CV date	09.05.2022

Part A. PERSONAL INFORMATION

Name	Germán Alejandro Rivas Caballero		
ID number	35259631-X	Age	61
	SCOPUS Author ID	35556044500	
	ORCID	0000-0003-3450-7478	

A.1. Current position

University/Institution	Consejo Superior de Investigaciones Científicas - CSIC			
Department	Centro de Investigaciones Biológicas - CIB			
Address and Country	Ramiro de Maeztu 9, 28040-Madrid (Spain)			
Phone number	0034 91-8373112	E-mail	grivas@cib.csic.es	
Current position	CSIC Research Professor		From	2015
Keywords	physical and cellular biochemistry; molecular biophysics; macromolecular interactions; self-organization; cell division; bottom-up synthetic biology; biochemical reconstitution			

A.2. Education

Degree	University	Year
MSc – Chemistry / Biochemistry	Univ. Autónoma – Madrid (Spain)	1984
PhD – Chemistry / Biochemistry	Univ. Autónoma – Madrid (Spain)	1989

A.3. JCR articles, h Index, thesis supervised…

- Total number of citations > 9000 (SCOPUS – last 5 years: > 5000)
- Total number of publications: 161 (Q1:133; D1:55) (SCOPUS)
- h index: 49 (SCOPUS)
- Doctoral thesis supervised in the last 10 years: 8 presented and 2 in progress

Part B. CV SUMMARY

Brief scientific career: CSIC pre-doctoral fellow (1985-1989): Instituto de Química Física, CSIC, Madrid. Fogarty postdoctoral fellow (1990-1992): National Institutes of Health, Bethesda. EMBO postdoctoral fellow (1993-1994): Biozentrum, University of Basel, Switzerland. CSIC tenure-track scientist (1994-1995), CSIC scientist (1996-2005), investigator (2006-2015) and research professor (since 2015) at CIB-CSIC, Madrid. Visiting scholar (Max Planck Inst. Biochemistry; 07/18-12/18).

Fields of expertise: Physical and cellular biochemistry; biochemical reconstitution; bottom-up synthetic biology; biomolecular interactions; self-organization; mechanistic and functional implications of macromolecular crowding and phase separation; biophysical methods (analytical ultracentrifugation, light scattering, fluorescence-based and surface-sensitive assays); protein science; bacterial division.

Research summary: Our research program integrates biochemistry, biophysics, and bottom-up synthetic biology to reconstruct minimal bacterial division machineries from its molecular building blocks in controlled cell-like environments. This effort, which is framed on the quest of building synthetic cells from scratch, will contribute to our understanding of how cells divide and will provide new horizons for biotechnological and biomedical applications.

To achieve these challenges, we aim to describe the detailed biochemistry and reconstitute the interacting protein assemblies central in cell division. The mode of operation of these subcellular systems is governed not only by specific molecular interactions between their components but also by the impact of physicochemical phenomena inherent of the crowded cell interior where they are located to function. Consequently, in our reconstitution studies, we faithfully reproduce elements of

the intracellular complexity, as excluded volume due to natural crowding, and compartmentation driven by liquid-liquid phase separation, an emergent paradigm of the subcellular organization.

Scientific accomplishments:

- Introduction in Spain of advanced methods of analytical ultracentrifugation (1994) and static light scattering (2006, 2009) to measure macromolecular interactions in solution.
- Development of equilibrium sedimentation methods to study the behavior of proteins in highly crowded solutions reproducing natural environments (1999, 2001,2004, 2010).
- Biochemical description of how crowding influences the self-association (2001) and assembly (2003) of the essential bacterial division FtsZ protein.
- Biophysical description of how FtsZ assembles in solution (2005, 2012).
- Description of the mechanism of interaction of FtsZ and negative regulators of Z-ring stability in solution (2013, 2015).
- Division proto-ring reconstruction in minimal membrane systems (nanodiscs, 2012; bilayers – 2015; giant vesicles – 2011,2013; droplets - 2013).
- Exploitation of minimal proto-rings to design screening assays (plasmonic encoded beads, 2014, 2017).
- Crowding-driven phase transitions and spatio-temporal organization of FtsZ polymers in cell-like environments (2017, 2018).
- Formation of chiral vortices is an intrinsic property of FtsZ (2018).
- First description of dissipative self-assembly of FtsZ in coacervate-protocells (2018).
- First observation that FtsZ forms phase-separated condensates (2019).
- First description that MatP protein from the chromosomal Ter-linkage (2019) and nucleotide associated SlmA protein (2020) bind to lipid membranes.

Part C. RELEVANT MERITS

Publications

- Rivas G, and Minton AP. 2022. Influence of nonspecific interactions on protein associations: Implications for biochemistry in vivo. *Annu. Rev. Biochem.* (in press)
- Robles-Ramos MÁ, Margolin W, Sobrinos-Sanguino M, Alfonso C, Rivas G*, Monterroso B*, Zorrilla S*. 2020. The nucleoid occlusion protein SlmA binds to lipid membranes. *mBio* 11:e02094-20
- Monterroso B*, Zorrilla S*, Sobrinos-Sanguino M, Robles-Ramos MÁ, Alfonso C, Söderström B, Meiresonne NY, Verheul J, den Blaauwen T, Rivas G*. 2019. The bacterial DNA binding protein MatP involved in linking the nucleoid terminal domain to the divisome at midcell interacts with lipid membranes. *mBio.* 10:e00376-19.
- Monterroso B, Zorrilla S, Sobrinos-Sanguino M, Robles-Ramos MA, López-Álvarez M, Margolin W, Keating KD, Rivas G. 2019. Bacterial division FtsZ protein forms phase-separated condensates with its nucleoid-associated inhibitor SlmA. *EMBO reports* 20:e45946.
- Te Brinke E, Groen J, Herrmann A, Heus HA, Rivas G, Spruijt E, Huck WTS. 2018. Dissipative adaptation in driven self-assembly leading to self-dividing fibrils. *Nat Nanotechnol.* 13:849-855 **Dissipative adaptation drives droplet division.**
- Ramirez-Diaz DA, García-Soriano DA, Raso A, Mücksch J, Feingold M, Rivas G*, Schwille P*. 2018. Treadmilling analysis reveals new insights into dynamic FtsZ ring architecture. *PLoS Biol.* 16:e2004845. **Chiral vortex dynamics on membranes is an intrinsic property of FtsZ, driven by GTP hydrolysis.**
- Sobrinos-Sanguino M, Zorrilla S, Keating CD, Monterroso B, Rivas G. 2017. Encapsulation of a compartimentalized cytoplasm mimic within a lipid membrane by microfluidics. *Chem Comm* 53:4775-4778.
- Rivas G*, Minton AP*. 2016. Macromolecular crowding in vitro, in vivo, and in between. *Trends Biochem Sci.* 41:970-981 & Zhou HX*, Rivas G*, Minton AP*. 2008. Macromolecular crowding and confinement: Biochemical, biophysical, and potential physiological consequences. *Annu. Rev. Biophys.* 37:375-397. **Cytomimetic biochemistry: reactivity and organization of macromolecular systems in crowded cell-like environments.**

- Martos A, Raso A, Jiménez M, Petrášek Z, Rivas G*, Schwille P*. 2015. FtsZ polymers tethered to the membrane by ZipA are susceptible to spatial regulation by Min waves. *Biophys J* 108:2371-2383. **Description of FtsZ waves driven by oscillating Min proteins in ZipA-containing bilayers.**
- Ahijado-Guzmán R, Prasad J, Rosman C, Henkel A, Tome L, Schneider D, Rivas G*, Sönnichsen C*. 2014. Plasmonic nanosensors for simultaneous quantification of multiple protein-protein binding affinities. *Nano Lett.* 14:5528-5532. **Explotation of bacterial proto-ring for screening assays.**
- Rivas G*, Vogel SK, Schwille P*. 2014. Reconstitution of cytoskeletal protein assemblies for large-scale membrane transformation. *Curr. Opin. Chem. Biol.* 22C:18-26 & Martos A, Jiménez M, Rivas G*, Schwille P*. 2012. Towards a bottom-up reconstitution of bacterial cell division. *Trends Cell Biol.* 22:634-643. **Bottom-up synthetic biology: reconstructing essential cell cycle machineries in cell-like test tubes.**
- Cabré EJ, Sánchez-Gorostiaga A, Carrara P, Ropero N, Casanova M, Palacios P, Stano P, Jiménez M, Rivas G*, Vicente M*. 2013. Bacterial division proteins FtsZ and ZipA induce vesicle shrinkage and cell membrane invagination. *J. Biol. Chem.* 288:26625-26634. **Constriction forces partially reproduced by defined bacterial division elements (FtsZ, ZipA) when assembled in permeable cell-like vesicles.**
- Monterroso B, Alfonso C, Zorrilla S, Rivas G. 2013. Combined light scattering, ultracentrifugation and fluorescence correlation spectroscopy studies on the associations and assembly of the Escherichia coli cell division FtsZ protein. *Methods* 59:349-362. **Physical biochemistry: quantitative analysis of protein associations and assembly.**
- Hernández-Rocamora VM, Reija B, García-Montañés C, Natale P, Alfonso C, Minton AP, Zorrilla S, Rivas G*, Vicente M*. 2012. Dynamic interaction of the Escherichia coli cell division ZipA and FtsZ proteins evidenced in nanodiscs. *J. Biol. Chem.* 287:30097-30104.

Research projects and grants

- 2020-2023: BASYC – Bacterial division in synthetic cytomimetic environments. Spanish Government. Ref. PID2019-104544GB-I00. 250000 € (+ FPI pre-doctoral contract). Principal investigator (PI).
- 2017-2019: BIOROOMS – Biophysical analysis, synthesis and re-assembly of biorooms active in bacterial division. Spanish Government, Plan Nacional I+D+i, BFU2016-75471-C2-1-P. 220000 € (+ FPI pre-doctoral contract). Principal investigator (PI).
- 2015-2016: ODIVITUBE - Biochemical organization of minimal divisomes in the test tube. Spanish Government, Plan Nacional I+D+i, BFU2014-28941-C03-02. 165000 €. PI.
- 2012-2014: SYNVISION - Synthetic biology of bacterial cell division: reconstruction of minimal divisomes in biomimetic membrane systems. Spanish Government, Plan Nacional I+D+i, BIO2011-28941-C03-03. 230000 €. PI.
- 2011-2014: Synthetic biology of bacterial cell division. Human Frontier Science Program RGP0050-2010. 1200000 USD (shared between 4 IPs).
- 2009-2013: DIVINOCELL - Exploiting Gram-negative cell division targets in the test tube to obtain anti-microbial compounds. European Commission, FP7-HEALTH-F3-2009-223431. 5956086 € (shared between 15 IPs).

Prizes and Honors

2019: Manuel Rico – Bruker Award, Spanish Biophysical Society

Organization summer schools, advanced masters and international meetings

- 10/2021: UIMP-CSIC Advanced Master (120 ECTS) on Integrative Synthetic Biology. Director.
- 2019-10: II International Symposium on Building a Synthetic Cell. Organizer. Madrid
- 2019-07: 12th EBSA 10th ICBP-IUPAP Biophysic Congress. Organizing committe. Madrid
- 2019-05: Bienal RSEQ. Symposium on Biochemical Reactions in Cytomimetic Media. Symposium organizer. San Sebastian, Spain

- 2014-2019: Summer School on Molecular and Cellular Integrative Biology. Universidad International Menéndez Pelayo University (UIMP). Organizer (with Rafael Giraldo). Santander, Spain. Six editions (the next will be in 2021).
- Since 2016: UIMP-CSIC Advanced Master (90ECTS) on Molecular and Cellular Integrative Biology (Mcib). CIB-CSIC, Madrid. Director. 5 promotions (3 finished, 2 on course).
- 2012-09: EMBO workshop "Reconstructing the essential bacterial cell cycle machinery". Organizer (with M. Vicente and J. Ayala). Real Sitio de San Ildefonso, Segovia, Spain

Scientific management and evaluation

- Since 2020: Coordinator of the CSIC network on synthetic cell research (CSyCell) and coordinator of the Spanish node of the European Synthetic Cell Initiative
- Since 2019: Head, Department of Structural and Chemical Biology at CIB-CSIC
- 2018: Guest editor (with Allen P. Minton). Special issue on “Biochemical reactions in cytomimetic media”. Frontiers Molecular Biosciences.
- 2016: Vice-director, CIB-CSIC
- 2012-2015: Member, Biology and Biomedicine Committee, CSIC
- 2009: Head, Dept. Chemical and Physical Biology, CIB-CSIC
- 2006-present: Member, Editorial Board, European Biophysics Journal
- 2006-2010: Scientific secretary, Spanish Biophysical Society
- 1994-2010: Scientific coordinator, Analytical Ultracentrifugation Facility, CIB-CSIC
- Since 2009: Reviewer for journals (including *PNAS-USA, Science Advances, Nature Comm, EMBO J, ACS Nano, JACS*), and funding agencies (both national and international – including ERC, NIH, NSF, Human Frontiers, CNRS, Pasteur Institute).

Invited talks to international conferences (last 10 years)

- 2021-10: International Titisee Conference – Life 2.0 (Titisee, Germany)
- 2021-06: Iberian Biophysical Society Congress, Coimbra, Portugal (plenary lecturer)
- 2020-09: EMBO Workshop on Birth and Fission of Cellular Compartments. Bilbao, Spain (*)
- 2020-07: Reconstituting Biology 2020. Lorentz Center Workshop. Leiden, The Netherlands (*)
- 2020-03: International Symposium on Membrane-Less Organelles in Cell Life and Disease. Ramón Areces Foundation at CiC-Cartuja. Sevilla, Spain (*)
- 2020-02: IX International Conference BIFI. Zaragoza, Spain
- 2019-07: Joint 12th EBSA 10th ICBP-UIPAB Biophysics Congress. Madrid, Spain
- 2019: EBSA/IUPAB Biophysics Congress. Madrid. Spain. (Manuel Rico – Bruker Prize Lecture)
- 2019-06: EMBO Workshop on Bacterial cell division: Closing the gap. Lund, Sweden
- 2019-04: Internation Conference on Cell Biology of Prokaryotes. Bad Staffelstein, Germany
- 2017-07: III Telluride Workshop on Macromolecular Crowding. Telluride, USA
- 2016-12: Biological Interfaces workshop. Univ. Leeds, UK
- 2016-06: Gordon Research Conference on Bacterial Cell Surfaces. Mount Snow, West Dover, VT USA.
- 2016-02: BIFI International Symposium on Molecular Recognition. Zaragoza, Spain
- 2014-09: 18th EMBL PhD Symposium. Heidelberg, Germany
- 2014-05: Academy Colloquium - 50 Years of Fts: The A-Z of Bacterial Cell Division. Amsterdam, NL
- 2014-02: Human Frontier workshop, CNB-CSIC, Madrid, Spain
- 2013-09: Chemical Biology Meeting, Bienal RSEQ, Santander, Spain
- 2013-05: Belgian Biophysical Society. Leuven, Belgium

(*) postponed to 2022 due to the COVID-19 pandemic