

Sumeet Pal Singh | PhD

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Personal Details

Birth Date: August 12, 1985

Nationality: Indian

Family Status: Married

Research Experience

Assistant Professor (Tenured)

2022–Onwards

Institut de Recherche Interdisciplinaire en Biologie Humaine et Moléculaire (IRIBHM)
Université Libre de Bruxelles (ULB)

Brussels, Belgium

Group Members: Three PhD Candidates + One Technician.

Project title: Regenerative and Stress Biology.

Research Group Leader

2019–2022

Institut de Recherche Interdisciplinaire en Biologie Humaine et Moléculaire (IRIBHM)
Université Libre de Bruxelles (ULB)

Brussels, Belgium

Education / Training

Post-Doctoral Fellow

2014–2019

DFG Center for Regenerative Therapies Dresden

Dresden, Germany

Research Advisor: Nikolay Ninov, Ph.D.

Project title: Cellular and Epigenetic Dynamics in β -cell during Development, Regeneration and Diabetes.

Post-Doctoral Fellow

2013–2014

Max Planck Institute of Molecular Cell Biology and Genetics

Dresden, Germany

Research Advisor: Jochen Rink, Ph.D.

Project title: Live Imaging Stem Cell Dynamics during Growth and Regeneration.

PhD

2008–2013

Duke University

Durham, USA

Research Advisor: Kenneth D. Poss, Ph.D.

Thesis Title: Cellular and Molecular Determinants of Zebrafish Fin Osteoblast Regeneration.

B. Tech., Biological Sciences and Bioengineering

2004–2008

Indian Institute of Technology (IIT)

Kanpur, India

Grade: 8.7 / 10

Lab's Vision

The Singh Lab @ IRIBHM, ULB focusses on regenerative and stress biology. We are interested in understanding the ability of organs to recover from injuries and stress. For example, we are able to heal a cut to our finger, even if it happens multiple times. Our blood regenerates after blood donation within a day or two. In ancient Greek mythology, Prometheus was sentenced to having half of his liver eaten by an eagle every day, but the liver would regenerate during the night – highlighting the almost infinite regenerative capacity of the liver. We are fascinated by such robustness in regenerative systems - which are a hallmark of a dynamic biological system.

To understand the robustness of biological systems, we explore two main themes: **plasticity and adaptation**.

For our experimental model, we use Zebrafish, which possesses amazing regenerative abilities. It is able to recover from complete loss of bone cells or pancreatic beta-cells. We utilize its super-natural regenerative ability to explore our themes, with the hope that the lessons we learn can be translated to improve outcomes of human injury.

Contribution to Science

1. Cellular plasticity during regeneration

During my doctoral studies, I focused on the cellular source of bone-synthesizing osteoblast cells in the zebrafish fin. I developed a model for depleting the osteoblast population using a cell-specific and inducible ablation strategy. This revealed that the contribution of osteoblasts to bone and fin regeneration was redundant, and that the mesenchymal fibroblasts could contribute in their absence, demonstrating cellular plasticity during regeneration.

As a post-doctoral researcher, I embarked on understanding the plasticity in the pancreatic β -cell regeneration. Zebrafish can recover from complete β -cell destruction. In contrast, human β -cells do not recover after massive death, which in turn leads to Type 1 or Type 2 diabetes. For this, we carried out single-cell mRNA-Sequencing (scRNASeq) of the endocrine islets after β -cell ablation. This led to an intriguing observation that suggested plasticity within the endocrine population. We documented a new progenitor source for β -cells. Specifically, we observed a sub-population of the pancreatic δ -cells were capable of trans-differentiating into β -cells.

(a) Singh SP, Holdway JE, Poss KD.

Regeneration of amputated zebrafish fin rays from de novo osteoblasts.

Developmental Cell: Apr 17; doi:10.1016/j.devcel.2012.03.006

2012

(b) Singh SP*, Chawla P*, et al.

*Equal contribution

A single-cell atlas of de novo beta-cell regeneration reveals the contribution of hybrid beta/delta cells to diabetes recovery in zebrafish.

Development: January 28; doi:10.1242/dev.199853

2022

2. Adaptation to stress response

A major driver of evolutionary selection is the adaptation to starvation as animals in the wild face uncertain food supply. Adaptation to periods of famine shapes physiology in a variety of species: fatty liver in migratory birds, high blood sugar in seals and insulin resistance (IR) in hibernating bears. **In the first independent publication from my group**, we demonstrated that the zebrafish liver accumulates lipid droplets in response to starvation. Hepatic steatosis, in this case,

creates an energy reservoir that allows survival during long-term caloric deprivation. We studied this “natural” mode of liver steatosis to uncover the mechanisms underlying its induction and resolution, identifying insulin-driven calcium signaling as a regulator of fatty liver. Other metabolic stressors, such as high-fat diet and alcohol both cause fatty liver, medically referred to as Non-alcoholic Fatty Liver (NAFL) and Alcoholic Fatty Liver (AFL), respectively. As steatosis is the first step towards liver disease, we are currently applying our findings to these clinically significant contexts.

(a) Pozo Morales M, Garteizgogea I, Perazzolo C, **Singh SP**.

In vivo imaging of calcium dynamics in zebrafish hepatocytes.

Hepatology: March 01; [doi:10.1002/hep.32663](https://doi.org/10.1002/hep.32663)

2023

Grants Awarded

Research Credit (CDR) - FNRS

2022

Learning from the extreme: Starvation induces non-alcoholic fatty liver in zebrafish, which is resolved by mobilization of endo-lysosomal calcium stores.

Jaumotte-Demoulin Foundation

2021

Metabolic adaptation to nutritional deprivation.

MISU-PROL FNRS Fellow

2021–2022

Regulators of cellular plasticity in endocrine organs.

Jaumotte-Demoulin Foundation

2020

Regulators of metabolic cell death.

ULB ERC Support

2020

Financial support for reaching second start of the ERC Competition.

MISU FNRS Fellow

2019–2021

How multi-tasking segregates homogenous cellular societies.

Deutsche Forschungsgemeinschaft (DFG) Research Fellowship (Declined)

2019–2021

How multi-tasking segregates homogenous cellular societies.

EFSD/Lilly Young Investigator Research Award

2018–2019

The role of tetraspanin-7, an islet autoantigen, in regulating beta-cell functional heterogeneity

CRTD Postdoctoral Seed Grant

2016–2017

Dissecting functional heterogeneity in β -cells using Single-cell RNA-Seq

CRTD Postdoctoral Seed Grant

2015–2016

Inducible Cas9/CRISPR for Conditional Gene Knockouts in Vertebrate Regenerative Model Systems

Publications

Preprints

1. Valiente-Gabioud A, Garteizgogea I, Idziak A, Fabritius A, Angibaud J, Basquin J, Nägerl UV, **Singh SP**, Griesbeck O.
Fluorescent Sensors for Imaging Interstitial Calcium.

bioRxiv: March 24; [doi:10.1101/2023.03.23.533956](https://doi.org/10.1101/2023.03.23.533956) 2023

2. Ibneeva L, **Singh SP**, Sinha A, Eski SE, Wehner R, Rupp L, Perez-Valencia JA, Gerbaulet A, Reinhardt S, Wobus M, Bonin M, Sancho J, Lund FE, Dahl A, Schmitz M, Bornhaeuser M, Chavakis T, Wielockx B, Grinenko T.
CD38 promotes hematopoietic stem cell dormancy via c-Fos.

bioRxiv: February 08; [doi:10.1101/2023.02.08.527614](https://doi.org/10.1101/2023.02.08.527614) 2023

3. De Faria Da Fonseca B, Barbee C, Romitti M, Eski S E, Gillotay P, Monteyne D, Perez-Morga D, Refetoff S, **Singh SP**, Costagliola S.
Foxe1 orchestrates thyroid and lung cell lineage divergence in mouse stem cell-derived organoids.

bioRxiv: May 16; [doi:10.1101/2022.05.16.492074](https://doi.org/10.1101/2022.05.16.492074) 2022

4. Gillotay P, Romitti M, Dassay B, Haerlingen B, Parakkal MS, De Faria Da Fonseca B, Panos Z G, **Singh SP**, Gerasimos S, Costagliola S.
Nrf2 promotes thyroid development and hormone synthesis.

bioRxiv: March 01; [doi:10.1101/2022.02.27.482168](https://doi.org/10.1101/2022.02.27.482168) 2022

Original Research Articles

5. Yu Q, Walters HE, Pasquini G, **Singh SP**, León-Periñán D, Petzold A, Kesavan P, Subiran C, Garteizgogea I, Knapp D, Wagner A, Bernardos A, Alfonso M, Nadar G, Dahl A, Busskamp V, Martínez-Máñez R, Yun MH.
Cellular senescence modulates progenitor cell expansion during axolotl limb regeneration.

bioRxiv: May 16; [doi:10.1101/2022.09.01.506196](https://doi.org/10.1101/2022.09.01.506196) 2022

Developmental Cell: Accepted 2023

6. Pozo Morales M, Garteizgogea I, Perazzolo C, **Singh SP**.
In vivo imaging of calcium dynamics in zebrafish hepatocytes.

Hepatology: March 01; [doi:10.1002/hep.32663](https://doi.org/10.1002/hep.32663) 2023

7. Romitti M, Tourneur A, De Faria Da Fonseca B, Doumont G, Gillotay P, Liao X-H, Eski S, E, Van Simaey G, Chomette L, Lasolle H, Monestier O, Figini Kasprzyk D, Detours V, **Singh SP**, Goldman S, Refetoff S, Costagliola S.
Transplantable human thyroid organoids generated from embryonic stem cells to rescue hypothyroidism.

Nature Communications: November 17; [doi:10.1038/s41467-022-34776-7](https://doi.org/10.1038/s41467-022-34776-7) 2022

8. McLaughlin K, Acreman S, Nawaz S, Cutteridge J, Clark A, Knudsen JG, Denwood G, Spigelman AF, Manning Fox JE, **Singh SP**, MacDonald PE, Hastoy B, Zhang Q.
Loss of tetraspanin-7 expression reduces pancreatic β -cell exocytosis Ca^{2+} sensitivity but has limited effect on systemic metabolism.

Diabetic Medicine: October 20; [doi:10.1111/dme.14984](https://doi.org/10.1111/dme.14984) 2022

9. Xiao P, Takiishi T, Moretti Violato N, Licata G, Dotta F, Sebastiani G, Marselli L, **Singh SP**, Sze M, Van Loo G, Dejardin E, Gurzov EN, Cardozo AK.
NF-kappaB-inducing kinase (NIK) is activated in pancreatic beta-cells but does not contribute to the development of diabetes.

Cell Death & Disease: May 19; [doi:10.1038/s41419-022-04931-5](https://doi.org/10.1038/s41419-022-04931-5) 2022

10. Nahaboo W, Eski SE, Despin-Guitard E, Vermeersch M, Saykali B, Monteyne D, Gabriele S, Magin TM, Schwarz N, Leube RE, Zwijsen A, Perez-Morga D, **Singh SP**, Migeotte I.
Keratin filaments mediate the expansion of extra-embryonic membranes in the post-gastrulation mouse embryo.
EMBO Journal: March 10; [doi:10.15252/emboj.2021108747](https://doi.org/10.15252/emboj.2021108747) 2022
11. **Singh SP***, Chawla P*, Hnatiuk A, Kamel M, Silva LD, Spanjard B, Eski SE, Janjuha S, Olivares P, Kayisoglu O, Rost F, Blasche J, Krankel A, Petzold A, Kurth T, Reinhardt S, Junker JP, Ninov N.
*Equal contribution
A single-cell atlas of de novo beta-cell regeneration reveals the contribution of hybrid beta/delta cells to diabetes recovery in zebrafish.
Development: January 28; [doi:10.1242/dev.199853](https://doi.org/10.1242/dev.199853) 2022
12. Elvira B, Vandenbempt V, Bauza-Martinez J, Crutzen R, Negueruela J, Ibrahim H, Winder M, Brahma M, Vekerlotaite B, Martens P-J, **Singh SP**, Rossello F, Lybaert P, Otonkoski T, Gysemans C, Wu W, Gurzov E.
PTPN2 regulates the interferon signalling and endoplasmic reticulum stress response in pancreatic beta-cells in autoimmune diabetes.
Diabetes: January 19; [doi:10.2337/db21-0443](https://doi.org/10.2337/db21-0443) 2022
13. Romitti M^{§*}, Eski SE*, Fonseca BF, **Singh SP[§]**, Costagliola S[§].
*Equal contribution
[§]Co-Corresponding Author
Single-cell trajectory inference guided enhancement of thyroid maturation in vitro using TGF-beta inhibition.
Frontiers in Endocrinology: May 31; [doi:10.3389/fendo.2021.657195](https://doi.org/10.3389/fendo.2021.657195) 2021
14. Pronobis MI, Zheng S, **Singh SP**, Goldman JA, Poss KD.
In vivo proximity labeling identifies cardiomyocyte protein networks during zebrafish heart regeneration.
eLife: March 25; [doi:10.7554/eLife.66079](https://doi.org/10.7554/eLife.66079) 2021
15. Gillotay P, Shankar MP, Haerlingen B, Eski SE, Pozo-Morales M, Garteizgogeoasoa I, Reinhardt S, Kraenkel A, Blaesche J, Petzold A, Ninov N, Kesavan G, Lange C, Brand M, Detours V, Costagliola S[§], **Singh SP[§]**.
[§]Co-Corresponding Author
Single-cell transcriptome analysis reveals thyrocyte diversity in the zebrafish thyroid gland.
EMBO Reports: November 06; [doi:10.15252/embr.202050612](https://doi.org/10.15252/embr.202050612) 2020
Featured as Cover Image
16. Mathiah N, Despin-Guitard E, Stower M, Nahano W, Eski SE, **Singh SP**, Srinivas S, Migeotte I
Asymmetry in the frequency and position of mitosis in the mouse embryo epiblast at gastrulation.
EMBO Reports: October 05; [doi:10.15252/embr.202050944](https://doi.org/10.15252/embr.202050944) 2020
17. Eski SE, Dubois C, **Singh SP[§]**.
[§]Corresponding Author
Nuclei Isolation from Whole Tissue using a Detergent and Enzyme-Free Method.

- JoVE**: June 24; [doi:10.3791/61471](https://doi.org/10.3791/61471) 2020
18. Chen LS, **Singh SP**, Mueller G, Bornstein SR, Kanczkowski W.
Transcriptional analysis of sepsis-induced activation and damage of the adrenal microvascular cells.
Frontiers in Endocrinology: January 22; [doi:10.3389/fendo.2019.00944](https://doi.org/10.3389/fendo.2019.00944) 2020
 19. Salem V, Silva LD, Suba K, Georgiadou E, Gharavy SNM, Akhtar N, Martin-Alonso A, Gaboriau DCA, Rothery SM, Stylianides T, Carrat G, Pullen TJ, **Singh SP**, Hodson DJ, Leclerc I, Shapiro AMJ, Marchetti P, Briant LJB, Distaso W, Ninov N, Rutter GA.
Leader beta-cells coordinate Ca²⁺ dynamics across pancreatic islets in vivo.
Nature Metabolism: June 14; [doi:10.1038/s42255-019-0075-2](https://doi.org/10.1038/s42255-019-0075-2) 2019
 20. Chen LS, **Singh SP**, Schuster M, Grinenko T, Bornstein SR, Kanczkowski W.
RNA-seq analysis of LPS-induced transcriptional changes and its possible implications for the adrenal gland dysregulation during sepsis.
J. Steroid Biochem. Mol. Biol: November 29; [doi:10.1016/j.jsbmb.2019.04.009](https://doi.org/10.1016/j.jsbmb.2019.04.009) 2019
 21. **Singh SP[§]**, Janjuha S, Chaudhuri S, Reinhardt S, Dietz S, Eugster A, Bilgin H, Korkmaz S, Zararsiz G, Ninov N, Reid JE.
[§]Corresponding Author
Machine learning based classification of cells into chronological stages using single-cell transcriptomics.
Scientific Reports: November 21; [doi:10.1038/s41598-018-35218-5](https://doi.org/10.1038/s41598-018-35218-5) 2018
 22. Cox BD, Simone AD, Tornini VA, **Singh SP**, Talia SD, Poss KD.
In Toto imaging of dynamic osteoblast behaviors in regenerating skeletal bone.
Current Biology: November 29; [doi:10.1016/j.cub.2018.10.052](https://doi.org/10.1016/j.cub.2018.10.052) 2018
 23. Janjuha S*, **Singh SP***, Ninov N.
*Equal contribution
Analysis of Beta-cell Function Using Single-cell Resolution Calcium Imaging in Zebrafish Islets.
JoVE: July 03; [doi:10.3791/57851](https://doi.org/10.3791/57851) 2018
 24. Janjuha S*, **Singh SP***, Tsakmaki A, Gharavy SNM, Murawala P, Konantz J, Birke S, Hodson DJ, Rutter GA, Bewick GA, Ninov N.
*Equal contribution
Age-related islet inflammation marks the proliferative decline of pancreatic beta-cells in zebrafish.
eLife: April 06; [doi:10.7554/eLife.32965](https://doi.org/10.7554/eLife.32965) 2018
 25. **Singh SP**, Janjuha S, Hartmann T, Kayisoglu O, Konantz J, Birke S, Murawala P, Alfar EAA, Murata K, Eugster A, Tsuji N, Morrissey ER, Brand M, Ninov N.
Different developmental histories of beta-cells generate functional and proliferative heterogeneity during islet growth.
Nature Communications: September 22; [doi:10.1038/s41467-017-00461-3](https://doi.org/10.1038/s41467-017-00461-3) 2017
 26. Fei JF, Knapp D, Schuez M, Murawala P, Zou Y, **Singh SP**, Drechsel D, Tanaka EM.
Tissue and time-directed electroporation of CAS9 protein-gRNA complexes in vivo yields efficient multigene knockout for studying gene function in regeneration.
npj Regenerative Medicine: June 1; [doi:10.1038/npjregenmed.2016.2](https://doi.org/10.1038/npjregenmed.2016.2) 2016

27. **Singh SP**, Holdway JE, Poss KD.
Regeneration of amputated zebrafish fin rays from de novo osteoblasts.
Developmental Cell: Apr 17; doi:[10.1016/j.devcel.2012.03.006](https://doi.org/10.1016/j.devcel.2012.03.006) 2012
28. Wang JH, Panáková D, Kikuchi K, Holdway JE, Gemberling M, Burris JS, **Singh SP**, Dickson AL, Lin YF, Sabeh MK, Werdich AA, Yelon D, Macrae CA, Poss KD.
The regenerative capacity of zebrafish reverses cardiac failure caused by genetic cardiomyocyte depletion.
Development: Aug 15; doi:[10.1242/dev.068601](https://doi.org/10.1242/dev.068601) 2011

Review Article

29. **Singh SP**, Ninov N.
The triumvirate of beta-cell regeneration: Solutions and bottlenecks to curing diabetes.
Int. J. Dev. Biol.: June 28; doi: [10.1387/ijdb.180067nn](https://doi.org/10.1387/ijdb.180067nn) 2018

Book Chapter

30. **Singh SP**, Ninov N.
Multicolor labeling and tracing of pancreatic beta-cell proliferation in zebrafish.
Animal Models of Diabetes: Methods and Protocols
 Editor: King, Aileen. Publisher: Springer US. doi:[10.1007/978-1-0716-0385-7_12](https://doi.org/10.1007/978-1-0716-0385-7_12) 2020

Editorial

31. Costagliola S, **Singh SP**.
Emerging Technologies in Thyroid Biology: Pushing the Frontiers of Thyroid Research.
Molecular and Cellular Endocrinology.: May 01; doi:[10.1016/j.mce.2023.111912](https://doi.org/10.1016/j.mce.2023.111912) 2023

Conference Talks / Seminars (Last Five Years)

Seminar: Indian Institute of Technology (IIT), Kanpur	Kanpur, India
Mechanisms of starvation resistance	2023
Seminar: Indian Institute of Technology (IIT), Delhi	New Delhi, India
Mechanisms of starvation resistance	2023
Seminar: Biology Department, KU Leuven	Leuven, Belgium
Resolution of hepatic steatosis in zebrafish	2022
Belgium Society for Cell and Developmental Biology	Brussels, Belgium
Resolution of hepatic steatosis in zebrafish	2022
Helmholtz Zentrum München	Webinar
Preprint publishing and evolving the peer-review process	2022
6th European Zebrafish PI Meeting	Dresden, Germany
Speaker: Single-cell interactome	
Chair: Metabolism and Endocrinology	2022
43rd Annual Meeting of the European Thyroid Association	Milano, Italy*
Zebrafish as a model of human thyroid disorders	2021
Seminar: University of Wisconsin–Madison	Madison, USA*
Single-cell endocrinology	2021

EMBL-EBI Training with Europe PMC

Preprints 101 for authors

Webinar

2021

3rd Italian Zebrafish Meeting (ZFIM)

Thyroid Macrophage Interaction

Napoli, Italy*

2021

Seminar: New York University Abu Dhabi

Single-cell endocrinology

Abu Dhabi, UAE*

2021

26th Japanese Medaka and Zebrafish Meeting

Thyroid Morphogenesis

Chiba, Japan*

2020

4th Challenges in Computational Biology meeting

Single Cell Data Analysis

Mainz, Germany*

2020

*In-person meeting moved online due to COVID19

Interdisciplinary Scientific Seminars - ULB

Cooperative Behaviour

Brussels, Belgium

2020

Applied Bioinformatics in Life Sciences (3rd edition)

Machine Learning in Aging

Leuven, Belgium

2020

Awards and Achievements

10x Genomics Grant Program: Best Abstract 2020**Best Poster Award: CRTD Day** 2019**Deutsche Zentrum für Diabetesforschung (DZD) Award: Conference Presentation** 2016**Best Talk Award: Genetics and Genomics Departmental Retreat** 2012**Best Talk Award: Cell Biology Departmental Retreat** 2012**Summer Internship Award: Jawaharlal Nehru Centre for Advanced Scientific Research** 2007**Baljit and Nirmal Dhindsa Scholarship: Highest Grades (Biological Department)** 2005**Academic Excellence Award: Freshman Student** 2004

Ongoing Memberships in International Societies

International Society for Regenerative Biology (ISRB)

European Association for the Study of the Liver (EASL)

International Zebrafish Society (IZFS)

European Zebrafish Society (EZS)

European Thyroid Association (ETA)

Society for Experimental Biology (SEB)

Society for Developmental Biology (SDB)

Belgian Society for Cell and Developmental Biology (BSCDB)

Belgian Society of Physiology and Pharmacology (PhysPhar-Belgium)

Scientific Outreach

ASAPBio Fellow 2021[Raise awareness of preprints and encourage their productive use in the life sciences](#)**Pint of Science (Belgium)** 2020[Animal Models in Science](#)**Science Slam (Deutsch)** 2017[Vorhersage des Zellulären Alters durch Künstliche Intelligenz](#)**Journal Coverage Podcast** 2015–2019[Audio interviews of scientific authors with recent, important publications](#)

Pedagogy

Instructor, Scientific Communication - 5 credit course Medical Department, ULB	2022–Onwards Brussels, Belgium
Instructor, Hands-on Introduction to RNA-Seq CIVIS (European CIVIC University), ULB	2021 Brussels, Belgium
Organizer, School Workshop International School of Brussels (ISB)	2020–2021 Brussels, Belgium
Instructor, Online Courses R and Bioinformatics	2020 YouTube
Mentor, English Language Freedom English Academy (FEA)	2018–2019 via Skype, India
Volunteer, School Student Lab Practical Course Center for Regenerative Therapies Dresden	2018 Dresden, Germany
Teaching Assistant (TA), Advanced Topics: Genetics/Genomics Duke University	2009 Durham, USA

Diversity Promotion

Member - Diversity, Equity, and Inclusion (DEI) committee International Zebrafish Society (IZFS)	2020–2022
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