings, email and social campaigns, signage, and other promotional and educational materials. Also, maintain database donor information and all foundation bookkeeping activities.

--- 14. Add additional Information and Notes: ---

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