

SHAINA KELLY, Ph.D.

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📍 New York, NY

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Geoscientist and engineer specialized in fluid flow in porous media mechanisms and nanoscale phenomena.

OBJECTIVE

Advancing transport in porous media characterization and technologies to address the fundamental fluid storage and deliverability challenges facing sustainable subsurface energy and decarbonization operations.

RESEARCH INTERESTS

Subjects:

- Transport phenomena in porous media (geologic and engineered materials), system heterogeneity
- Multiphase fluid dynamics
- Interfacial Phenomena

Methods:

- Core/sample analysis laboratory techniques
- Optical and electron microscopy, image analysis

- Microfluidics and nanofluidics

- Computational fluid dynamics (CFD), digital twins

Applications:

- Carbon capture and storage (CCS)
- Sustainable oil and gas recovery
- Sustainable water use and treatment
- Enhanced geothermal systems
- Hydrogen storage

EDUCATION

The University of Texas at Austin, Austin, TX

Ph.D. in Petroleum and Geosystems Engineering, December 2015

M.S.E. in Petroleum and Geosystems Engineering

Co-Advisors: Dr. Carlos Torres-Verdín and Dr. Matthew Balhoff

GPA: 3.77/4.00

The University of Florida, Gainesville, FL

B.Sc. in Environmental Engineering, May 2011

Minor in Business Administration

GPA: 3.72/4.00

Selected coursework: Transport Phenomena, Fluid Flow and Heat Transfer (Chemical Engineering Dept.), Engineering Analysis, Advanced Thermodynamics and Phase Behavior, Advanced Petrophysics, Numerical Simulation of Reservoirs, Advanced Well Logging, Geological Concepts for Engineers, Advanced Reservoir Engineering, Advanced Production Engineering, Electron Microbeam Techniques, Environmental Physical Organic Chemistry, Public Health Engineering, Engineering a Sustainable Future, Water Chemistry, Surface Hydrology, Water/Wastewater Treatment, Wastewater Microbiology, Advanced Air Pollution Control Design

DISSERTATION

Topic: "Using nanofluidics and microscopy to study unconventional pore-scale transport phenomena"

Digital copy: <https://repositories.lib.utexas.edu/handle/2152/33376>

Summary: This work covers nanofluidic imbibition experiments in varied nanochannels and nano-networks, the fabrication of those devices, and corresponding methods that enable quantification of transport variables under nano-confinement. Phenomenological models were derived to scale the findings in terms of engineering variables such as effective pore diameter, viscosity and diffusivity for tight rock energy production and storage.

PROFESSIONAL EXPERIENCE

Academic Appointments and Industry Research & Development

Columbia University | New York, NY

July 2022-Present

Assistant Professor – Earth and Environmental Engineering

Responsible for managing the Kelly Lab research group and teaching in the Department of Earth and Environmental Engineering, Fu Foundation School of Engineering and Applied Science

AquaNRG Consulting Inc. | Houston, TX

March 2021-June 2022

Senior Geoscience Engineer – Environmental and Energy Technology

Responsible for advancing the engineering and business functionality of reactive transport modeling technologies for oil & gas, CCS, geothermal, hydrogen storage, mining, and nuclear waste storage clients.

- Designed product validation tests and client-facing case studies for AquaNRG's aiRock, a cloud-based simulation platform supported by \$1.4MM in Department of Energy (DOE) and National Science Foundation (NSF) awards. Guided 2 developers (Agile sprints) and built 3 end-user applications.
- Innovated CCS storage diagnostics by streamlining 2 state-of-the-art, open-source modeling tools (Lattice Boltzmann Porous Media, OpenFOAM) to quantify CO₂ trapping mechanisms.
- Coordinated (Principal Investigator) a \$3MM Enhanced Geothermal Systems DOE Funding Opportunity Announcement technical proposal with industry and academic partners.

ConocoPhillips Company | Houston, TX

January 2018 - March 2021

Senior Petrophysicist – Geoscience

Delivered special core analysis (SCAL) subject matter expertise, petrophysical models, technology development, and advanced numerical modeling to global Exploration & Production business units (BUs).

- Consulted BUs on sample analysis programs for multi-\$MM coring operations (L48, Alaska, North Sea, Africa), enabling assessment of revenue-determining reservoir storage and deliverability properties.
- Evaluated reservoir properties for 10+ global assets, conventional and unconventional and sedimentary to volcanic lithologies (L48, Alaska, Canada, South America), by synthesizing multi-scale core and well log data of varied vintage. Integrated results with reservoir engineers, geologists, etc. to advise BU managers.
- Led 8 interdisciplinary geoscientists in a multi-year “digital twin” Technology Development project that simulated fluid flow data for cost-prohibitive or complex/unattainable core analysis scenarios. Achieved 3 BU adoptions (Eagle Ford, Malaysia, Alaska) with strategic management of a \$250k/year budget.
- Directed 4+ Fracture Fluid-Rock Interaction investigations (laboratory and modeling) to diagnose the impacts of chemical additives and injection strategy on production improvement in marginal wells. Results prompted mineral scale mitigation programs in 3 major assets (Eagle Ford, Niobrara, Montney).
- Organized 10+ vendor partnerships with Contacts, Intellectual Property, and Supply Chain teams. Authored/presented at least 1 technical conference paper per year and co-authored 2 patents.

ConocoPhillips Company | Houston, TX

January 2016 - January 2018

Petrophysicist – Applied Geoscience

Responsible for determining reservoir properties via logging program design, petrophysical models, and core analysis. Consulted on special topics including enhanced oil recovery, pore-filling bitumen, and sand control.

- Oversaw 7 multi-\$MM Arctic logging and coring operations for Alaska Exploration, enabling real-time go/no-go data acquisition decisions through on-site analysis of logging while drilling and wireline data.
- Provided drilling operations support and petrophysical evaluations to Exploration stakeholders for 4+ wells/basins, including offshore Gulf of Mexico and Nova Scotia prospects.

- Forged BU partnerships to reduce asset storage uncertainty with Reservoir Quality imaging technologies. Developed and integrated those workflows with Permian and Eagle Ford core analysis programs.

ConocoPhillips Company | Houston, TX

Summer 2013, 2014

Petrophysical Technology Intern – Geoscience & Reservoir Engineering

Analyzed the technology readiness level of computation fluid dynamics predictions of tight rock (shale) permeability. Published findings (*Advances in Water Resources*) have received >150 citations. Benchmarked a new gamma ray spectroscopy logging tool in the Eagle Ford and recommended tool use cases to the Technology and business unit teams.

South Florida Water Management District | West Palm Beach, FL

Summer 2009, 2010

Everglades Restoration & Capital Projects Intern – Engineering Services

Improved engineering guideline drawings (AutoCAD), written specifications, and statements of work for Everglades restoration and hydraulic control projects. Evaluated and proposed solutions for related operational issues including sulfur and microbial attack on concrete water control structures.

ACADEMIC AND TEACHING EXPERIENCE

The University of Texas at Austin | Austin, TX

August 2011 - December 2015

Graduate Research Assistant – Department of Petroleum and Geosystems Engineering

Established nanofluidic (lab-on-a-chip) experiments to investigate fluid flow dynamics in tight porous media systems. Synthesized findings for the shale revolution and carbon sequestration applications.

- Authored 5 peer-reviewed publications in high-impact factor journals including *Langmuir* and *Nanoscale* and presented findings at 4+ major technical conferences and seminars.
- Mentored 4 undergraduate research assistant interns and 1 postdoctoral researcher.

University of Florida | Gainesville, FL

January 2009 - April 2011

Content Tutor – Academic Technology Teaching Center

Tutored Calculus I-III, Differential Equations, and Physics I & II in individual, group, and live television tutoring sessions, including a tutoring assignment with the University of Florida's Navy ROTC (10 hours per week). Also tutored University of Florida student-athletes in individual sessions at the University Athletic Association (5 hours per week).

PEER-REVIEWED PUBLICATIONS

h-index: 10 (GoogleScholar metrics)

Nanofluidics

Kelly, S., Torres-Verdín C., Balhoff, M.T. (2018). "Influences of polarity and hydration cycles on imbibition hysteresis in silica nanochannels", *Physical Chemistry Chemical Physics*, 20 (1), 456-466.

Kelly, S., Balhoff, M.T., Torres-Verdín, C. (2016) "Subsurface to substrate: dual-scale micro/nanofluidic networks for investigating transport anomalies in tight porous media", *Lab on a Chip*, 16 (15), 2829-2839. (Featured in the themed collection "Lab on a Chip Recent Hot Articles")

Kelly, S., Balhoff, M. T., Torres-Verdín, C. (2016). "Anomalous liquid imbibition at the nanoscale: the critical role of interfacial deformations", *Nanoscale*, 8 (5), 2751-2767.

Kelly, S., Balhoff, M. T., Torres-Verdín, C. (2015). "Quantification of Bulk Solution Limits for Liquid and Interfacial Transport in Nanoconfinements", *Langmuir*, 31 (7), 2167-2179.

Computational Fluid Dynamics (Porous Media)

Mehmani, A.*, **Kelly, S.***, Torres-Verdín, C. (2020). “Leveraging digital rock physics workflows in unconventional petrophysics: A review of opportunities, challenges, and benchmarking”, *Journal of Petroleum Science and Engineering*, 190, <https://doi.org/10.1016/j.petrol.2020.107083>. (*S.K. and A.M. are co-first authors)

Kelly, S. A., El-Sobky, H., Torres-Verdín, C., Balhoff, M. T. (2016). “Assessing the Utility of FIB-SEM Images for Shale Digital Rock Physics”, *Advances in Water Resources*, Pore scale modeling and experiments (special issue), 95, 302-316. (>150 citations)

Shabro, V., **Kelly, S.**, Torres-Verdín, C., Sepehrnoori, K., Revil, A. (2014). “Pore-scale modeling of electric resistivity and permeability in FIB-SEM images of organic mudrock”, *Geophysics*, 79 (5), D289-D299. (*Honorable Mention in the Best Paper category for the Society of Exploration Geophysicists’ (SEG) 2015 Honors and Awards*)

Transport in Porous Media Characterization & Geoscience

Terry, O., Caro, D., **Kelly, S.**, Dewey, J., Kaszuba, J. “Fracture Fluid Reactions and Invasion during Well Shut In: A Multiscale Study in the Niobrara Formation, Denver-Julesburg Basin, Colorado, USA”, in preparation.

Watt, E. A., Laycock, D. P., Michael, E., Tobin, R. C., **Kelly, S.**, Johnston, M. N. (2022), “Hydrocarbon charge and petroleum system evolution of the Montney Formation: A multidisciplinary case study of the Blueberry sub-play in Northeast British Columbia, Canada”, *Bulletin of Canadian Energy Geoscience*, 69 (1), 21-50.

Jiang, T., Bonnie, R.J.M., Simoes Correa, T., Krueger, M. C., **Kelly, S. A.**, Wasson, M. S. (2022). “NMR-Based Wettability Index for Unconventional Rocks”, *Petrophysics*, 63 (03), 277-289

Dick, M.J., Veselinovic, D., Bonnie, R.J.M., **Kelly, S.** (2022). “NMR-Based Wettability Index for Unconventional Rocks”, *Petrophysics*, 63 (03), 418-441.

Mehmani, A., **Kelly, S.**, Torres-Verdín, C. (2020). “Review of micro/nanofluidic insights on fluid transport controls in tight rocks”, *Petrophysics*, 60 (06): 872–890.

Du, Y., Mehmani, A., Xu, K., **Kelly, S.**, Balhoff, M. T., Torres-Verdín, C. (2020). “Microfluidic diagnostics of the impact of local microfracture connectivity on hydrocarbon recovery following water injection”, *Water Resources Research*, 56 (7), <https://doi.org/10.1029/2019WR026944>.

Mehmani, A., **Kelly, S.**, Torres-Verdín, C., Balhoff, M. T. (2019) “Capillary trapping following imbibition in porous media: Microfluidic quantification of the impact of pore-scale surface roughness”. *Water Resources Research*, 55 (11), 9905-9925.

Mehmani, A., **Kelly, S.**, Torres-Verdín, C., Balhoff, M. T. (2019) “Residual oil saturation following gas injection in sandstones: Microfluidic quantification of the impact of pore-scale surface roughness”, *Fuel*, 251, 147-161.

SELECTED CONFERENCE PAPERS

Note: corresponding conference presentation given by first author

Kelly, S., Bonnie, R.J.M., Dick, M.J., Veselinovic, D. (2021). “NMR Wettability Index Measurements and Methods Compared on a Variety of Unconventional Samples”, SPWLA 62nd Annual Logging Symposium, Virtual Conference.

Laycock, D., Watt, E., Tobin, R., **Kelly, S.**, Johnston, M., Michael, E. (2021). “Examining the origins and yield impact of a stratified oil column in the Montney Formation, NE BC”, 2021 SPE/AAPG/SEG Unconventional Resources Technology Conference (URTeC), Houston, TX.

Kelly, S., Bonnie, R.J.M., Dick, M.J., Veselinovic, D. (2020). “NMR Time-Lapse Wettability Assessments in Unconventionals: Insights from Imbibition”, 2020 SPE/AAPG/SEG Unconventional Resources Technology Conference (URTeC), Virtual Conference.

Kelly, S., Johnston, M., Lee, B., San Martin, R. (2019). “Kerogen-Bitumen-Porosity Nexus: Insights from Multi-Basinal Collocated SEM-Optical Light Petrography”, 2019 SPE/AAPG/SEG Unconventional Resources Technology Conference (URTeC), Denver, CO.

Reynolds, A. C., **Kelly, S. A.**, Bonnie, R.J.M., Howard, J. J., Krumm, R. L. (2018) “Quantifying Nanoporosity: Insights Revealed by Parallel and Multiscale Analyses”, 2018 SPE/AAPG/SEG Unconventional Resources Technology Conference (URTeC), Houston, TX.

Kelly, S., Torres-Verdín, C., Balhoff, M. T. (2015). “Shale Fluid Transport in Nano-Scale Networks: The Competing Roles of Fluid Properties, Interfaces and Network Geometry”, 2015 SPE/AAPG/SEG Unconventional Resources Technology Conference (URTeC), San Antonio, TX.

Kelly, S. (2013). “Experimental Investigation of the Influence of Molecular Surface Interactions on Imbibition in Shale Nano-Pore Proxies”, Society of Petroleum Engineers Student Paper, 2013 SPE Annual Technical Conference and Exhibition, New Orleans, LA.

PATENTS

Krueger, M. C., **Kelly, S. A.**, Michael, G. E., Simoes Correa, T. B., “High pressure core chamber and experimental vessel”, US Patent App. 17348883 (2021).

SELECTED HONORS

AWARDS

ConocoPhillips “*Shark Tank*” Winner, CTO-sponsored pitch (technology name: “NanoAtlas”) at 2019 ConocoPhillips Analytics & Innovation Symposium.

International Student Paper Contest Winner, 2013 Society of Petroleum Engineers (SPE) Annual Technical Conference and Exhibition, Masters Division.

Energy Challenge International First Place Winner, Air & Waste Management Association (AWMA) 2011 National Conference, Orlando, FL. (topic: renewable energy portfolio plan)

College of Engineering Female Speaker Award (*Commencement Speaker*), University of Florida Spring 2011 Commencement Ceremony.

FELLOWSHIPS AND SCHOLARSHIPS

Recipient, Statoil (Equinor) Fellows Program at The University of Texas at Austin (2015).

Recipient, Cockrell School of Engineering at The University of Texas at Austin Thrust 2000 Fellowship (2011-2015).

Recipient, National Science Foundation Graduate Research Fellowship Program Honorable Mention (2012).

Recipient, P.M. Pope Engineering Scholarship, University of Florida College of Engineering (2010).

Recipient, Environmental Engineering Alumni Scholarship, University of Florida College of Engineering (2009).

Recipient, CH2M Hill University of Florida College of Engineering Scholarship (2008).

Recipient, The College Board’s ‘Young Epidemiology Scholars’ Competition Scholarship (2007).

Recipient, Florida High School Athletic Association Academic All-State Team Scholarship (2007).

Recipient, Florida Bright Futures Academic Scholarship (2007-2011).

PROFESSIONAL ACTIVITIES

SELECTED INVITED TALKS

Seminar, “*Technical Opportunities for Subsurface Scientists and Engineers in the Energy Transition*”, AAPG/SPE/RMAG Rocky Mountain Members in Transition (MiT), Presented September 2021.
(Recorded talk: <https://www.rmag.org/index.php?src=gendocs&ref=RockiesMembersinTransition#sept9>)

Seminar, “*Leveraging Digital Rock Physics: Opportunities and Pitfalls*”, ConocoPhillips Petrophysics Network Meeting, Presented December 2018.

Seminar, “*Nanofluidics, Phenomenological Models, and Implications for Tight Rocks*,” Bureau of Economic Geology, The University of Texas at Austin, Presented October 2015.

SELECTED SERVICE

Session Chair, Theme: *Oil/Gas/Water: Fluid-Fluid, Fluid-Rock Interactions and Chemostratigraphy I*, 2019 Unconventional Resources Technology Conference (URTeC), Denver, CO.

Session Chair, Theme: *Deep Sensing Borehole Acoustics*, 2017 Society of Exploration Geophysicists (SEG) conference, Houston, TX.

Session Chair, Theme: *Meso-, Micro-, and Nano-Scale Imaging of Unconventional Reservoirs*, 2016 Unconventional Resources Technology Conference (URTeC), San Antonio, TX.

Student Paper Contest Judge, 2016 Society of Petroleum Engineers (SPE) Southwest Regional Student Paper Contest, Masters Division, Austin, TX.

Manuscript Reviewer: *Langmuir* (ACS), *The Journal of Unconventional Oil and Gas Resources* (Elsevier), *Fuel* (Elsevier), *American Association of Petroleum Geologists (AAPG) Bulletin*, *Marine and Petroleum Geology* (Elsevier), *Transport in Porous Media* (Springer), *Computational Geosciences* (Springer), *Journal of Petroleum Science and Engineering* (Elsevier), *Reservoir Evaluation & Engineering* (SPE), *Petrophysics* (Society of Petrophysicists and Well Log Analysts).

PROFESSIONAL MEMBERSHIPS

Society of Petrophysicists and Well Log Analysts (SPWLA)
Society of Petroleum Engineers (SPE)
Interpore - International Society for Porous Media
Society of Exploration Geophysicists (SEG)
American Geophysical Union (AGU)

Passed the NCEES Fundamentals of Engineering (FE) Exam (2011)

SELECTED TRAINING

ConocoPhillips Engineering and Geoscience Academy new hire training programs (2016-2018), including courses in structural geology, sedimentology/stratigraphy, seismic analysis, petrography, and risk assessment.

TOUGH REACT Short Course, Lawrence Berkeley National Lab, Berkeley, CA, 2018.

ConocoPhillips *Western Interior Seaway* Depositional Settings field trip, Green River, UT, 2019.

ConocoPhillips *Structural Geomechanics* field trip, Guadalupe and Big Bend National Parks, TX, 2017.

“Ask the Better Question” Meeting Facilitation Workshops, instructor: Katherine Rosback, ConocoPhillips, 2018.

OTHER

Extracurricular: Runner, cyclist, and triathlete (11 marathons, 1 Ironman 70.3)

Citizenship: United States