Julien Roche, Ph.D.

Roy J. Carver Department of Biochemistry, Biophysics and Molecular Biology
Iowa State University
1210 Molecular Biology Building
2437 Pammel Drive, Ames, IA, 50011
Phone: 515-294-6437 / jroche@iastate.edu

Academic position

Associate Professor, Roy J. Carver Department of Biochemistry, Biophysics & Molecular Biology, Iowa State University (2022 - present)

Assistant Professor, Roy J. Carver Department of Biochemistry, Biophysics & Molecular Biology, Iowa State University (2016 - 2022)

Education

University of Montpellier (France)	Biophysics	Ph.D. 2012
University of Montpellier (France)	Biophysics	M.S 2008
University of Montpellier (France)	Biology	B.S. 2006

Research Experience

June 2016 - present
Roy J. Carver Department of Biochemistry, Biophysics & Molecular Biology, ISU
Research focus: Structure, function and assembly of large scaffold proteins. Order/Disorder transitions.
Other affiliations: Bioinformatics & Computational Biology, Molecular, Cellular and Developmental Biology, Toxicology

September 2012 – June 2016
Postdoctoral Research Associate, The National Institutes of Health, Bethesda, MD
In the laboratory of Dr. Adriaan Bax

September 2008 – June 2012
Graduate Research Assistant, Centre de Biochimie Structurale, Montpellier, France
In the laboratory of Dr. Christian Roumestand and Dr. Catherine A. Royer

January 2008 – June 2008
Undergraduate Research Assistant, Rensselaer Polytechnic Institute, Troy, NY
In the laboratory of Dr. Angel E. Garcia

Secured Funding

National Institutes of Health, NIGMS R01 (1R01GM132561-01): $1,624,518
Structure and Function of DISC1 in the cAMP pathway
9/1/2019-8/31/2024,
Role: Sole PI.

Awards

- **LAS Award for Impact on Student Success (2023)**
- **LAS Award for Early Achievement in Research (2022)**
- Young researcher award from the French Biophysical Society (2014)
- Intramural AIDS Research Fellowship, NIH, renewal, one-year funding (2014)
- Intramural AIDS Research Fellowship, NIH, one-year funding (2014)
- Fellows Award for Research Excellence, NIH, travel grant (2013)
- Fulbright scholarship, 6 months stay in Prof. Angel E. Garcia's lab, RPI, NY (2011)
- Grant for Excellency, University of Montpellier, France (2007)

Publications (**total: 41**, first author: 16, corresponding author: 11, total number of citations: 1767)

1. Publications after joining ISU (17)

Kramer D.A, Narvaez-Ortiz, H.Y, Patel U, Shi R, Shen K, Nolen B.J, **Roche J***, Chen B*. (2023) The intrinsically disordered cytoplasmic tail of a dendrite branching receptor uses two distinct mechanisms to regulate the actin cytoskeleton. **eLife** (In press) **corresponding author*

Siang S, Underbakke E, **Roche J*** (2022) Intricate coupling between the transactivation and basic-leucine zipper domains governs phosphorylation of transcription factor ATF4 by casein kinase 2. **J. Biol. Chem** 298: 101633 **corresponding author*

Dershwitz P, Gu W, **Roche J**, Kang-Yun C.S, Semrau J.D, Bobik T.A, Fulton B, Zischka H, DiSpirito A.A (2022) MbnC is not required for the formation of the N-terminal oxazolone in the methanobactin from Methylosinus trichosporium OB3b. **Appli. Environ. Microbiol.** 88: e01841-21

Nguyen T. T, Siang S, **Roche J*** (2021) High-pressure NMR experiments for detecting protein low-lying conformational states. **J. Vis. Exp** 172**:** doi: 10.3791/62701 **corresponding author*

Nguyen T. T, Ghirlando R, **Roche J***, Venditti V.* (2021) Structure elucidation of the elusive Enzyme I monomer reveals the molecular mechanisms linking oligomerization and enzymatic activity. **Proc. Natl. Acad. Sci. USA**. 118: e2100298118 **corresponding author*

Levengood J, Peterson J, Tolbert B**, Roche J.*** (2021) Thermodynamic stability of hnRNP A1 low complexity domain revealed by high-pressure NMR. **Proteins** 89: 781-791 **corresponding author*

Roche J, Potoyan D.A. (2019) Disorder mediated oligomerization of DISC1 proteins revealed by coarse-grained molecular dynamics simulations. **J. Phys. Chem. B**. 45: 9567-9575

Roche J.* (2019) High-pressure NMR of biological systems in solution. **eMagRes** 8: 121-126 **corresponding author*

Roche J, Royer C.A, Roumestand C. (2019) Exploring protein conformational landscapes using high-pressure NMR. **Methods in Enzymology** 614:293-320

Alderson R.T, **Roche J**, Gastall H.Y, Pristisanac I, Bax A, Benesch J.L.P, Baldwin A.J. (2019) Local unfolding of the HSP27 monomer regulates chaperone activity. **Nature Commun.** 10: 1068

Andrews R, **Roche J**, Moss W. (2018) ScanFold: an approach for genome-wide discovery of local RNA structural elements – applications to Zika virus and HIV. **PeerJ**. 6: e6136

Roche J, Royer C.A (2018) Lessons from Pressure Denaturation of Proteins. **J. R. Soc. Interface** 15: pii 20180244

Baweja L.K, **Roche J.*** (2018) Pushing the limits of structure-based models: prediction of non-globular protein folding and fibrils formation with Go-model simulations. **J. Phys. Chem. B**. 122: 2525-2535 **corresponding author*

Roche J, Royer C.A, Roumestand C. (2017) Monitoring protein folding through high pressure NMR. **Prog. Nucl. Magn. Reson. Spectrosc.** 102-103: 15-31

Nguyen L.M, **Roche J.*** (2017) High-pressure NMR techniques for the study of protein dynamics, folding and aggregation. **J. Magn. Reson**. 277: 179-185 **corresponding author*

Shen Y, **Roche J**, Grishaev A, Bax A. (2017) Prediction of nearest neighbor effects on backbone torsion angles and NMR scalar coupling constants in disordered proteins. **Protein Sci**. 27: 146-158

Agniswamy J, Louis J.M, **Roche J**, Harrison R.W, Weber I.T (2016) Structural studies of a rationally selected multi-drug resistant HIV-1 protease reveal synergistic effect of distal mutations on flap dynamics. **PLoS One**. 11: e0168616

2. Publications before joining ISU (24)

Louis J.M, Baber J.L, Ghirlando R, Aniana A, Bax A, **Roche J.*** (2016) Insights into the conformation of the membrane proximal regions critical to the trimerization of the HIV-1 gp41 ectodomain bound to dodecyl phosphocholine micelles. **PLoS One.** 11: e0160597 **corresponding author*

Louis J.M, **Roche J.*** (2016) Evolution under drug pressure remodels the folding free-energy landscape of mature HIV-1 protease. **J. Mol. Biol**. 428: 2780-2792 **corresponding author*

Roche J, Ying J, Shen Y, Torchia D.A, Bax A. (2016) ARTSY-J: convenient and precise measurement of $^{3}J_{HNH\alpha}$ couplings in medium-size proteins from TROSY-HSQC spectra. **J. Magn. Reson.** 268: 73-81

Roche J, Shen Y, Jung Ho L, Jinfa Y, Bax A. (2016) Monomeric $A\beta^{1-40}$ and $A\beta^{1-42}$ peptides in solution adopt very similar ramachandran map distributions that closely resemble random coil. **Biochemistry** 55: 762-775 (cited > 100 times)

Roche J, Ying J, Bax A. (2015) Accurate measurement of $^{3}J_{HNH\alpha}$ couplings in small or disordered proteins from WATERGATE-optimized TROSY spectra. **J. Biomol**. **NMR** 64: 1-7

Roche J, Louis J.M, Bax A, Best R. (2015) Pressure-induced structural transition of mature HIV-1 Protease from a combined NMR/MD simulation approach. **Proteins**. 83: 2117-2123

Roche J, Dellarole M, Royer C.A, Roumestand C. (2015) Exploring the protein folding pathway with high-pressure NMR: steady-state and kinetics studies. **High pressure Bioscience: basic concepts, applications and frontiers (Subcell Biochem.)** 72: 261-278

Tugarinov V, Libich D.A, Meyer V, **Roche J**, Clore G.M. (2015) The energetics of a three-state protein folding system probed by high-pressure relaxation NMR from 1 to 2500 bar. **Angew. Chem. Int. Ed**. 54: 11157-11161

Dellarole M, Caro J.A, **Roche J**, Fossat M, Barthe P, Garcia-Moreno B, Royer C.A, Roumestand C (2015) Evolutionary conserved pattern of interactions in a protein revealed by local thermal expansion properties. **J. Am. Chem. Soc**. 137: 9354-9362

Roche J, Louis J.M, Aniana A, Ghirlando R, Bax A. (2015) Complete dissociation of the HIV-1 gp41 ectodomain and membrane proximal regions upon phospholipid binding. **J. Biomol. NMR** 61: 235-248

Roche J, Louis J.M, Bax A. (2014) Conformation of inhibitor-free HIV-1 protease derived from NMR spectroscopy in a weakly oriented solution. **Chembiochem**. 16: 214-218

Louis J.M, Aniana A, Lohith K, Sayer J.M, **Roche J**, Bewley C.A, Clore G.M. (2014) Binding of HIV-1 gp41-directed neutralizing and non-neutralizing fragment antibody binding domain (Fab) and single chain variable fragment (ScFv) antibodies to the ectodomain of gp41 in the pre-hairpin and six-helix bundle conformations. **PLoS One**. 9: e104683

Maltsev A.S, Grishaev A, **Roche J,** Zasloff M, Bax A. (2014) Improved cross validation of a static ubiquitin structure derived from high precision residual dipolar couplings measured in a drug-based liquid crystalline phase. **J. Am. Chem. Soc**. 136: 3752-3755

Roche J, Louis J.M, Grishaev A, Ying J, Bax A. (2014) Dissociation of the trimeric gp41 ectodomain at the lipid-water interface suggests an active role in HIV-1 Env-mediated membrane fusion. **Proc. Natl. Acad. Sci. USA**. 111: 3425-3430

Ying J, **Roche J**, Bax A. (2013) Homonuclear decoupling for enhancing resolution and sensitivity in NOE and RDC measurements of peptides and proteins. **J. Magn. Reson**. 241: 97-102 (cited > 100 times)

Louis. J.M, Tozser J, **Roche J**, Matuz K, Aniana A, Sayer J.M. (2013) Enhanced stability of monomer fold correlates with extreme drug resistance of HIV-1 Protease. **Biochemistry** 52: 7678-7688

Roche J, Dellarole M, Caro J.A, Norberto D.E, Garcia A.E, Garcia-Moreno B, Roumestand C, Royer C.A. (2013) Effect of internal cavities on folding rates and routes revealed by real-time pressure-jump NMR spectroscopy. **J. Am. Chem. Soc**. 135: 14610-14618

Roche J, Ying J, Maltsev A.S, Bax A. (2013) Impact of hydrostatic pressure on an intrinsically disordered protein: a high-pressure NMR study of α-synuclein. **Chembiochem**. 14: 1754-1761

Dellarole M, Kobayashi K, Rouget J-B, Caro J.A, **Roche J**, Islam M.M, Garcia-Moreno B, Kuroda Y, Royer C.A. (2013) Probing the physical determinants of thermal expansion of folded proteins. **J. Phys. Chem. B**. 117: 12742-12749

Roche J, Caro J.A, Dellarole M, Guca E, Royer C.A, Garcia-Moreno B, Garcia A.E, Roumestand C. (2013) Structural, energetic and dynamic responses of the native state ensemble of staphylococcal nuclease to cavity-creating mutations. **Proteins** 81: 1069-1080

Roche J, Dellarole M, Caro J.A, Guca E, Norberto D.E, Yang T, Garcia A.E, Roumestand C, Garcia-Moreno B, Royer C.A. (2012) Remodeling of the folding free-energy landscape of staphylococcal nuclease by cavity-creating mutations. **Biochemistry** 51: 9535-9546

Roche J, Caro J.A, Norberto D.E, Barthe P, Roumestand C, Schlessman J.L, Garcia A.E, Garcia-Moreno B, Royer C.A. (2012) Cavities determine the pressure unfolding of proteins. **Proc. Natl. Acad. Sci. USA**. 109: 6945-6950 (cited > **300** times)

Rouget J-B, Aksel T, **Roche J**, Saldana J.L, Garcia A.E, Barrick D, Royer C.A. (2011) Size and sequence and the volume change of protein folding. **J. Am. Chem. Soc**. 133: 6020-6027 (cited > 100 times)

Kitahara R, Hata K, Maeno A, Akasaka K, Chimenti M.S, Garcia-Moreno B, Schroer M.A, Jeworrek C, Tolan M, Winter R, **Roche J**, Roumestand C, Montet de Guillen K, Royer C.A. (2011) Structural plasticity of staphylococcal nuclease probed by perturbation with pressure and pH. **Proteins** 79: 1293-1305

Conferences & seminars (33)

- Cornell University, Extreme Biology workshop at CHESS, 2022 (Ithaca, NY): **Invited talk**
- Extreme Biophysics RCN, 2022 (Santa Fe, NM): **Invited Talk**
- Cornell University, Biology under extreme conditions workshop at CHESS, 2021 (virtual): **Invited talk**
- University of California San Diego, Department of Chemistry seminar, 2021 (virtual): **Invited talk**
- University of Illinois at Chicago, Department of Chemistry seminar, 2021 (virtual): **Invited talk**
- CUNY Advanced Science Research Center, Biochemistry seminar, 2021 (virtual): **Invited talk**
- Rensselaer Polytechnic Institute, Department of Biological Sciences, seminar, 2021 (virtual): **Invited talk**
- University of Illinois at Urbana-Champaign, Department of Chemistry seminar, 2021 (virtual): **Invited talk**
- Mississippi State University, Chemistry Department seminar, 2021 (virtual): **Invited talk**
- Johns Hopkins University, Biophysics Department seminar, 2021 (virtual): **Invited talk**
- Brown University, MCB Department seminar, 2021 (virtual): **Invited talk**
- Extreme Biophysics RCN, 2020 (Virtual): **Talk**
- 34th Gibbs Conference on Biological Thermodynamics, 2020 (Virtual): **Poster**
- Extreme Biophysics RCN, 2019 (San Diego, CA, USA): **Talk**
- RESOLV, 2019 (Bochum, Germany): **Invited talk**
- GRASP NMR, 2018 (Lawrence, KS, USA): **Invited talk**
- 62nd Biophysical Society Meeting, 2018 (San Francisco, CA, USA): **Poster**
- 61st Biophysical Society Meeting, 2017 (New Orleans, LA, USA): **Talk**
- 252nd ACS National Meeting, 2016 (Philadelphia, PA, USA): **Invited Talk**
- 60th Biophysical Society Meeting, 2016 (Los Angeles, CA, USA): **Talk**
- DCO workshop on extreme biophysics, 2015 (Washington, DC, USA): **Invited talk**
- 56th ENC, 2015 (Pacific Grove, USA): **Poster**
- 59th Biophysical society meeting, 2015 (Baltimore, MD, USA): **Talk**
- 7th IMBP, 2014 (Montpellier, France): **Invited talk**.
- Biomolecular structure, dynamics and function: membrane proteins, 2014 (Nashville, TN, USA): **Talk**
- 58th Biophysical society meeting, 2014 (San Francisco, CA, USA): **Poster**
- 51st EHPRG, 2013 (London, UK): **Invited talk**.
- 56th Biophysical Society meeting, 2012 (San Diego, CA, USA): **Talk**.
- 6th IMBP, 2011 (Otsu, Japan): **Talk**.

- 49th EHPRG, 2011 (Budapest, Hungary): **Poster**
- 8th EBSA, 2011 (Budapest, Hungary): **Talk**.
- GERM conference, 2011 (Sitges, Spain): **Talk**.

Advising Activities

Research Advisor

Graduate Students

- Luan Nguyen (Fall 17 – Summer 19). Master Thesis: "*Conformational change upon phosphorylation at S713 site of Disrupted-in-schizophrenia-1 (DISC1) leads to a change in the oligomeric state*". *Graduated 07/10/19*
- Tung Mei Khu (Summer 20 – Summer 22). Master Thesis: "*DISC1 as a sensor for oxidative stress*". *Graduated 08/16/22*
- Steven Siang (Fall 17 – present) Received a **BBMB Research Excellence Award** (Spring 22)
- Urval Patel (Spring 22 – present)
- Manuela Chavez Mejia (Spring 23 – present)

Undergraduate Students

- Mai Huong (Fall 16)
- Sam Kuhn (Fall 16 – Spring 17)
- Bete Ranzi (Fall 16 – Spring 17)
- Steven Siang (Fall 16 - Spring 17)
- Isaac Stine (Fall 18)
- Richard Weerts (Spring 19)
- Henry Anderson (Fall 18 - Fall 19)
- Juyoung Shin (Winter 20 - Spring 21)
- Grant Warren (Winter 20 - Spring 23) Received a **Thilo Scholarship** (Summer 22)
- Austin Petfalsi (Spring 23 - present)

Doctoral Committees

- Timothy Egner (Chemistry Dept. Pr. Venditti) *"Nuclear Magnetic Resonance Methodologies for the Study of Nanoparticle Surface Adsorbed Ligands" Graduated 11/15/19*
- Trang Nguyen (Chemistry Dept. Pr: Venditti) "*Allosteric regulation of bacterial Enzyme I: Toward the discovery of a new class of antimicrobial compounds*" *Graduated 04/07/21*
- Phan Phong Tuan (BBMB. Pr: Dipali) "*Defining the effects of mismatches on type I-E CRISPR immunity and phage escape*" *Graduated 07/16/21*
- Kristin Roach (BBMB, Pr. Peters) *"Investigations into the underlying mechanisms of Class II Diterpene Cyclases" Graduated 04/15/22*
- Ambuj Kumar (BBMB. Pr: Jernigan) "*New Computational Methods to Study the Relationship between Protein Structure and Function" Graduated 06/03/22*
- Suresh Shravanti (BBMB. Pr: Dipali) "*Cas4 and host exonucleases such as DinG facilitate adaptation in type I-C CRISRP-Cas systems" Graduated 06/24/22*
- Philip Dershwitz (BBMB, Pr. Dispirito) *"Methanobactin Biosynthesis and Redox Activity" Graduated 08/11/22*
- Jake Peterson (BBMB, Pr. Moss)
- Christopher Gayvert (Chemistry Dept. Pr. Potoyan)
- Monica Hepker (Vet. Med. Pr. Kanthasamy)

- SeongSoo Lee (Chemistry Dept. Pr. Anderson)
- Dulitha Prasanna (Chemistry Dept. Pr. Potoyan)
- Dan Burn (Chemistry Dept. Pr. Potoyan & Pr. Venditti)
- Chuan Ping (Chemistry Dept. Pr. Potoyan)
- Rachel Murphy (Biochemistry Dept. Pr. Chen)
- Kyle Malcom (Chemistry Dept. Pr. Venditti)
- Yijun Liu (Biochemistry Dept. Pr. Chen)
- Rachel Murphy (Biochemistry Dept. Pr. Chen)
- William Brown (Chemistry Dept. Pr. Potoyan)
- Baboucarr Faal (Chemistry Dept. Pr. Venditti)
- Sayan Das (Chemistry Dept. Pr. Venditti)
- Dilini Dissanayake (Chemistry Dept. Pr. Venditti)

Teaching Activities

- Instructor for BBMB 301 – Survey of Biochemistry (Fall 21, Spring 22, Summer 22, Fall 22, Spring 23, Summer 23, Fall 23)
- Instructor for BBMB 461/561 and 561L - Molecular Biophysics (Spring 20, Spring 21, Spring 22, Spring 23)
- Instructor for BBMB 549 – NMR spectroscopy (Spring 22, Spring 23)
- Instructor for BBMB 221 – Structure and Reactions in Biochemical Processes (Fall 17, Spring 19, Fall 19, Fall 20, Fall 21)
- Instructor for HON 322V – Biochemistry of Drug Addiction (Spring 19)

Other Teaching Activities

Guest Lecturer for the Life Skills Curriculum. Iowa Correctional Institution for Women in Mitchellville, IA. Lecture on Biochemistry of Drug Addiction (Summer 19)

Institutional Service

- BBMB Oral Research Proposition Exam (ORPE) Committee (2019 – present)
- BBMB Postdoctoral Committee (2019 – present)
- BBMB Graduate Affairs Committee (2018 – present)
- BBMB Seminar Committee (2016 – present)

Professional Service

- **Ad hoc reviewer for the Biophysics of Neural Systems (BPNS) NIH study section (2021)**
- Reviewer for Scientific Rep., J. Phys. Chem., Biophys. J., BBA - Proteins and Proteomics, J. Mol. Biol., PloS One, J. Am. Chem. Soc., Nature Commun., J. Biomol.NMR, Proteins, Biochemistry, eLife