CURRICULUM VITAE ABREVIADO (CVA)

Part A. PERSONAL INFORMATION

First name	JOAQUIM		
Family name	ROCA		
Gender (*)	Male	Birth date	10/11/1960
Social Security, Passport, ID number	35026021B		
e-mail	joaquim.roca@ibmb.csic.es	URL Web	https://www.ibmb.csic.es/en/
Open Researcher and Contributor ID (ORCID) (*)	0000-0003-1462-954X		

(*) Mandatory

A.1. Current position

Position	Professor of Research		
Initial date	30/05/2008		
Institution	CSIC (Spanish Research Council)		
Department/Center	IBMB (Molecular Biology Institute of Barcelona)		
Country	Spain	Teleph. number:	93 4020117
Key words	DNA Topology - DNA Supercoiling - DNA Knotting - Chromosome - Chromatin - Nucleosome - Topoisomerase - Cohesin - Condensin		

A.2. Previous positions (research activity interruptions, indicate total months)

Period	Position/Institution/Country/Interruption cause
1984 - 1987	Predoctoral Fellow (FPU) - Medical School - University of Barcelona
1987 - 1988	Lecturer - Medical School - University of Barcelona
1988 - 1991	Postdoctoral Fellow - Dep Biochemistry - Harvard University
1992 - 1995	Research Associate - Dep Biochemistry - Harvard University
1996 - 2005	Tenured Scientist - CSIC
2006 -2008	Senior Tenured Scientist - CSIC

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
Medicine (MD)	University of Barcelona (UB)	1983
Molecular & Structural Biology (Ms)	Politechnic University of Catalonia (UPC)	1985
Medicine (PhD)	University of Barcelona (UB)	1988

Part B. CV SUMMARY (max. 5000 characters, including spaces)

I obtained a MD degree (Medicine & Surgery) in 1984 from the University of Barcelona, a MS degree in Structural and Molecular Biology in 1985 from the Technology University of Catalonia, and a PhD degree in 1988 from the University of Barcelona with an Awarded Thesis on Chromosomal DNA Topology. In 1988, I moved to Harvard University to continue my research, three years as Postdoctoral Fellow and five years as Research Associate. In 1996, I returned to Spain as Staff Scientist of the Spanish Research Council (CSIC) to create the DNA Topology Lab at the Molecular Biology Institute of Barcelona (IBMB). Since then, I have supervised 11 Doctoral Thesis. I was promoted to Full Professor in 2008 and ranked within the world's top 2% most influential scientists in 2021.

I have been Chairman of the Molecular and Cellular Biology Department of the IBMB (2002-2006), Deputy Director of the IBMB (2006-2010) and Member of the CSIC Advisory Board of Biology and Biomedicine (2012-2023). Since 2023, I am Chairman of the Structural and Molecular Biology Department of the IBMB.

The major achievements throughout my scientific career are:

- A former and main contribution of my research has been deciphering the mechanism of DNA transport of type-II topoisomerases (Cell 1992, PNAS 1994, Cell 1994, TiBS 1995, PNAS 1996, JBC 2004, NAR 2009), currently depicted in the textbooks.

- My additional studies on eukaryotic topoisomerase II clarified its DNA transport preferences and how this essential enzyme can simplify DNA topology to below equilibrium values (JBC 1993, GenCells 1996, JMB 2001, GenCells 2002, JMB 2004, NAR 2014).

- My lab has pioneered the research on the interplay of topoisomerase activities with chromatin structure (EMBO 1989, JBC 2001, JBC 2002, EMBO 2006, EMBO 2010, NAR 2012, NAR 2013, EMBO 2014). These studies produced two relevant findings: (i) that topoisomerase II is the main relaxase of nucleosomal DNA; and (ii) that unbalanced relaxation of (+) and (-) supercoils by topoisomerase II produces a prevalence of (-) supercoiled DNA in eukaryotic chromatin.

- By measuring how protein-DNA interactions alter the DNA topology, my lab described the molecular architecture of point centromeres (Cell Rep 2015), in which DNA follows a right-handed instead of a left-handed path. With a similar approach, we determined that native nucleosomes restrain a DNA linking number difference of about -1.26 (Nature com 2018). This value solved the "linking number paradox of nucleosomal DNA", which had puzzled scientists over decades.

- My lab has pioneered the analysis of in vivo DNA knots using high-resolution 2D electrophoresis (NAR 2001, NAR 2019a). As knots are a footprint of the 3D path of DNA, we used this principle to infer DNA folding in viruses (PNAS 2002, PNAS 2005) and in eukaryotic chromatin (NAR 2018, NAR 2019b). These studies highlighted the occurrence of DNA knots as an unexpected yet common actor able to restrict chromatin configuration and genome transactions.

- By exploiting DNA topology analyses, my lab made two seminal contributions to the field of SMC complexes. We unravelled a new role of condensin in minimizing intracellular DNA entanglements (EMBO 2021, BioEssays 2022) and how condensin made DNA translocation steps during the process of DNA loop extrusion (EMBO 2023).

- Finally, my lab has introduced to the scientific community the new field of "Topolomics". We conducted the first analysis of psoralen:DNA photo-binding to map supercoiled DNA regions *in vivo* (NAR 2010, EMBO 2010), a method now broadly accepted and used. More recently, we have developed "topo-seq", a novel procedure to inspect the topology of large libraries of DNA circles in a single gel electrophoresis. We used topo-seq to conduct the first genome-wide analysis of the DNA topology constrained by nucleosomes (Nature com 2024).

- The above seminal contributions in the field of DNA Topology allocated me within the world's top 2% of most influential scientists (Sandford University ranking).

Part C. RELEVANT MERITS

C.1. Publications (10 selected in the last 10 years - All as corresponding author)

Nucleosomal DNA has topological memory. Segura; Diaz-Ingelmo, Martínez-García, Ayats-Fraile, Nikolaou; Roca*
Nature Com (2024)

Condensin pinches a short negatively supercoiled DNA loop during each round of ATP usage. Martínez-García, Dyson, Segura, Gutierrez-Escribano, Aragón, and Roca*
EMBO J -e111913 (2023)

Keeping intracellular DNA untangled: A new role for condensin?
Joaquim Roca*, Silvia Dyson, Joana Segura, Antonio Valdés, Belén Martínez-García
BioEssays Volume 44, Issue 1 (2022)

Condensin minimizes topoisomerase II-mediated entanglements of DNA in vivo. Dyson, Segura, Martínez-García, Valdés, and Roca*.
EMBO J - e105393 (2021)

Transcriptional supercoiling boosts topoisomerase II-mediated knotting of intracellular DNA. Valdés, Coronel, Martínez-García, Segura, Dyson, Díaz-Ingelmo, Micheletti, and Roca*
Nucleic Acids Res. 47:6946-6955 (2019)

Quantitative disclosure of DNA knot chirality by high-resolution 2D-gel electrophoresis
Valdés, Martínez-García, Segura, Dyson, Díaz-Ingelmo and Roca*
Nucleic Acids Res. 47:e29 (2019)

Intracellular nucleosomes constrain a DNA linking number difference of -1.26 that reconciles the Lk paradox. Segura, Joshi, Díaz-Ingelmo, Valdés, Dyson, Martínez-García and Roca*
Nature Com 28:3989 (2018)

DNA knots occur in intracellular chromatin. Valdes, Segura, Dyson, Martinez-Garcia and Roca*
Nucleic Acids Res 46, 650-660 (2018)

In silico, In vitro and In vivo Imageries of Type II Topoisomerases
Joaquim Roca*
Phys Life Rev Jul 8 pp. 147-149 (2016)

DNA Topology and Global Architecture of Point Centromeres. Diaz-Ingelmo, Martinez-Garcia, Segura, Valdes and Roca*
Cell Reports 13, 667-677 (2015)

Chromatin regulates DNA torsional energy via topoisomerase II-mediated relaxation of positive supercoils. Fernandez, Diaz-Ingelmo, Martinez-Garcia and Roca*
EMBO J 33, 1492-1501 (2014)

C.2. Congress (International selected as invited speaker in the last 10 years)

"Chromatin and DNA transport by topoisomerase II: A key interplay in topolomics" EMBO Workshop on DNA topoisomerases, DNA topology and human health. Les Diablerets, Switzerland, 13–17 September, 2015.

"Chromosomal DNA Topology: Topoisomerases Handle Extremely Supercoiled, Catenated and Knotted Chromatin Conformations" Gordon Research Conference, on DNA topoisomerases in Biology & Medicine. Maine. (EEUU). August 7- 12, 2016.

"In vivo DNA topology and conformations of chromatin" EMBO Workshop on DNA topoisomerases and DNA topology. Les Diablerets, Switzerland 17–21 September 2017.

"Inferring chromatin architecture from DNA knots" Chromosome Dynamics - Spring Meeting 2019 Max F. Perutz Laboratories, University of Vienna. Vienna. March 6-8, 2019.

"In vivo DNA topology: knotting and unknotting chromatin" EMBO Workshop on -DNA topology and topoisomerases in Genome Dynamics- Les Diablerets, Switzerland. 16–20 September 2019

"Keeping the genome untangled: Who is in charge?" EMBO Workshop on -DNA topology and topoisomerases in Genome Dynamics- Virtual, Switzerland. 20–23 September 2021

"Condensin pinches a short negatively supercoiled DNA loop during each round of ATP usage" Biochemical Society Meeting on Genome Organisation by SMC Complexes. Edinburgh, UK 27 –30 September 2022

"Topo-seq": A genome-wide approach to map DNA topology at nucleosome level. EMBO Workshop on -DNA topology and topoisomerases in Genome Dynamics- Villars, Switzerland. 3–7 September 2023

"Topo-seq reveals the topological memory of nucleosomal DNA" Genome Modality Annual Meeting. Karolinska Institute, Sweden. 20–22 September 2023

C.3. Research projects conducted as -Principal Investigator- in the last 10 years

"DNA Topology, Regulation and Functional Implications"
Funded by MINECO (Plan Nacional I+D+I) Ref. BFU2011-23851.
Period: 2012-2013-2014-2015 Amount: 310.970 €

Unidades de Excelencia Maria de Maeztu 2014
PIs: N. Verdaguer, M. Coll, I. Fita, X. Gomis, M. Solá, I. Usón, J. Roca
Funded by MINECO Ref. MDM 2014-0435
Period: 1/7/2015 to 30/6/2019 Amount: 2.000.000 €

"DNA Topology, Regulation and Functional Implications"
Funded by MINECO (Plan Nacional I+D+I) Ref. BFU2015-67007-P
Period: 1/1/2016 to 31/12/2020 Amount: 355.740 €

Ayuda Extraordinaria Menciones de Excelencia Severo Ochoa 2020
Funded by CSIC - Ref. 20202CEX003
Period: 5/2/2020 to 31/3/2021 Amount: 281.250 €

"DNA Topology, Regulation and Functional Implications"
Funded by MINCIN (Plan Nacional I+D) Ref. PID2019-109482GB-I00
Period: 1/6/2020 to 31/5/2024 Amount: 350.900 €