BIOGRAPHICAL SKETCH

NAME: Paul DeCaen

eRA COMMONS USER NAME (credential, e.g., agency login): pdecaen

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of California, Santa Barbara CA, USA	B.Sc	03/2002	Physiology, Chemistry
University of Washington, Seattle WA, USA	Ph.D.	12/2010	Pharmacology Adviser: **William A. Catterall**
Harvard Medical School, HHMI, Boston Children's Hospital, Boston MA, USA	Fellow	08/2016	Ion channel biophysics Adviser: **David E. Clapham**

A. Personal Statement

Our research program aspires to revolutionize our understanding of molecular mechanisms which control ion channel function and the pathology of ciliopathies. Ciliopathies are disease cause by dysregulation of primary cilia proteins. *Primary cilia are solitary antenna-like structures that are enriched with ion channels and receptors that transduce external stimuli to the cell body*. The role primary cilia in cell physiology are highlighted by the growing number of diseases which have devastating consequence on the function and development of many organ systems. Our goal is to understand how ion channel dysfunction at the molecular level initiates cilia diseases in disparate tissues.

My unique training as a professional research scientist at ***Pfizer Research and Development*** and as an ***HHMI fellow at Harvard Medical School***, has provided me with a unique set of strengths in pharmacology, ion channel biophysics and structural biology to rigorously test outstanding questions in biology. Our laboratory will leverage a cutting-edge tool kit of cilia methodologies, which I developed as a HHMI fellow, includes direct cilia electrophysiology and cilia specific calcium-sensors. We will also deploy super resolution and atomic resolution methods to understand the trafficking and molecular dysregulation of cilia ion channels during ciliopathy diseases. *My prospects at achieving these goals is supported by my consistent output of scientific publications and my ground-breaking contributions to my discipline. During my graduate and post-graduate training, I published 11 first author manuscripts in* ***Nature (3 separate articles), PNAS, Cell Research, eLife and EMBO.***

After my training, I selected Northwestern University to leverage its state-of-the-art photonics and structural biology facilities, and its faculty's concentrated expertise in ion channels and cilia biology. Since starting my lab 6 years ago, we have corresponding authored *12 manuscripts* in ***PNAS***, ***Nature Communications***, ***eLife, Molecular Cell, Cell Reports and Cell***. We have contributed to resolving voltage sodium channel structures in the open and drug bound states. Separately, we have fundamentally defined the ionic and electrical relationship between the cilia and the cell, identifying the molecular mechanism of PKD2 channel dysregulation responsible for autosomal dominant polycystic kidney disease (ADPKD). *Listed below are my four most recent publications.*

1) McCollum MM, Larmore M, Ishihara S, Ng LCT, Kimura LF, Guadarrama E, Ta MC, Vien TN, Frost GB, Scheidt KA, Miller RE, DeCaen PG. Targeting the tamoxifen receptor within sodium channels to block osteoarthritic pain. ***Cell Reports***, Aug 23, 2022, PMID: 36001977
2) Sula A, Ng LCT, Hollensworth D, Larmore M, DeCaen PG**, Wallace BA**. The tamoxifen receptor in a voltage gated sodium channel. ***Molecular Cell***. March 21, 2021 PMID: 33503406
3) Vien TN, Ng LCT, Smith JM, Krappitz M, Gainullin VG, Fedeles S, Harris PC, Somlo S, DeCaen PG Disrupting polycystin-2 EF hand Ca^{2+} affinity does not alter channel function or contribute to polycystic kidney disease ***JCS***, Dec 24 2020, PMID: 33199522
4) Vien TN, Ng LC, Cao E, DeCaen PG Molecular dysregulation of polycystin-2 caused by TOP domain variants. ***PNAS***, Apr 24 2020, PMID: 3233217

In total, this application represents an alignment of my scientific strengths and demonstrated track record of breakthrough achievements in cilia biology, pharmacology and ion channel structural biology— thus merits consideration for this award. I intend to sustain my research momentum by directly address how channel variants alter ion channel function and molecular structure— thereby enhancing our understanding of the disease mechanism. I hope to continue conducting collaborative science as a NIH supported investigator and have a strong commitment to basic science. I am well-prepared to execute the aims of this proposal through my world-class training in industry and academic institutions.

Research Support

Ongoing Research Support

1R01DK123463-01 DeCaen (PI) 09/01/2019-Present
Role: PI
Project Title: Impacts of Finger 1 variants on PKD2 ion channel function in the primary cilia
Overlap: None

Completed Research Support

PKD Research Grant DeCaen (PI) 06/01/2018-07/01/2020
From the PKD Foundation
Project Title: The molecular and mechanistic impacts of variants on PKD2 ion channel function in the primary cilia.

1R56DK119709-01 DeCaen (PI) 10/1/2018-10/02/2019
Role: PI
Project Title: Impacts of Finger 1 variants on PKD2 ion channel function in ER membranes

Carl W. Gottschalk Research Scholar DeCaen (PI) 08/01/2017-07/29/2019
From the American Nephrology Society
Project title: Calcium regulation of Polycystin Ion channels

R00 DK106655 DeCaen(PI) 03/08/2017-03/09/2019
Role: PI
Project Title: The genetic identity of the primary cilia ion channels of kidney collecting duct cells and their regulation by internal calcium.

B. Positions, Scientific Appointments, and Honors

Positions

8/2016- present Assistant Professor, Northwestern University, Feinberg School of Medicine, Department of Pharmacology, Chicago IL
8/2010- 08/2016 Postdoctoral Fellow, Harvard Medical School, Howard Hughes Medical Research Institute, Dept. of Neurobiology, Boston MA, under David E. Clapham MD, PhD
9/2005-08/2010 Graduate Student Researcher, University of Washington, Department of Pharmacology, Seattle WA, under William A. Catterall PhD
4/2002-2005 Associate Scientist, **Pfizer Research and Development**, Cardiovascular Pharmacology, La Jolla CA

Honors

10/2021 American Society of Nephrologists, Elected Honorary Faculty
05/2021 Lakeside Discovery, a competitively awarded, 4-year drug discovery partnership, Deerfield IL
05/2018 Polycystic Kidney Disease Foundation Research Scholar
03/2018 Mayo Clinic's PKD Translational Research award
08/2017 Carl W. Gottschalk Research Scholar from the American Nephrology Society
08/2015 Pathway to Independence Award, NIH K99/R00
10/2015 First Prize, Poster Competition, ASPET Annual Meeting, Great Lakes Chapter, Chicago IL
9/2013 First Prize, Poster Competition, Harvard Medical School, Department of Neuroscience, Boston MA.
2/2010 NRSA Student Poster Competition, First Prize in Membrane Biophysics, Biophysical Society Annual Meeting, San Francisco CA
9/2009 First Prize, Poster Competition, University of Washington, Molecular, Cellular Developmental Biology Training Grant Annual Meeting, Seattle, Washington.

6/2006 Competitive Training Grant Awarded (CMB TG NRSA T32 GM07270)
6/2005 Pfizer Research and Development, Innovators Award for Implementation of High Through put Drug-induced Long QT Syndrome GLP Screening Assays, Division of Pharmacology, La Jolla, CA.
03/2002 Academic Excellence Award, College of Letters and Science, University of California Santa Barbara

Invited Seminars and Meetings *(Keynote**, international and other prestigious invitations are underlined)*

11/2021 American Nephrology Society Annual Meeting, Distinguished faculty Lecture, San Diego, CA, USA
09/2021 University of Leuven, International Leuven TRP Channel Meeting, Leuven, Belgium
06/2021 University of Colorado, Division of Nephrology, Denver CO, USA
05/2021 University of Maryland, Department of Physiology, Virtual Seminar, Baltimore MD, USA
1/2021 University of Illinois, Chicago, Grand Rounds for the Department of Nephrology, Virtual
10/2020 University of Miami, Grand Rounds for the Department of Nephrology, Virtual
09/2020 University of Tennessee, Seminar in Department of Biophysics, Virtual
02/2020 Biophysical Society Meeting, Ion Channels, Pharmacology and Disease— *Also presided as chair of this platform, San Diego CA
10/2019 American Nephrology Society Annual Meeting, Platform in PKD Research, CA, USA
10/2019 Yale University, Seminar in Department of Nephrology, New Haven CT, USA
03/2019 University of Iowa, Seminar in Department of Physiology and Biophysics, ", Iowa City IA, USA
10/2018 American Nephrology Society Annual Meeting, New & Notable Platform**, San Diego CA, USA
06/2018 FASEB Conference on Calcium Signaling, Platform Lake Tahoe, NV USA
04/2018 Mayo Clinic PKD Symposium, Keynote Speaker**, Rochester, MN USA
03/2018 University of Chicago, Grand Rounds Seminar, Chicago IL USA
10/2017 Biophysical Society, Emerging concepts in ion channel biophysics Platform, Mexico City, Mexico
09/2017 University of Maryland, PKD Symposium, Baltimore MD, USA
07/2017 FASEB Conference on Polycystic Kidney Disease, Bozeman MT USA
05/2017 Cold springs Harbor, Asia Conference on Cilia and Centrosomes, Suzhou, China
02/2017 Vertex Polycystic Kidney Disease Day, Keynote presentation**, Montreal, Canada
07/2016 University of London, Seminar in Department of Structural Biology, London, UK
06/2016 University of Washington, Seminar for Department of Biophysics, Seattle WA
01/2015 University of Pennsylvania, Seminar in Department of Physiology, Philadelphia PE
12/2014 University of California, Seminar in Biophysics and Physiology, Irvine CA, USA
04/2014 Washington University, Lockheed Martin Seminar in Biological Systems Engineering, Saint Louis, MO USA
03/2014 Biophysical Society Annual Meeting, TRP channel Platforms, San Francisco C.A. USA.
01/2014 Tufts University, Department of Pharmacology and Experimental Therapeutics, Boston MA, USA.
12/2013 University of New South Wales, Victor Chang Research Institute Seminar, Sydney, Australia.
11/2013 Royal Melbourne Institute of Technology, Health Innovations Seminar Series, Melbourne, Australia.
02/2013 Aurora Biomedical Ion Channel Conference, Sodium Channel Pharmacology, Vancouver, Canada.
09/2012 Pain Research Forum, Harvard Medical School, Boston MA, USA
05/2012 Gordon Research Conference on Ion Channels, TRP Channel Platform, Holy Yolk MA., USA

Professional Memberships

American Society for Pharmacology and Experimental Therapeutics	2014-Currently
Biophysical Society	2007-Currently
Society for Neuroscience	2014-Currently
American Society of Nephrology	2016-Currently

C. Contributions to Science

I began my faculty appointment at Northwestern in August 2016. List below are my four contributions to science made during my training and as an **early stage investigator.**

1. Structural determinate of voltage-gating in sodium channels.

Voltage gated sodium channels (Na_Vs) pass ionic current required for electrical signaling in excitable tissues like neuronal and cardiac muscle cells. Na_Vs are exquisitely sensitive to changes in cell membrane potential, responding to changes by turning on and off their ion conductance. Voltage sensing is conferred by positively charged elements within the 'voltage sensor modules' (VSM) found in the equivalent transmembrane segments one through four (S1-4). The precise limits and type of movement of the VSD attracts interest because they form a state dependent receptor site and presents a fundamental biophysical feature found in channels of prokaryotic and eukaryotic cells. As a graduate student of William Catterall, I used electrophysiology of a mutagenic screen

in conjunction with Rosetta modeling to interrogate the motion of the VSD of a prokaryotic Na_V. Our conclusions enumerated the type of hydrogen bonds and electrostatic interactions with the VSD and the total range of transmembrane motion of the positively charged S4. Building from our work, we and other scientists have subsequently captured these state-dependent interactions in crystal structures of prokaryotic Na_Vs and our work has aided the design of state-dependent antagonists of Na_Vs.

a) DeCaen PG, Yarov-Yarovoy V, Zhao Y, Scheuer T, Catterall W.A., Disulfide locking a sodium channel voltage sensor reveals ion pair formation during activation, ***PNAS*** Sep 22, 2008, PMID: 18809926, PMC2567506
b) DeCaen PG, Yarov-Yarovoy V, Sharp E, Scheuer T, Catterall W.A., Sequential Formation of Ion Pairs During Voltage-dependent Activation of a Sodium Channel, ***PNAS*** Dec 22, 2009, PMID: 20007787 PMC2799717
c) DeCaen PG, Yarov-Yarovoy V, Scheuer T, Catterall W.A., Gating charge interaction with a negative charge in the S1 segment in resting and activated states of a sodium channel. ***PNAS*** Nov. 15, 2011, PMID: 22042870 PMC3219111
d) DeCaen PG*, Yarov-Yarovoy V*****, Scheuer, T., Baker D. and Catterall, W.A. Structural basis for gating charge movement in the voltage sensor of a sodium channel. ***PNAS*** Jan 10, 2012. PMID: 22160714, PMC3258622

2. Biophysical mechanism of ion selectivity in sodium channels.
Once Na_Vs have opened in response to membrane potential, they must discriminate amongst other ions and only allow sodium to pass into the cell. This process called is called 'selectivity' and without it, cells would be at the mercy of external tonicity and life on earth might not exist. While the molecular determinates for K^+ have been characterized, selectivity for Na^+ had not. Together with collaborators using x-ray crystallography, molecular dynamic simulations and electrophysiology, we have determined the four coordination sites which filter Na^+ ions through the Na_V. These were the first studies to capture a sodium channel structure with the Na^+ ions bound in the filter, which were then validated by functional measurements. In addition, we have also discovered adaptations to Na_V selectivity filters from bacteria which allow them to dwell in Na^+-poor environments by switching their selectivity preference to K^+. These discoveries have addressed how Na_Vs selectively allow only sodium ions into the cell and the adaptive plasticity of the selectivity filter required for halophilic bacteria.

a) Ulmschneider M, Bagnéris CM, Cusker E, DeCaen PG**,** Clapham DE, Ulmschneider J.P., Wallace B.A., Molecular Dynamics of Ion Transport through the Open Conformation of a Bacterial Voltage-gated Sodium Channel. ***PNAS*** Apr 12 2013, PMID: 23542377, PMC3631666
b) DeCaen P.G., Ito M. Krulwich TA., Clapham D.E., Ionic selectivity and thermal adaptations within the voltage-gated sodium channel family of alkaliphilic Bacillus species. ***eLife***, Nov 11, 2014, PMID: 25385530, PMC4225499
c) Naylor CE, Bagnéris C, DeCaen PG, Sula A, Scaglione A, Clapham DE, Wallace BA. Molecular basis of ion permeability in a voltage-gated sodium channel. **EMBO Journal**. Feb 12, 2016, PMID: 26873592;
d) Sula A., Booker J., Ng L.C., Naylor, DeCaen P.G.†, Wallace B.A.†, The complete structure of an activated open sodium channel. ***Nature Communications***. Feb 16 2017, PMID: 28205548,

3. Sodium channel pharmacology and inactivation.
After Na_Vs open and Na^+ flows into the cell, the channel must be turned off in order for the cell to maintain it's resting potential. This process is called 'inactivation' and is often impacted of Na_V heritable mutations. Delay in the inactivation process manifests as hyperexciabilty in clinically relevant and potentially lethal phenotypes such as forms of epilepsy and cardiac arrhythmia. Thus understand the molecular features of Na_V inactivation is desired for treatment and the design therapeutic drugs. We have again utilized the prototypic bacteria Na_Vs as structural models to study Na_V inactivation. Based on our crystal structures of full-length and pore-only proteins, we hypothesize that inactivation can be caused by asymmetric distortions of the selectivity filter and alterations to the c-terminal domain. In epilepsy, hyper-excited neurons that express Na_Vs spend disproportionately more time in the inactivated state and present unique conformation to target with drugs, which thereby leaves normal functioning Na_Vs less effected. We collaborated with a pharmaceutical company (Pfizer) to identify and co-crystalize an Na_V with prototypic anti-epileptics (Lamotrigine and Valproic Acid). This binding site is shared by prokaryotes and eukaryotes and is located within pore vestibule, where lamotrigine can plug permeation of Na^+ ions. Our work provided the first structural view of a drug-bound Na_V and the inactivated state.

a) Zhang X*, , DeCaen PG*, Yan C, Tao X, Wang J, Hasegawa K, He J, Wang J, Clapham D.E., and Yan N. Crystal structure of NavAP, an orthologue of the NaChBac voltage-gated sodium channel, ***Nature***, June 29 2012, PMID: 22678295, PMC3979295

b) Bagnéris C*, DeCaen PG*, Naylor CE, Clapham DE, Wallace BA., The prokaryotic NavMs channel as a structural and functional model for sodium channel antagonism., ***PNAS***, Jun 10, 2014, PMID: 24850863; PMC40600673
c) Zanatta G, Sula A, Miles T, Ng LCT, Pryde D, DeCaen PG†, Wallace BA‡, Valproic acid interactions with the NavMs voltage-gated sodium channel, ***PNAS,*** Dec 10 2019, PMID: 31822620
d) Sula A, Ng LCT, Hollingsworth D, DeCaen PG†, Wallace BA‡, The tamoxifen receptor in a voltage-gated sodium channel, ***Molecular Cell,*** January 20 2021, *Accepted*

4. Molecular biophysics of polycystin ion channels

Separate from Na_Vs, I am investigating members of the transient receptor potential (TRP) ion channels with special emphasis on the polycystins (P family, or PKDs). We have found several members of the Polycystin (PKD1, PKD2, PKD1L1 and PKD2L1) reside in the primary cilia of various cell types. Cells which express primary cilia are found in all organs of the human body, including hippocampal neurons and inner medullary kidney collecting duct epithelia. Many patients (≈100,000 in the US) with autosomal dominant polycystic kidney disease (ADPKD) develop extensive and proliferative kidney cysts in midlife which are caused by deleterious mutations in genes which encode PKD2. We have provided the first direct measurement of the PKD2 and PKD2-L1 from the cilia of disparate tissues using electrophysiological and genetically encoded calcium sensors. We established that the cilium contains high levels of Ca^{2+} (580 nM) as a consequence of the large population (~29 channels/μm^2) of resident PKD channels. My current work at Northwestern focuses on determining the structural states and the pharmacophore of polycystin channels. We hope to determine the mechanism(s) of how ADPKD-causing variants result in channel dysfunction and ultimately cyst formation in the kidney collecting ducts.

a) DeCaen PG*, Delling M*, Vien TN and Clapham DE, Direct recording and molecular identification of the calcium channel of primary cilia., ***Nature***, Dec 12, 2013, PMID: 24336289, PMC4073646
∞*Research Highlight, Nature Reviews Molecular Cell Biology; Du Toit A, Dec 27,2013 PMID: 24370826*
b) Delling M*, DeCaen PG*, Doerner JF, Febvay S, Clapham DE, Primary cilia are specialized high-[Ca2+] signaling organelles., ***Nature***, Dec 12, 2013, PMID: 24336290, PMC4112737
∞*Editor's Choice, Science Signaling; Berndt J.D. A, Dec 17, 2013 PMID: 2562226*
c) Shen P.S., Yang X, DeCaen PG, Liu X, Bulkley D, Clapham DE, Cao E., The Structure of the Polycystic Kidney Disease Channel PKD2 in Lipid Nanodiscs. ***Cell***, Oct 20, 2016, PMID: 27768895
d) Liu X., Vien T.N., Clapham D.E.‡, DeCaen. P.G.‡ PKD2 is an essential ion channel subunit in the primary cilium of the renal collecting duct epithelium, ***eLife***, Feb 14 2018, PMID: 29443690,

****denotes equal contribution †denotes co-corresponding authorship ∞denotes featured in comments***

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Orhi Esarte Palomero

eRA COMMONS USER NAME (credential, e.g., agency login): ORHIEP1

POSITION TITLE: Postdoctoral Fellow

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Start Date MM/YYYY	Completion Date MM/YYYY	FIELD OF STUDY
Euskal Herriko Unibertsitatea – Universidad del Pais Vasco	BS	09/2012	06/2015	Chemistry
The University of Texas at Austin	PHD	08/2015	04/2020	Chemistry (Advisor: Richard A. Jones)
The University of Texas at Austin	Postdoctoral Fellow	05/2020	07/2021	Microbiology and Molecular Biology (Advisor: Bryan W. Davies)
Northwestern University	Postdoctoral Fellow	08/2021	Present	Pharmacology (Advisor: Paul G. DeCaen)

A. Personal Statement

I am originally from northern Spain where I obtained my B.S in chemistry and was involved in the characterization of nanoparticles, both polymers and proteins, for potential drug delivery applications. For my predoctoral studies I moved to the University of Texas at Austin working in synthetic organic/inorganic chemistry and X-ray crystallography making contributions in new C-N reactivity and carbon capture materials. My productivity during this time was greatly enhanced thanks to a fellowship I obtained from the Spanish “la Caixa” Banking Foundation which is competitive across all fields. Thereafter and during pandemic times, I transitioned to my first postdoctoral position in antibiotic discovery where I was able to research novel antimicrobial biologics as well as discover the antibiotic activity of an irritable bowel syndrome prescription drug against gut pathogens.

I am currently a Chicago Kidney Urology Hematology TL1 postdoctoral trainee in the lab of Professor Paul G. DeCaen at Northwestern University interested in ion channels biophysics and developing their structural characterization. My research focuses on mammalian and bacterial ion channels. On the one hand, I am interested in the regulation of specific domains of the PKD1 and PKD2 the channels behind Autosomal Dominant Polycystic Kidney Disease (ADPKD), a debilitating kidney condition caused by mutations in the PKD1 and PKD2 genes. On the other hand, I am interested in a class of bacterial ion channel involved in signal transduction and assembly of coordinated bacterial growth through intracellular metabolic factors.

My scientific journey has taken me through a diversity of fields like synthetic chemistry, molecular biology, microbiology, protein biochemistry and materials science. This unique background has equipped me with the cross functional experience required to do research at the interface of chemistry and biology.

By applying for comprehensive Cryo-EM training, I hope to acquire state-of-the-art training in macromolecular protein characterization that will complement my current skillset in protein biochemical characterization. After my postdoctoral tenure at Northwestern University, I hope to start my own independent research career designing protein biologics that leverage unique chemical properties of inorganic materials. I want to leverage this training opportunity in Cryo-EM to enhance the quality and reach of my future structural research.

a) **Esarte Palomero O,** Jones RA. 1,1′-dicarbodiimidoferrocenes: Synthesis, characterization, and group IV 1,1′-bisguanidinateferrocene complexes**.** Organometallics. 2019, 38,13, 2689-2698.

b) **Esarte Palomero O,** Jones RA. Ferrocene tethered boramidinate frustrated Lewis pairs: stepwise capture of CO_2 and CO. Dalton Trans., 2021, 51, 6275-6284.

c) Cunningham AL, **Esarte Palomero O**, Voss BJ, Trent MS, Davies BW. 2021. IBS therapeutic has broad spectrum antimicrobial activity. Antimicrobial Agents and Chemotherapy. 2021; 65:e00443-2.

d) **Esarte Palomero O***, Larmore M*, DeCaen PG. Polycystin Channel Complexes. Annu. Rev. Physiol. 2023; 85:X-X. *Share first co-authorship.

B. Positions, Scientific Appointments and Honors

Positions and Scientific Appointments

2021-Present	Chicago KUH Forward Postdoctoral Trainee, Northwestern University
2020-2021	Postdoctoral Fellow, The University of Texas at Austin
2019-Present	Member, American Chemical Society
2017-2020	“la Caixa” Fellow, The University of Texas at Austin
2015-2020	Graduate Student, The University of Texas at Austin

Honors

2022 Kirschstein-NRSA Postdoctoral Trainee, Chicago Kidney, Urology, and Hematology Research Training Program (Chicago KUH Forward)
2018 Dean’s Prestigious Fellowship Supplement, in recognition for retaining a fully funded external fellowship.
2017 “la Caixa” fellowship, awarded by the Spanish “la Caixa” banking foundation to support predoctoral studies in the US, only chemist in 2017.
2015 B.S. awarded with highest honors, Euskal Herriko Unibertsitatea – Universidad del Pais Vasco

C. Contributions to Science

My scientific contributions are organized in four sections: 1. Undergraduate career, 2. Graduate Career, 3. Postdoctoral Career I, and 4. Postdoctoral Career II

1. **Undergraduate career:** during my undergraduate studies in Spain, I was involved in two research opportunities involving nanoscience research for drug delivery applications. This work was presented at local university level undergraduate research symposia. First, I worked at the POLYMAT Polymer Institute characterizing the physical properties of thermoresponsive and biocompatible polymer nanoparticles with different degrees of crosslinking. Afterwards I moved to CICnanogune Nanoscience Institute to study the photodemineralization of the iron reserves in Ferritin, the mammalian iron storage protein, under different wavelengths of LED light, pH and subunit composition.

2. **Graduate career:** most of my graduate work primarily focused on early transition metal complexes using a novel class of ferrocene linked carbodiimide ligands. I used this family of molecules for stabilizing early transition metal compounds leading to uncommon metal-ligand binding motifs and new organic C-N reactivity involving the carbodiimido/diazetidine equilibrium reaction. Based on the same ferrocene chemistry I developed a frustrated Lewis pair scaffold to demonstrate sequential capture of CO_2 and CO in one molecule paving the way for new designs of carbon capture materials.

a) **Esarte Palomero O,** Jones RA. 1,1′-dicarbodiimidoferrocenes: Synthesis, Characterization, and Group IV 1,1′-Bisguanidinateferrocene Complexes**.** Organometallics. 2019, 38,13, 2689-2698.

b) **Esarte Palomero O,** Jones RA. Synthesis and characterization of 1,1'-dicarbodiimidoferrocenes and their group IV 1,1'-bisguanidinateferrocene complexes. American Chemical Society National Meeting; 2019; San Diego, CA.

c) **Esarte Palomero O**. Sequential capture of CO_2 and CO by a Frustrated Lewis Pair. DOWBest Symposium; 2019; Midland, MI.

d) **Esarte Palomero O**, Jones RA. Accessing pentagonal bipyramidal geometry with pentadentate pincer amido-bis(amidate) ligands in group IV and V early transition metal complexes. Organometallics. 2020, 39, 20, 3689-3694.

e) **Esarte Palomero O,** Jones RA. Ferrocene Tethered Boramidinate Frustrated Lewis Pairs: Stepwise capture of CO_2 and CO. Dalton Trans., 2022, 51, 6275-6284.

f) **Esarte Palomero O**. Ferrocene tethered boramidinate frustrated Lewis pairs: Model platform for sequential small molecule capture. American Chemical Society National Meeting; 2022; San Diego, CA.

g) **Esarte Palomero O,** Jones RA. Hyperbulky 1,1'-dicarbodiimidoferrocene proligand induces an asymmetric guanidinate coordination in a zirconium (IV) complex. Submitted to Dalton Transactions.

During my graduate studies I was involved in additional research projects that leveraged the unique properties of inorganic compounds for potential biomedical applications. I have published on the stability of inorganic compounds for potential ^{19}F-MRI contrast agents, functional luminescent lanthanide nanomaterials and transition metal based antimicrobial compounds.

h) King TL, **Esarte Palomero O**, Grimes, DA, Goralski ST, Jones RA, Que EL. Modulating extraction and retention of fluorinated β-diketonate metal complexes in perfluorocarbons through the use of non-fluorinated neutral ligands. Inorganic Chemistry Frontiers. 2021, 8, 4488-4496.

i) King TL*, **Esarte Palomero O***, Bard AB, Espinoza JA, Guo H, Schipper D, Yang X, DePue LJ, Que EL, Jones RA. Visible luminescent Ln42 nanotorus coordination clusters. Journal of Coordination Chemistry. 2020, 92-101. *Share first co-authorship.

j) **Esarte Palomero O,** Cunningham AL, Davies BW, Jones RA. Antibacterial thiamine inspired silver(I) and gold(I) N-heterocyclic carbene compounds. Inorganica Chimica Acta. 2021, 517, 120152.

3. **Postdoctoral career I:** for my first postdoctoral studies I transitioned to the Davies laboratory at UT AUSTIN working on new antibiotic discovery. I characterized the antimicrobial activity of a drug used to treat irritable bowel syndrome against gut pathogens. This compound offered an untapped chemical structure to develop much needed non-absorbed antibiotic therapies. I was also involved in the development of recombinant protein expression and purification pipelines for two classes of antimicrobial biologics. These antibiotic molecules have novel mechanisms of action. Single chain antibodies or nanobodies target the *E. coli* outer membrane lipids. On the other hand, a naturally occurring bacterial microcin toxin was produced with a narrow spectrum of activity.

e) Cunningham AL, **Esarte Palomero O**, Voss BJ, Trent MS, Davies BW. 2021. IBS therapeutic has broad spectrum antimicrobial activity. Antimicrobial Agents and Chemotherapy. 2021; 65:e00443-2.

f) Wang X, **Esarte Palomero O**, Quaddoura A, Brodbelt J, Mavridou D, Davies BW. Antimicrobial single-chain antibody targets *E. Coli* outer membrane lipopolysaccharide. Manuscript in preparation

4. **Postdoctoral career II:** for my current postdoctoral training at Northwestern University, I am studying polycystin ion channels in the context of ADPKD for which I have recently authored a comprehensive review about their structure and function. My current research is focused on the development of new synthetic biology approaches to increase the rate of functional characterization of polycystins PKD1 and PKD2. I have a particular interest in the study of disease relevant variants because they concentrate in specific protein domains that are post translationally modified. Understanding how post-translational modifications like N-glycosylation result in dysregulated polycystin function will expand the opportunities for developing a cure for ADPKD.

a) **Esarte Palomero O***, Larmore M*, DeCaen PG. Polycystin Channel Complexes. Annu. Rev. Physiol. 2023; 85:X-X. *Share first co-authorship.

Complete list of published works in My Bibliography**:**
https://www.ncbi.nlm.nih.gov/myncbi/orhi.esarte%20palomero.1/bibliography/public/

D. Scholastic Performance

YEAR	COURSE TITLE	GRADE*
	THE UNIVERSITY OF TEXAS AT AUSTIN	
2015	Advanced Analytical Chemistry	A
2015	Inorganic Reactions and Structure	A^-
2015	Bio-inorganic Chemistry	B^+
2016	Professional Development for Graduate Students in Chemistry	CR
2016	Fluorescence Microscopy and Spectroscopy	A
2016	Cell Biology	B^+
2016	Advanced Inorganic Chemistry: Organometallic Chemistry and Catalysis	A
2018	Nuclear and Radiochemistry	A

*The University of Texas Graduate Courses are letter graded. The professional development course was graded as CR (credit) or NC (no credit) based on attendance and assignment completion.