

BIOGRAPHICAL SKETCH

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NAME: Daniel Louis Minor, Jr., Ph.D.

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

POSITION TITLE:

Professor, Departments of Biochemistry and Biophysics, & Cellular and Molecular Pharmacology
Investigator, Cardiovascular Research Institute, University of California San Francisco
Faculty Scientist, Molecular Biophysics & Integrated Imaging Division, Lawrence Berkeley National
Laboratory, Berkeley

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
University of Pennsylvania, Philadelphia, PA	B.A. <i>magna cum laude</i>	05/1989	Biochemistry (Honors)
Massachusetts Institute of Technology, Cambridge, MA	Ph.D.	02/1996	Biophysics (Honors) Chemistry
MRC Laboratory of Molecular Biology, Cambridge, UK	postdoc	09/1996	Ion channel structure
University of California, San Francisco, CA	postdoc	12/2000	Ion channel structure and function

A. Personal Statement

I have a broad background in ion channel structural biology and functional characterization. My interest in the physical chemistry of biological phenomena began with my undergraduate study in biophysics and biochemistry at the University of Pennsylvania. As a graduate student in the Department of Chemistry at MIT with Prof. Peter S. Kim, I focused on understanding the basic principles of protein folding and molecular interactions. While at MIT, I developed a keen interest in the proteins involved in electrical signaling. To pursue this interest, I worked as a postdoctoral fellow with Dr. Nigel Unwin at the LMB Cambridge and with Prof. Lily Y. Jan at UCSF where I was able to apply my background in structural biology to specific questions regarding ion channel structure and regulation. As a PI, I have focused my laboratory's efforts on structural and mechanistic understanding of ion channels and in the development of new pharmacological tools for orphaned channel classes. My lab is pursuing a research program that combines structural biology, ion channel functional studies, and chemical biology approaches to develop new channel pharmacologies. I am a Professor of Biochemistry and Biophysics and Cellular and Molecular Pharmacology, an Investigator in the Cardiovascular Research Institute at UCSF, and a Faculty Scientist at LBNL.

My laboratory has made many contributions to the structural understanding of the function of various classes of ion channels and development of new channel modulators using a multidisciplinary approach employing genetic selections, biophysical approaches, chemical biology, and X-ray crystallography. Our work is exemplified by the following six key papers:

1. Van Petegem, F., Clark, K.A., Chatelain, F.C., and **Minor, D.L., Jr.**, "Structure of a complex between a voltage-gated calcium channel β -subunit and an α -subunit domain" *Nature* **429** 671-675 (2004) **PMID:15141227** (*Research Highlight Nature Rev. Neuroscience* 5:517, 2004; rated 'Exceptional' Faculty of 1000)
2. Bagriantsev, S., Clark, K.A., Peyronnet, R., Honoré, E., and **Minor, D.L., Jr.**, 'Multiple modalities act through a common gate to control K_v channel function' *function' The EMBO Journal* **30** 3594-3606 (2011) **PMID: 21765396** **PMCID: PMC3181481**
3. Bagriantsev, S. N., Ang, K.H., Gallardo-Godoy, A, Clark, K.A., Arkin, M.R., Renslo, A.R, and **Minor, D.L., Jr.**, 'A high-throughput functional screen identifies small molecule regulators of temperature- and mechano-sensitive K_v channels' *ACS Chemical Biology* **8** 1841-1851 (2013) **PMID: 23738709****PMCID: PMC3747594**
4. Lolicato, M., Riegelhaupt, P.M., Arrigoni, C., Clark, K.A., Minor, D.L., Jr.' *Transmembrane helix straightening and buckling underlies activation of mechanosensitive and thermosensitive K_v channels' *Neuron* **84** 1198-1212 (2014) **PMID: 25500157** **PMCID: PMC4270892***
5. Arrigoni, C., Rohaim, A., Shaya, D., Findeisen, F., Stein, R.A. Nurva, S.R., Mishra, S., Mchaourab, H.S., and **Minor, D.L., Jr.**, 'Unfolding of a temperature-sensitive domain controls voltage-gated channel activation' *Cell* **164** 922-936 (2016) **PMID: 26919429** **PMCID:PMC4769381**

6. Lolicato, M., Arrigoni, C., Mori, T., Sekioka, Y., Bryant, C., Clark, K.A., **Minor, D.L., Jr.** 'K_v2.1(TREK-1):activator complexes reveal a cryptic selectivity filter binding site' *Nature* **547** 364-368 (2017) **PMID: 28693035** **PMCID: PMC5778891**

B. Positions and Honors:

Positions and Employment

- 1990-1996 Graduate Student, Department of Chemistry, Massachusetts Institute of Technology
Advisor: Peter S. Kim, Ph.D.
- 1996 Postdoctoral Fellow, MRC-Laboratory of Molecular Biology Cambridge, England
Advisor: Nigel Unwin, Ph.D.
- 1996-2000 Postdoctoral Fellow, Howard Hughes Medical Institute, Department of Physiology, University of California, San Francisco, Advisor: Lily Y. Jan, Ph.D.
- 2000-2007 Assistant Professor, Department of Biochemistry and Biophysics, UCSF
- 2002-2007 Assistant Professor, Department of Cellular and Molecular Pharmacology, UCSF
- 2000-present Investigator, Cardiovascular Research Institute, UCSF
- 2007-2011 Associate Professor (w/ tenure), Departments of Biochemistry and Biophysics & Cellular and Molecular Pharmacology, UCSF
- 2009-present Biochemist, Faculty Scientist, Physical Biosciences Division, Lawrence Berkeley National Laboratory (as of 2016, renamed as Molecular Biophysics & Integrated Imaging Division)
- 2011-present Professor (w/ tenure), Cardiovascular Research Institute, Departments of Biochemistry and Biophysics & Cellular and Molecular Pharmacology, UCSF

Other experience and Professional Memberships

- 2000-present Member, Graduate Programs in Biological Sciences: Biochemistry, Biophysics, Chemistry and Chemical Biology, Neuroscience, Program in Molecular Medicine, UCSF
- 2000-2006 Member, Graduate program in Biomedical Science
- 2001-present Protein Society, Member
- 2001-present Biophysical Society, Member
- 2001-present Society for Neuroscience, Member
- 2007 NIH BST-Q Study Section (*ad hoc* member)
- 2007 NIH NTRC Study Section (*ad hoc* member)
- 2008 NIH BPNS Study Section (*ad hoc* member)
- 2008-present Member, Graduate program in Biomedical Science
- 2008-present Society of General Physiologists, Member
- 2009 NIH NIDA CEBRA Study Section (*ad hoc* member)
- 2011-present NIH BPNS Study Section (permanent member)
- 2012-2015 Biophysical Society Council Member
- 2013-2014 US-Israel Binational Science Foundation – Scientific Advisory Board Member
- 2015-2016 Beckman Young Investigator, Beckman Foundation - Selection Committee Member
- 2016 NIH ZEY1 VSN Study Section (*ad hoc* member)
- 2016 NSF CAREER Review Study Section, MCB Division, Molecular Biophysics Cluster
- 2017 NIH: Special Emphasis Panel 'Biophysics' ZRG1 MDCN-R(04) (*ad hoc* member)
- 2017 NSF Biomolecular Dynamics and Function II Study Section, MCB Division, Molecular Biophysics Cluster

2016-present *Neuron* Editorial Board

2017-present *Journal of Molecular Biology* Editorial Board

Honors:

- 1985 ILGWU Scholarship
- 1986, 1987, 1988 Dean's list, University of Pennsylvania,
- 1988-89 Penn Student Agencies Scholarship, University of Pennsylvania
- 1989 Helix Prize in Biochemistry, University of Pennsylvania
- 1989 Phi Beta Kappa
- 1996 Burroughs Wellcome Hitchings-Elion Fellowship
- 2001-2004 McKnight Scholar in Neuroscience
- 2001-2005 Rita Allen Scholar
- 2002-2004 Alfred P. Sloan Research Fellow
- 2002-2005 Beckman Young Investigator
- 2002-2004 March of Dimes, Basil O'Connor Scholar

2002-2005 Searle Scholar
2004-2006 McKnight Technological Innovations in Neuroscience Award
2007-2011 Established Investigator, American Heart Association
2010-2012 Fellow of the American Asthma Foundation
2011 Weizmann Institute of Science, Feinberg Visiting Faculty Fellowship

C. Contributions to science:

1) Protein folding: I established the experimental scale for β -sheet formation (*Minor and Kim, 1994a*) and uncovered that this property is context dependent (*Minor and Kim, 1994b*). Previously, there were no experimental measures of β -sheet formation. The observation of the effect of context led us to design an 11-residue sequence, the 'chameleon' sequence whose folding was entirely context dependent (*Minor and Kim, 1996*). *This work established that context could drive the formation of entire secondary structures, a demonstration that had implications for understanding structural transitions in amyloid and other fibril-forming proteins.*

Minor, D. L., Jr. and Kim P. S. "Measurement of the β -sheet forming propensities of amino acids" *Nature* **367** 660-663 (1994a) **PMID: 810785**

Minor, D.L., Jr. and Kim P.S. "Context is a major determinant of β -sheet propensity" *Nature* **371** 264-267 (1994b) **PMID: 8078589**

Minor, D.L., Jr. and Kim P.S. "Context-dependent secondary structure formation of a designed protein sequence" *Nature* **380** 730-734 (1996) **PMID: 8614471**

2) Voltage-gated calcium channels (Ca_vs): Voltage-gated calcium channels (Ca_vs) are central components of excitable tissues in the brain and heart. *When my laboratory started working on this channel family there were no high-resolution data for Ca_vs.* My laboratory determined the first high-resolution structure of part of a Ca_v, the β -subunit, alone and in complex with its interaction site from the channel (*Van Petegem et al., 2004*). *We subsequently have determined structures for all of the components for which there are presently high-resolution data* including calcium-calmodulin complexes of Ca_v1 (*Van Petegem et al., 2005; Kim et al., 2010*) and Ca_v2 IQ domains (*Kim et al., 2008*). These studies have established a structural foundation for investigating Ca_v function and have demonstrated the conformational complexities that underlie Ca_v feedback modulation by calcium-calmodulin.

Van Petegem, F., Clark, K.A., Chatelain, F.C., and **Minor, D.L., Jr.**, "Structure of a complex between a voltage-gated calcium channel β -subunit and an α -subunit domain" *Nature* **429** 671-675 (2004) **PMID:15141227** **PMCID: PMC3076333** (*Research Highlight Nature Rev. Neuroscience* **5**:517, 2004; rated 'Exceptional' Faculty of 1000)

Van Petegem, F, Chatelain, F.C., **Minor, D.L., Jr.**, "Insights into voltage-gated calcium channel regulation from the structure of the Ca_v1.2 IQ domain-Ca²⁺/calmodulin complex" *Nature Structural & Molecular Biology* **12** 1108-1115 (2005) **PMID: 16299511** **PMCID: PMC3020901**

Kim, E.Y., Rumpf, C.H., Fujiwara, Y., Cooley, E.S., Van Petegem, F., and Minor, D.L., Jr., "Structures of Ca_v2 Ca²⁺/CaM-IQ domain complexes reveal binding modes that underlie calcium-dependent inactivation and facilitation" *Structure* **16** 1455-1467 (2008) **PMID: 18940602; PMCID: PMC2701236** (Rated 'Must Read' by Faculty of 1000)

Kim, E.Y., Rumpf, C.H., Fujiwara, Y., Van Petegem, F., Arant, R., Findeisen, F., Cooley, E.S., Isacoff, E.Y. and **Minor, D.L., Jr.**, 'Multiple C-terminal Tail Ca²⁺/CaMs regulate Ca_v1.2 function but do not mediate channel dimerization' *The EMBO Journal* **29** 3924-3938 (2010) **PMID: 20953164** **PMCID: PMC3020648**

3) Bacterial voltage gated sodium channels (BacNa_vs): BacNa_vs are model systems for understanding the fundamental principles of voltage gated channel function. Using a protein dissection approach, we demonstrated that BacNa_vs are modular within the membrane and that the pore domain can be excised from the voltage sensors to produce functional sodium or calcium selective channels. These 'pore-only' proteins establish a general design principle of modularity within voltage-gated ion channel membrane domains and show that the pore domain and voltage sensor domains are separable units (*Shaya et al. 2011*). We determined the structure of a bacterial 'pore-only' sodium channel. *This work uncovered the complete structure of a pore-only BacNa_v and revealed the structure of a crucial part, the cytoplasmic tail that had evaded other structural studies* (*Shaya et al. 2014*). This finding together with functional tests resolved controversy over the location of the intracellular gate that controls channel opening and established a role for the cytoplasmic domain in controlling channel opening. Structure determination of a 'pore-only' bacterial sodium channel also identified an ion binding site having common to human voltage-gated calcium channel pores and

discovered a previously unknown determinant of ion selectivity in human voltage-gated calcium channels (Shaya et al. 2014).

There has been much debate about the origins of thermosensitivity in ion channels and whether such responses rely on a dedicated sensing to domain or a more distributed property of the channel. *Our recent studies of BacNa_v mechanisms have defined the first authentic temperature-sensitive module in an ion channel and show that it is possible for a single, defined domain to control channel thermal responses.* (Arrigoni et al. 2016).

Shaya, D., Kreir, M., Robbins, R.A., Wong, S., Hammon, J., Brüggemann, A., and **Minor, D.L., Jr.**, 'Voltage-gated sodium channel (Na_v) protein dissection creates a set of functional 'pore-only' proteins' *Proc Natl Acad Sci USA* **108** 12313-12318 (2011) **PMID: 21746903: PMCID: PMC3145705**

Shaya, D., Findeisen, F., Abderemane-Ali, F., Arrigoni, C., Wong, S., Reddy Nurva, S., Loussouarn, G., and Minor, D.L., Jr., 'Structure of a prokaryotic sodium channel pore reveals essential gating elements and an outer ion binding site common to eukaryotic channels' *Journal of Molecular Biology* **426** 476-483 (2014) **PMID: 24120938 PMCID: PMC3947372**

Arrigoni, C., Rohaim, A., Shaya, D., Findeisen, F., Stein, R.A. Nurva, S.R., Mishra, S., Mchaourab, H.S., and **Minor, D.L., Jr.**, 'Unfolding of a temperature-sensitive domain controls voltage-gated channel activation' *Cell* **164** 922-936 (2016) **PMID: 26919429 PMCID: PMC4769381**

4) K_v channels K_v channels are a diverse set of potassium channels that produce 'leak' currents that control cellular excitability. K_v2.1 (TREK-1) is a classic polymodal channel that is gated by a wide range of stimuli including pH, temperature, and pressure. *When we began studying this channel family, it was unclear whether the various inputs controlled the channel by separate or common mechanisms.* Using a gain-of-function selection that identified K_v2.1 (TREK-1) mutants that rescued a potassium transport deficient yeast strain, we identified a key element of the channel gate and established that pH, temperature, and pressure act through a common mechanism to control the gate, which is the channel selectivity filter (Bagriantsev et al., 2011). We established that signals from the intracellular sensors for temperature and phosphorylation are relayed to the selectivity filter via transmembrane helix M4 (Bagriantsev et al. 2012). Structure determination of two gain-of-function mutants in K_v4.1 (TRAAK) revealed an unexpected mechanism that is opposite from prior expectations based on studies of other potassium channel classes (Lolicato et al. 2014). Upon activation M4 straightens at a conserved glycine and causes the M2 transmembrane helix to buckle at a conserved 'GXG' sequence. Structure-based functional tests demonstrate that this mechanism operates in the thermosensitive and mechanosensitive K_v subfamily. *Our studies have shown that K_v channels gate at the selectivity filter rather than an intracellular gate. Our latest work has defined the structure of K_v2.1 (TREK-1) and uncovered a previously unknown small molecule modulatory site and demonstrates that small molecules can directly activate the selectivity filter gate* (Lolicato et al., 2017).

Bagriantsev, S., Clark, K.A., Peyronnet, R., Honoré, E., and **Minor, D.L., Jr.**, 'Multiple modalities act through a common gate to control K_v channel function' *The EMBO Journal* **30** 3594-3606 (2011) **PMID: 21765396 PMCID: PMC3181481**

Bagriantsev, S., Clark, K.A., and **Minor, D.L., Jr.**, 'Metabolic and thermal stimuli control K_v2.1 (TREK-1) through modular sensory and gating domains' *The EMBO Journal* **31** 3297-3308 (2012) **PMID: 22728824 PMCID: PMC3411076**

Lolicato, M., Riegelhaupt, P.M., Arrigoni, C., Clark, K.A., and **Minor, D.L., Jr.** 'Transmembrane helix straightening and buckling underlies activation of mechanosensitive and thermosensitive K_v channels' *Neuron* **84** 1198-1212 (2014) **PMID: 25500157 PMCID: PMC4270892'**

Lolicato, M., Arrigoni, C., Mori, T., Sekioka, Y., Bryant, C., Clark, K.A., **Minor, D.L., Jr.** 'K_v2.1(TREK-1):activator complexes reveal a cryptic selectivity filter binding site' *Nature* **547** 364-368 (2017) **PMID: 28693035 PMCID: PMC5778891**

5) Ion channel-modulator interactions: We established a yeast genetic selection system for investigating ion channel-modulator interactions. By selecting for barium resistant mutants of the inward rectifier Kir2.1, we identified a T→K mutant that demonstrated that the pore helix dipole, thought by many to be important for function, is not involved in ion permeation (Chatelain et al. 2005). We showed that the yeast system could be used generally to identify residues important for ion channel-small molecule interactions. Recently, we have established this system as a means to identify small molecule modulators of K_v channel function and have developed a novel, selective activator of the K_v subclass of mechanosensitive and thermosensitive channels (Bagriantsev et al., 2013). *Our has defined the first set selective K_v activators and resulted in a patent* (Bagriantsev et al. 61/785,155). We have also shown that the yeast system can be used to discover novel protein-based regulators of ion channel function (Bagriantsev et al., 2014). *We have recently defined a novel class*

of K_v activators that bind to a previously unknown site supporting the channel selectivity filter, the ' K_v modulator pocket'. These studies set the stage for the development of a new class of ion channel modulators (Lolicato et al., 2017).

Chatelain, F.C., Alagem, N., Xu, Q., Pancaroglu, R., Reuveny, E., and **Minor, D.L., Jr.**, "The pore helix dipole has a minor role in inward rectifier channel function" *Neuron* **47** 833-843 (2005) **PMID: 16157278** **PMCID: PMC3017504 (Preview Neuron 47 777-778, 2005)**

Chatelain, F.C., Gazzarrini, S., Fujiwara, Y., Arrigoni, C., Domigan, C., Ferrara, G., Pantoja, C., Thiel, G., Moroni, A., and **Minor, D.L., Jr.**, 'Selection of inhibitor-resistant viral potassium channels identifies a selectivity filter site that affects barium and amantadine block' *PLoS ONE* **4** (10) e7496. doi:10.1371/journal.pone.0007496 (2009) **PMID: 19834614; PMCID: PMC2759520**

Bagriantsev, S. N., Ang, K.H., Gallardo-Godoy, A., Clark, K.A., Arkin, M.R., Renslo, A.R, and **Minor, D.L., Jr.**, 'A high-throughput functional screen identifies small molecule regulators of temperature- and mechano-sensitive K_v channels' *ACS Chemical Biology* **8** 1841-1851 (2013) **PMID: 23738709** **PMCID: PMC3747594**

US patent application number 61/785,155 'Modulation of K_v channels' Bagriantsev, S.N., Renslo, A.R., and **Minor, D. L., Jr.**

Bagriantsev, S.N., Chatelain, F.C., Clark, K.A., Alagem, N., Reuveny, E., Minor, D.L., Jr. 'Tethered protein display identifies a novel Kir3.2 (GIRK2) regulator from protein scaffold libraries' *ACS Chemical Neuroscience* **5** 812-822 (2014) **PMID: 25028803** **PMCID: PMC4176385**

Lolicato, M., Arrigoni, C., Mori, T., Sekioka, Y., Bryant, C., Clark, K.A., **Minor, D.L., Jr.** ' $K_v2.1$ (TREK-1):activator complexes reveal a cryptic selectivity filter binding site' *Nature* **547** 364-368 (2017) **PMID: 28693035** **PMCID: PMC5778891**

URL to myNCBI a full list of published work

<http://www.ncbi.nlm.nih.gov/sites/myncbi/daniel.minor.1/bibliography/41458029/public/?sort=date&direction=ascending>.

Complete list of Peer-reviewed publications (in chronological order):

1. **Minor, D. L., Jr.** and Kim P. S. "Measurement of the β -sheet forming propensities of amino acids" *Nature* **367** 660-663 (1994) **PMID: 810785**
2. **Minor, D.L., Jr.** and Kim P.S. "Context is a major determinant of β -sheet propensity" *Nature* **371** 264-267 (1994) **PMID: 8078589**
3. Schumacher, T.N.M., Mayr, L.M., **Minor, D.L., Jr.**, Milhollen, M.A., Burgess, M.W. and Kim, P.S. "Identification of (D)-peptide ligands through Mirror-Image phage display" *Science* **271** 1854-1857 (1996) **PMID: 8596952**
4. **Minor, D.L., Jr.** and Kim P.S. "Context-dependent secondary structure formation of a designed protein sequence" *Nature* **380** 730-734 (1996) **PMID: 8614471**
5. **Minor, D.L., Jr.**, Masseling, S.J., Jan, Y.N. and Jan, L.Y. "Transmembrane structure of an inwardly rectifying potassium channel" *Cell* **96** 879-891 (1999) **PMID: 10102275**
6. **Minor, D.L., Jr.**, Lin, Y.F, Mobley, B.C., Avelar, A., Jan, Y.N., Jan, L.Y. and Berger, J.M. "The polar T1 interface is linked to conformational changes that open the voltage-gated potassium channel" *Cell* **102** 657-670 (2000) **PMID: 11007484**
7. Mosavi, L. K., **Minor, D.L., Jr.**, and Peng, Z.-y., "Consensus-derived structural determinants of the ankyrin repeat motif" *Proceedings of the National Academy of Sciences, USA* **99** 16029-16034 (2002) **PMID:12461176; PMCID: PMC138559**
8. Walden, H., Podgorski, M.S., Huang, D.T., Miller, D.W., Howard, R.J., **Minor, D.L., Jr.**, Holton, J.M., and Schulman, B.A., "The structure of APPBP-1UBA3-NEDD8-ATP complex reveals the basis for selective ubiquitin-like protein activation by an E1" *Molecular Cell* **12** 1427-1437 (2003) **PMID: 14690597**
9. Van Petegem, F., Clark, K.A., Chatelain, F.C., and **Minor, D.L., Jr.**, "Structure of a complex between a voltage-gated calcium channel β -subunit and an α -subunit domain" *Nature* **429** 671-675 (2004) **PMID:15141227 (Research Highlight Nature Rev. Neuroscience 5:517, 2004; rated 'Exceptional' Faculty of 1000)**
10. Chatelain, F.C., Alagem, N., Xu, Q., Pancaroglu, R., Reuveny, E., and **Minor, D.L., Jr.**, "The pore helix dipole has a minor role in inward rectifier channel function" *Neuron* **47** 833-843 (2005) **PMID: 16157278 (Preview Neuron 47 777-778, 2005)**

11. Van Petegem, F, Chatelain, F.C., **Minor, D.L., Jr.**, "Insights into voltage-gated calcium channel regulation from the structure of the Ca_v1.2 IQ domain-Ca²⁺/calmodulin complex" *Nature Structural & Molecular Biology* **12** 1108-1115 (2005) **PMID: 16299511** **PMCID: PMC3020901**
12. Tsuruda, P., Julius, D., and **Minor, D.L., Jr.**, "Identification and characterization of a domain required for assembly of a cold-activated TRP channel" *Neuron* **51** 201-212 (2006) **PMID: 16846855** **PMCID: PMC3014052**
13. Michelsen, K., Mrowiec, T., Duderstadt, K.E., Frey, S., **Minor, D.L., Jr.**, Mayer, M.P., Schwappach, B., "A multimeric membrane protein reveals 14-3-3 isoform specificity in forward transport in yeast" *Traffic* **7** 903-916 (2006) **PMID: 16734667**
14. Pioletti, M., Findeisen, F., Hura, G.L., and **Minor, D.L., Jr.**, "Three-dimensional structure of the KChIP1/Kv4.3 T1 domain complex reveals a cross-shaped octamer" *Nature Structural & Molecular Biology* **13** 987-995 (2006) **PMID: 17057713** **PMCID: PMC3018330**
15. Howard, R.J., Clark, K.A., Holton, J.M., and **Minor, D.L., Jr.**, "Structural insight into KCNQ (Kv7) channel assembly and channelopathy" *Neuron* **53** 663-675 (2007) **PMID: 17329207** **PMCID: PMC3011230**
16. Balss, J., Paptheodorou, P., Mehmel, M., Baumeister, D., Hertel, B., Delaroque, N., Chatelain, F. C., **Minor, D.L., Jr.**, Van Etten, J.L., Rassaw, J., Moroni, A., and Thiel, G. "Transmembrane Domain Length of Viral Potassium Ion Channels is a Signal for Mitochondria Targeting" *PNAS* **105** 12313-12318 (2008) **PMID: 18719119**; **PMCID: PMC2518832**
17. Van Petegem, F, Duderstadt, K.E., Clark, K.A., Wang, M., **Minor, D.L., Jr.**, "Alanine-scanning mutagenesis defines a conserved energetic hotspot in the Ca_v1 AID-Ca_v1β interaction site that is critical for channel modulation" *Structure* **14** 280-294 (2008) **PMID: 18275819** **PMCID: PMC3018278**
18. Fujiwara, Y. and **Minor, D.L., Jr.**, 'X-ray crystal structure of a TRPM assembly domain reveals an antiparallel four-stranded coiled-coil' *Journal of Molecular Biology* **383** 854-870 (2008) **PMID: 18782578**; **PMCID: PMC2630241**
19. Kim, E.Y., Rumpf, C.H., Fujiwara, Y., Cooley, E.S., Van Petegem, F., and **Minor, D.L., Jr.**, "Structures of Ca_v2 Ca²⁺/CaM-IQ domain complexes reveal binding modes that underlie calcium-dependent inactivation and facilitation" *Structure* **16** 1455-1467 (2008) **PMID: 18940602**; **PMCID: PMC2701236** (Rated 'Must Read' by Faculty of 1000)
20. Hammon, J., Palanivelu, D.V., Chen, J., Patel, C., and **Minor, D.L., Jr.**, 'A green fluorescent protein screen for identification of well-expressed membrane proteins' *Protein Science* **18** 121-133 (2009) **PMID: 19177357** ; **PMCID : PMC2708023** (Rated 'Recommended' by Faculty of 1000)
21. Findeisen, F. and **Minor, D.L., Jr.**, 'Disruption of the IS6-AID linker affects voltage-gated calcium channel inactivation and facilitation' *Journal of General Physiology* **133** 327-343 (2009) **PMID: 19237593**; **PMCID: PMC2654080**
22. Xu, Q. and **Minor, D.L., Jr.**, 'Crystal structure of a trimeric form of the Kv7.1 (KCNQ1) A domain Tail coiled coil reveals structural plasticity and context dependent changes in a putative coiled-coil trimerization motif' *Protein Science* **18** 2100-2114 (2009) **PMID 19693805** **PMCID: PMC2786974**
23. Chatelain, F.C., Gazzarrini, S., Fujiwara, Y., Arrigoni, C., Domigan, C., Ferrara, G., Pantoja, C., Thiel, G., Moroni, A., and **Minor, D.L., Jr.**, 'Selection of inhibitor-resistant viral potassium channels identifies a selectivity filter site that affects barium and amantadine block' *PLoS ONE* **4** (10) e7496. doi:10.1371/journal.pone.0007496 (2009) **PMID: 19834614**; **PMCID: PMC2759520**
24. Kohout S.C., Bell S.C., Liu L., Xu Q., **Minor, D.L., Jr.**, and Isacoff, E.Y., "Electrochemical coupling in the voltage-dependent phosphatase Ci-VSP" *Nature Chemical Biology* **6** 369-375 (2010) **PMID: 20364128**; **PMCID: PMC2857593** (Preview *Nature Chemical Biology* **6** 315-316, 2010)
25. Kim, E.Y., Rumpf, C.H., Fujiwara, Y., Van Petegem, F., Arant, R., Findeisen, F., Cooley, E.S., Isacoff, E.Y. and **Minor, D.L., Jr.**, 'Multiple C-terminal Tail Ca²⁺/CaMs regulate Ca_v1.2 function but do not mediate channel dimerization' *The EMBO Journal* **29** 3924-3938 (2010) **PMID: 20953164** **PMCID: PMC3020648**
26. Findeisen, F. and **Minor, D.L., Jr.**, 'Structural basis for the differential effects of CaBP1 and calmodulin on Ca_v1.2 calcium-dependent inactivation' *Structure* **18** 1617-1631(2010) **PMID: 21134641**; **PMCID: In Progress** (Rated 'Recommended' by Faculty of 1000)
27. Shaya, D., Kreir, M., Robbins, R.A., Wong, S., Hammon, J., Brüggemann, A., and **Minor, D.L., Jr.**, 'Voltage-gated sodium channel (Na_v) protein dissection creates a set of functional 'pore-only' proteins' *Proc Natl Acad Sci USA* **108** 12313-12318 (2011) **PMID: 21746903**; **PMCID: PMC3145705**

28. Bagriantsev, S., Clark, K.A., Peyronnet, R., Honoré, E., and **Minor, D.L., Jr.**, 'Multiple modalities act through a common gate to control K_v channel function' *The EMBO Journal* **30** 3594-3606 (2011) **PMID: 21765396** **PMCID: PMC3181481**
29. Findeisen, F., Tolia, A., Arant, R., Kim, E.Y., Isacoff, E.Y., and Minor, D.L., Jr., 'Calmodulin overexpression does not alter $Ca_v1.2$ function or oligomerization state' *Channels* **5** 320-324 (2011) **PMID: 21712653** **PMCID: PMC3225732**
30. Liu L., Kohout, S.C., Xu, Q., Müller, S., Kimberlin, C.R., Isacoff, E.Y. **Minor, D.L., Jr.**, 'A glutamate switch controls voltage-sensitive phosphatase function' *Nature Structural and Molecular Biology* **19** 633-641 (2012) **PMID: 22562138** **PMCID: PMC3529583**
31. Laggner, C., Kokel, D., Setola, V., Tolia, A., Lin, H., Irwin, J.J., Keiser, M.J., **Minor, D.L., Jr.**, Roth, B.L., Peterson, R.T., Shoichet, B.K., 'Chemical informatics and target identification in a zebrafish phenotypic screen' *Nature Chemical Biology* **8** 144-146 (2012) **PMID:22179068** **PMCID: PMC3262069**
32. Bagriantsev, S., Clark, K.A., and **Minor, D.L., Jr.**, 'Metabolic and thermal stimuli control $K_v2.1$ (TREK-1) through modular sensory and gating domains' *The EMBO Journal* **31** 3297-3308 (2012) **PMID: 22728824** **PMCID: PMC3411076**
33. Xu, Q., Chang, A., Tolia, A., and **Minor, D.L., Jr.**, 'Structure of a $Ca^{2+}/CaM:KV7.4$ (KCNQ4) B-helix complex provides insight into M-current modulation' *Journal of Molecular Biology* **425** 378-394 (2013) **PMID: 23178170** **PMCID: PMC3540129**
34. Petrov, E., Palanivelu, D., Nomura, T., Constantine, M., Rohde, P.R., Cox, C.D., **Minor, D.L., Jr.**, and Martinac, B. 'Patch-clamp characterization of the MscS-like mechanosensitive channel from *Silicibacter pomeroyi*' *Biophysical Journal* **104** 1426-1434 (2013) **PMID: 23561519** **PMCID: PMC3617418**
35. Tien, J., Lee, H.Y., Minor, D.L., Jr., Jan, Y.N, and Jan, L.Y. 'Identification of a dimerization domain in the TMEM16A calcium-activated chloride channel (CaCC)' *Proc. Natl. Acad. Sci. USA* **110** 6352-6357 (2013) **PMID: 23576756** **PMCID: PMC3631655**
36. Bagriantsev, S. N., Ang, K.H., Gallardo-Godoy, A, Clark, K.A., Arkin, M.R., Renslo, A.R, and **Minor, D.L., Jr.**, 'A high-throughput functional screen identifies small molecule regulators of temperature- and mechano-sensitive K_v channels' *ACS Chemical Biology* **8** 1841-1851 (2013) **PMID: 23738709****PMCID: PMC3747594**
37. Findeisen, F., Rumpf, C.H., and **Minor, D.L., Jr.** 'Apo states of calmodulin and CaBP1 control Ca_v1 voltage-gated calcium channel function through direct competition for the IQ domain' *Journal of Molecular Biology* **425** 3217-3234 (2013) **PMID: 23811053** **PMCID: PMC3839849**
38. Shaya, D., Findeisen, F., Abderemane-Ali, F., Arrigoni, C., Wong, S., Reddy Nurva, S., Loussouarn, G., and **Minor, D.L., Jr.**, 'Structure of a prokaryotic sodium channel pore reveals essential gating elements and an outer ion binding site common to eukaryotic channels' *Journal of Molecular Biology* **426** 476-483 (2014) **PMID: 24120938** **PMCID: PMC3947372**
39. Bagriantsev, S.N., Chatelain, F.C., Clark, K.A., Alagem, N., Reuveny, E., Minor, D.L., Jr.' Tethered protein display identifies a novel Kir3.2 (GIRK2) regulator from protein scaffold libraries' *ACS Chemical Neuroscience* **5** 812-822 (2014) **PMID: 25028803** **PMCID: PMC31476385**
40. Lolicato, M., Riegelhaupt, P.M., Arrigoni, C., Clark, K.A., Minor, D.L., Jr.' Transmembrane helix straightening and buckling underlies activation of mechanosensitive and thermosensitive K_v channels' *Neuron* **84** 1198-1212 (2014) **PMID: 25500157** **PMCID: PMC427089**
41. Arrigoni, C., Rohaim, A., Shaya, D., Findeisen, F., Stein, R.A. Nurva, S.R., Mishra, S., Mchaourab, H.S., and **Minor, D.L., Jr.**, 'Unfolding of a temperature-sensitive domain controls voltage-gated channel activation' *Cell* **164** 922-936 (2016) **PMID: 26919429** **PMCID:PMC4769381**
42. Findeisen, F., Campiglio, M., Jo, H., Abderemane-Ali, F., Rumpf, C.H., Pope, L., Rossen, N.D., Flucher, B.E., DeGrado, W.F., and **Minor D.L., Jr.**, 'Stapled voltage-gated calcium channel (Ca_v) α -Interaction Domain (AID) peptides act as selective protein-protein interaction inhibitors of Ca_v Function' *ACS Chemical Neuroscience* **8** 1313-1326 (2017) **PMID: 28278376** **PMCID: PMC5481814**
43. Lolicato, M., Arrigoni, C., Mori, T., Sekioka, Y., Bryant, C., Clark, K.A., **Minor, D.L., Jr.** 'K_v2.1(TREK-1):activator complexes reveal a cryptic selectivity filter binding site' *Nature* **547** 364-368 (2017) **PMID: 28693035** **PMCID: PMC5778891**
44. Dang, S., Feng, S., Tien, J., Peters, C.J., Bulkley, D., Lolicato, M., Zhao, J., Zuberbühler, K., Ye, W., Qi, L., Chen, T., Craik, C.S., Jan, Y.N., **Minor, D.L.Jr.**, Cheng, Y., Jan, L.Y., 'Cryo-EM structures of the TMEM16A calcium-activated chloride channel' *Nature* **552** 426-429 (2017) **PMID: 29236684** **PMCID: PMC5750132**

45. Ely, L., Lolicato, M. David, T., Lowe, K., Kim, Y.C., Samuel, D., Bessette, P., Garcia, J.L., Mikita, T., **Minor, D.L. Jr.**, Coughlin, S.R., 'Structural basis for activity and specificity of an anticoagulant anti-FXIIa monoclonal antibody and a reversal agent' *Structure* **26** 187-198 (2018) PMID:29336885 PMCID:PMC5803430
46. Chang, A., Abderemane-Ali, F., Hura, G.L., Rossen, N.D., Gate, R.E., **Minor, D.L. Jr.**, 'A calmodulin C-lobe Ca²⁺-dependent switch governs Kv7 channel function' *Neuron* Feb 6. pii: S0896-6273(18)30060-6. doi: 10.1016/j.neuron.2018.01.035. [Epub ahead of print] (2018) PMID:29429937 PMCID: In progress

Reviews, Book Chapters, and commentaries

1. **Minor, D.L., Jr.**, "Potassium channels: life in the post-structural world" *Current Opinion in Structural Biology* **11** 403-407 (2001) PMID: 11495731
2. Yi, B.A, **Minor, D.L., Jr.**, Lin, Y.F., Jan, Y.N. and Jan, L.Y., "Controlling potassium channel activities: Interplay between the membrane and intracellular factors" *Proceedings of the National Academy of Sciences, USA* **98** 11016-11023 (2001)
3. **Minor, D.L., Jr.**, "Overview: Function and three-dimensional structures of ion channels" in **Handbook of Cellular Signaling**, Eds. R. Bradshaw and E. Dennis, Academic Press, San Diego (2004)
4. **Minor, D.L., Jr.**, "Bend to open?" *Structure* **13** 1094-1095 (2005) PMID: 16084381
5. **Minor, D.L., Jr.**, "Wanting contact: how to pick up a channel" *Nature Chemical Biology* **2** 298-299 (2006) PMID: 16710336
6. **Minor, D.L., Jr.**, "A sensitive channel family replete with sense and motion" *Nature Structural & Molecular Biology* **13** 388-390 (2006) PMID: 16738606
7. Van Petegem, F. and **Minor, D.L., Jr.**, "The structural biology of voltage-gated calcium channel function and regulation" *Biochemical Society Transactions* **34** 887-893 (2006) PMCID: PMC3010275
8. **Minor, D.L., Jr.**, "Puzzle plugged by pore plasticity" *Molecular Cell* **26** 459-460 (2007)
9. **Minor, D.L., Jr.**, "The neurobiologist's guide to structural biology: A Primer on why macromolecular structure matters and how to evaluate macromolecular structural data" *Neuron* **54** 511-533 (2007) PMCID: PMC3011226
10. **Minor, D.L., Jr.**, "Searching for interesting channels: Pairing selection and molecular evolution methods to study ion channel structure and function" *Molecular Biosystems* **5** 802-810 (2009) PMID: 19603113 PMCID: PMC3016960
11. Kim, E.Y., Findeisen, F. and **Minor, D.L., Jr.**, 'Calmodulin interactions with Ca_v1 and Ca_v2 voltage-gated calcium channel IQ domains' *Handbook of Metalloproteins* (Ed. A. Messerschmidt, John Wiley: Chichester. DOI: 10.1002/0470028637.met281. Published 15 December 2010.)
12. Bagriantsev, S. and **Minor, D.L., Jr.**, 'Small molecule-ion channel match making: A natural fit for new ASIC ligands' *Neuron* **68** 1-3 (2010) PMCID: PMC2981581
13. Findeisen, F. and **Minor, D.L., Jr.**, 'Progress in the structural understanding of voltage-gated calcium channel (Ca_v) function and modulation' *Channels* **4** 28-43 (2010) PMID: 21139419; PMCID: PMC3018750
14. Bagriantsev, S. and **Minor, D.L., Jr.**, 'Using yeast to study potassium channel function and interactions with small molecules' *Methods in Molecular Biology* **995** 31-42 (2013) PMID: 23494370 PMCID: PMC3950311
15. Isacoff, E.Y., Jan, L.Y., and **Minor, D.L., Jr.**, 'Conduits of life's spark: A perspective on ion channel research since the birth of Neuron' *Neuron* **80** 658-674 (2013) PMID: 24183018 PMCID: PMC3867263
16. Payandeh, J. and **Minor, D.L., Jr.**, 'Bacterial voltage-gated sodium channels (BacNa_vs) from the soil, sea, and salt lakes enlighten molecular mechanisms of electrical signaling and pharmacology in the brain and heart' *Journal of Molecular Biology* **427** 3-30 (2015) PMID: 25158094 PMCID: PMC4277928
17. Gaudet, R., Roux, B. and **Minor, D.L., Jr.**, 'Insights into the molecular foundations of electrical excitation' *Journal of Molecular Biology* **427** 1-2 (2015) PMID: 25542854 PMCID: PMC5544904
18. **Minor, D.L., Jr.**, 'Let it go and open up: an ensemble of ion channel active states' *Cell* **164** 597-598 (2016) PMID: 26871624
19. Plant, L.D., Bayliss, D.A., **Minor, D.L. Jr.**, Czirják, G., Enyedi, P., Lesage, F., Sepúlveda, F., Goldstein, S.A.N., 'Two P domain potassium channels, introduction. IUPHAR/BPS Guide to PHARMACOLOGY (2017) <http://www.guidetopharmacology.org/GRAC/FamilyIntroductionForward?familyId=79>.
20. **Minor, D.L. Jr.**, 'Channel surfing uncovers a dual-use transporter' *The EMBO Journal* **36** 3272-3273 (2017) PMID: 29051229 PMCID: PMC5686543

21. Arrigoni, C. and **Minor, D.L. Jr.**, 'Global versus local mechanisms of temperature sensing in ion channels', *Pflügers Archiv: European Journal of Physiology* Jan 17. doi: 10.1007/s00424-017-2102-z. [Epub ahead of print] (2018)

Patents issued or pending

Patent US9862684B2 'Modulation of K_v channels' Bagriantsev, S.N., Renslo, A.R., and **Minor, D. L., Jr.**

D. Research Support.

Ongoing Research Support:

R01HL080050 NIH/NHLBI Minor (PI) 5/1/05-3/31/18

Structure and function of voltage-gated calcium channels \$388,174

The major goals of this project are to investigate the molecular origins of calcium channel function.

Role: PI

R01 MH093603-01 NIH/NIMH Minor (PI) 03/01/11 – 02/28/21

Genetic and chemical biological studies of K_v structure, function, and modulation \$400,000

The major goals are to develop genetic selection-based, approaches to define and characterize essential elements of K_v channel gating and to discover and characterize small molecule K_v modulators.

Role: PI

R01DC007664 NIH/NIDCD Minor (PI) 07/01/05-01/31/22

Structure and function of ion channel assembly and signaling complexes \$360,648

The major goal of this project is to study the structural biology of potassium channel regulation.

Role: PI

U.S.-Israel Binational Science Foundation Grant 2011124 Minor/Reuveny (PI) 10/1/16 – 09/30/20

'Molecular Mechanisms of the regulation of SOCE by SARAF' \$13,376

The major goals of this project are to develop an understanding the interactions between SOCE channels and calcium regulation

Role: Co-PI with E. Reuveny, Weizmann Institute

Pending Research Support:

R01 MH116278-01 NIH/NIMH Renslo (PI) 4/1/18 – 3/31/21

'Expanding the chemical biology of K_v channels with selective cellular and in vivo probes'

The major goals of this project are to advance new cellular and *in vivo* compatible probes of K_v channels.

Role: Co-PI with A. Renslo, UCSF