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Department of Mathematics and Statistics
University of New Mexico

Committee Member,

I aim to enroll at University of New Mexico to become quantitatively literate. J. Lorenz's work in fluid mechanics and A. Korotkevich's simulation of dynamic gas flow motivates this application. At UNM, I would design and implement numerical methods to model ground water and aquifers. I intend to defend these methods in a master's thesis. Upon attainment of an M.S., I plan to complete a Ph.D. and enter industry.

Here are two rough descriptions of my research interest.

**Sediment Transport** In Idaho's Treasure Valley, farmers use a network of reservoirs and canals to suspend and divert the Boise river. To understand how this irrigation regime sweeps up and transports material, I would model water's energy in flood irrigated fields. Constrained by agricultural machinery and topography, I would search for furrow patterns that minimize water's turbidity. As a related project, I would consider canal geometries that interrupt high-velocity flows.

**Ground Water Contamination** The Army's vacillation over the Dakota Access Pipeline pushes me to research contaminant diffusion. Were I to contribute to an environmental impact statement, I would (i) model geomorphic stress on the pipeline and (ii) consider the effects of a leak in regions of stress. I imagine the first item, characterizing tension in surrounding media, to be accessible as an inverse problem. I would approach the second, modeling diffusion, with a modified finite element method.

I share two examples of my relevant research experience.

**Galois Theory & Fuchsian Equations** Following Michio Kuga's analysis of Fuchsian-type differential equations, I parameterized the solution space of the hypergeometric equation. For interesting cases, I found the monodromy representation at singular points. I presented my method, its history and a potential application to fluid flow at The College of Idaho's 2016 student research conference.

**Igneous Dikes in Scotland** Relying on N. L. Bowen's *The Evolution of the Igneous Rocks*, I modeled the cooling of plagioclase feldspar magma. I proposed that my geology abroad group in Scotland visit Glen Sligachan, a significant site for Bowen's field observations. On June 4$^{th}$, noticing rough shards of buoyantly exposed olivine lodged within dense clusters of plagioclase crystals, we validated Bowen's hypothesis that molten plagioclase carried partially solidified mafic minerals into the crust.

I am now a medical care intern at a resettlement office in Houston. I work on a small team to support refugees with complex medical conditions. In this work, I help limited English proficiency clients navigate one of the nation's densest health-care bureaucracies, I coordinate health plans to ensure coverage of medical services, and I accompany clients to safety nets (e.g., shelters and food pantries) in emergency situations.

However, my heart's work is empirical, not service-oriented. Keeping in mind that "we can … only augur well for the sciences when the ascent [proceeds] by a true scale and successive steps, without interruption or breach, from particulars,"[1] I am ready to endure the rigors of graduate study. Eventually, I hope to have some serious ecological impact by attacking water use controversies with numerical methods.

I would contribute formidably to your program. Thank you for your consideration.

Respectfully,
Colton Grainger

1. Francis Bacon. *Novum Organum*. Sec. I, para. 104