RESEARCH SCIENTIST · LIFE SCIENCES

Hari Raj Singh PhD

Molecular Cell Biologist | Scientific Programme Builder | Bio x AI

I study how molecular mechanisms shape cellular organisation, and build experimental, quantitative and computational systems that make those relationships testable.

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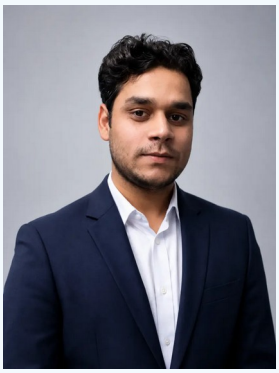

16 OUTPUTS	15+ YEARS	CROSS-SCALE	TRIMCode
Research, reviews, tools & commentary	International scientific experience	Molecules | cells | data | evidence	TRIM-family mesoscale biology

SCIENTIFIC PROFILE

Scientific practice across scales.

Interdisciplinary molecular and cellular biologist connecting mechanistic discovery, quantitative imaging, human genetics, mesoscale organisation, predictive biology and scientific platform development. The work moves from molecular control to cellular phenotype - and from evidence to responsible translation.

Mechanistic cell biology • **Quantitative bioimaging** • **Human genetics** • **Predictive biology & AI** • **Programme stewardship**

SELECTED SCIENTIFIC AND PROGRAMME IMPACT

Evidence across mechanism, organisation and prediction.

PUBLISHED · VALIDATED **PICNIC - predictive biology.** Co-developed the machine-learning framework and prospective cell-based validation; 21 of 24 positive predictions were experimentally confirmed. Co-first author, Nature Communications (2024).

PROGRAMME · ACTIVE **TRIMCode - programme building.** Founded a family-scale experimental and data framework across all 75 human TRIM proteins, linking architecture, localisation, cellular organisation, disease evidence and prediction.

HUMAN GENETICS **TRIM8 syndrome.** Co-discovered a human genetic condensatopathy and built variant, rescue and quantitative phenotype assays connecting genotype to altered cellular organisation and function.

PUBLISHED · MECHANISTIC **ALC1 - translational biology.** As single first author, established the PAR-dependent release of ALC1 autoinhibition - a Molecular Cell mechanism relevant to later ALC1-focused therapeutic development.

CAREER

Academic and professional history.

TRIMCode Research Programme | Germany

Founder & Lead | Independent Researcher & Programme Developer — 2026-PRESENT

- Building Predictive Genomics of Cellular Organisation: a programme connecting genome sequence, cellular architecture, disease mechanisms, AI and biological engineering.
- Developing evidence-grounded Python and agentic workflows for multiscale reasoning, prospective evaluation, provenance and transparent scientific review.

Max Planck Institute of Molecular Cell Biology and Genetics | Dresden, Germany

Senior Postdoctoral Scientist / Experimental Platform Lead — JUL 2019-FEB 2026

- Led interdisciplinary programmes across molecular biology, human genetics, quantitative imaging, biophysics, computation and translational disease research.
- Built TRIMCode and the mechanistic TRIM8 programme; translated family-scale measurements and patient variants into traceable biological evidence.
- Co-developed PICNIC across feature design, evaluation logic, prospective experiments and interpretation; created analysis-ready multimodal datasets with explicit controls and metadata.
- Coordinated collaborations across Europe and North America; mentored seven early-career researchers; contributed to programmes exceeding EUR 500,000.

Technical University of Munich | Munich, Germany

Postdoctoral Scientist, Synthetic Biology and Nucleic Acid Systems — 2018-2019

- Developed programmable biomolecular systems at the interface of synthetic biology, DNA nanotechnology, intracellular information processing and quantitative design.

EARLIER CAREER

Mechanism and chromatin biology.

Ludwig Maximilian University Munich | Munich, Germany

Doctoral Researcher, Molecular Cell Biology 2012-2017

- Discovered how poly(ADP-ribose) releases ALC1 autoinhibition through protein engineering, biochemistry, live-cell microscopy and structure-function analysis.
- Published the mechanism as a single-first-author Molecular Cell study and connected molecular regulation to an oncogenic chromatin-remodelling programme.

JNCASR | Bengaluru, India

Junior Research Fellow, Chromatin and Stem Cell Biology 2009-2011

- Investigated chromatin dynamics, epigenetic regulation and stem-cell biology in a nationally funded research programme.

METHODS AND CAPABILITIES

Experimental depth with quantitative reach.

- **Experimental systems.** Molecular cloning; construct and variant design; targeted mutagenesis; mammalian cell culture; protein/nucleic-acid characterisation; >2,000 DNA/plasmid constructs.
- **Quantitative cell biology.** Live-cell and high-content imaging; FRAP; flow cytometry; localisation, morphology, dynamics and phenotype analysis; atlas-scale studies spanning 200+ proteins.
- **Disease mechanisms.** Human genetics; variant and rescue assays; chromatin and DNA-damage biology; E3 ligases; proteostasis; biomolecular organisation.
- **Data and AI.** Python; Pandas; NumPy; SQL; Git/GitHub; statistics; feature engineering; model evaluation; multimodal integration; traceable metadata; AlphaFold-informed analysis.
- **Scientific delivery.** Programme design; experimental controls; reproducibility; evidence standards; stakeholder alignment; partnerships; mentoring; scientific and public communication.

BIO X AI

Digital science and AI development.

- Full-time Data Science & AI programme, neue fische / SPICED Academy, Germany | June-October 2026; IHK certification expected October 2026. Python, SQL, statistics, ML, deep learning, NLP, AI agents, deployment and cloud workflows.
- Built a public portfolio of interactive, in-browser Bio x AI laboratories spanning perturbation intelligence, time-series biology, multiscale technologies, data visualisation and scientific communication.
- Extended predictive-biology infrastructure through the PICNIC Web Server (Bioinformatics, 2026 issue; online 2025) and CD-CODE 2.0 knowledgebase (Nucleic Acids Research, 2026 issue; online 2025).

RESEARCH RECORD

Selected publications and platforms.

- PICNIC accurately predicts condensate-forming proteins regardless of structural disorder across organisms. **Nature Communications · 2024 · co-first author** Publication
- Mesoscale landscaping of the TRIM protein family reveals a novel human genetic condensatopathy. **bioRxiv · 2025 · co-first/co-corresponding** Publication
- A poly-ADP-ribose trigger releases the auto-inhibition of a chromatin remodelling oncogene. **Molecular Cell · 2017 · single first author** Publication
- Structures of Drosophila cryptochrome and mouse cryptochrome1 provide insight into circadian function. **Cell · 2013** Publication
- Principles and applications of nucleic acid strand displacement reactions. **Chemical Reviews · 2019** Publication

SCIENTIFIC COMMUNICATION

Editorial judgement and public scholarship.

- Author of six commissioned commentaries and perspectives across Molecular Cell, Nature Structural & Molecular Biology, Trends in Genetics, Trends in Biochemical Sciences, Trends in Molecular Medicine and Trends in Cancer.
- Peer reviewer for Nature Communications, Molecular Cell, EMBO Journal, Nature Microbiology and Nucleic Acids Research; mentor in manuscript framing, journal positioning and responses to peer review.

EDUCATION AND DEVELOPMENT

Formal training and programme leadership.

- Data Science & Artificial Intelligence, neue fische / SPICED Academy, Germany | June-October 2026; IHK certification expected October 2026.
- PhD (Dr. rer. nat.), Molecular Biology, LMU Munich | 2017; MSc Biotechnology, University of Pune / NCCS | 2009; BSc (Hons.) Biochemistry, Aligarh Muslim University | 2007.
- Former Head, MPI-CBG Committee for Science and Society; organised scientific retreats, forums and community initiatives; contributor to NOMIS, DFG, Volkswagen Foundation, Marie Curie ITN and DAAD-supported programmes.

Explore the full research record, publications and interactive Bio x AI work: hari-raj-singh.com/record