HHS Public Access

Author manuscript

Nature. Author manuscript; available in PMC 2023 February 07.

Published in final edited form as:

Nature. 2022 September ; 609(7927): E8. doi:10.1038/s41586-022-05226-7.

Author Correction: PHGDH heterogeneity potentiates cancer cell dissemination and metastasis

A full list of authors and affiliations appears at the end of the article.

In the version of this article initially published, we unintentionally omitted to indicate that Extended Data Fig. 2h and Extended Data Fig. 3f display images from the same experiment. The upper panel in Extended Data Fig. 3f represents green and red channels of the same tumour region as the panel on the top left in Extended Data Fig. 2h. The lower panel in Extended Data Fig. 3f represents green and red channels of the same tumour region as the panel on the top right in Extended Data Fig. 2h. This has now been clarified in Extended Data Fig. 2h and Extended Data Fig. 3f legends and in the Methods “Orthotopic mouse models: Melanoma” subsection, as reflected in the HTML and PDF versions of the article.

Extended Data Fig. 2h. Representative pictures of PHGDH protein expression in primary and metastatic melanoma mouse model (*Tyr::N-Ras*$^{+/Q61K}$*;Ink4a*$^{-/-}$). Left panels represent tumours from mice injected with melanoma cells alone; middle and right panels represent tumors from mice co-injected with melanoma and Bend3 endothelial cells (ratio 1:4). Green, Phgdh; red, dsRed tumour cell marker; blue, DAPI nuclear staining.

Extended Data Fig. 3f. Representative pictures of PHGDH protein expression in primary melanoma model (*Tyr::N-Ras*$^{+/Q61K}$*;Ink4a*$^{-/-}$) from mice injected with melanoma cells alone or co-injected with melanoma and Bend3 endothelial cells (ratio 1:4). Outcome of this experiment is also depicted in Extended Data Fig 2h. Upper panel represents green and red channels of the same tumor region as the panel on the top left in Extended Data Fig. 2h. Lower panel represents green and red channels of the same tumour region as the panel on the top right in Extended Data Fig. 2h. Green, Phgdh; red, dsRed tumour cell marker; blue, DAPI nuclear staining. Scale bar 200 μm.

Methods “Orthotopic mouse models: Melanoma” subsection.

Primary melanoma tumour from *Tyr::N-Ras*^{Q61K}*;Ink4a*$^{-/-}$ (*Tyr::cre*^{ERT2}) animals was dissociated into small pieces using forceps and scissors. Tissue was digested using a mix of collagenase I (2 mg ml^{-1}, Sigma-Aldrich, C0130) and IV (2 mg ml^{-1}, Sigma-Aldrich, C5138) for 20 min at 37 °C followed by a trypsin (trypsin-EDTA 0.05%, Thermo Fisher Scientific, 25300054) digestion for 5 min at 37 °C. Single cells were separated from the remaining tissue using a 40 μm cell strainer and cultured in vitro using DMEM supplemented with 10% fetal bovine serum and 100 μg ml^{-1} penicillin–streptomycin.

Corresponding author: Correspondence to Sarah-Maria Fendt.
Author information
These authors contributed equally: Matteo Rossi, Patricia Altea-Manzano

Correction to: *Nature* https://doi.org/10.1038/s41586-022-04758-2 Published online 18 May 2022

Tyr::N-Ras$^{+/Q61K}$;*Ink4a*$^{-/-}$ mouse melanoma cells stably expressing dsRed-encoding lentiviruses and Bend3 immortalized endothelial cells stably expressing GFP encoding lentiviruses were mixed at a ratio 1:4 (10^5 melanoma, 4×10^5 endothelial cells) and resuspended in Matrigel (5 mg ml^{-1}; Thermo Fisher Scientific, 356255). Then, melanoma cells alone or mixed with Bend3 cells were injected subcutaneously into the back skin of Foxn1^{nu} mice. Mice were euthanized when tumours and organs were collected, 25 days after melanoma initiation. Tumour volume was monitored using callipers and the volume was calculated using the following formula: $V = (\pi/6) \times \text{length} \times \text{width} \times \text{height}$.

Mice were housed in filter-top cages and IVC cages. Housing and experimental animal procedures were approved by the Institutional Animal Care and Research Advisory Committee of KU Leuven, Belgium. The animal study complies with ethical regulations and was approved by the KU Leuven ethics committee. Humane end points were determined as follows: tumour size of 1.8 cm^3, loss of ability to ambulate, unhealthy fur; difficult respiration because of lung metastasis, surgical infection or weight loss over 20% of initial body weight. Mice were monitored and, after detection of one of the above-mentioned symptoms, the mouse was euthanized.

Authors

Matteo Rossi,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Patricia Altea-Manzano,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Margherita Demicco,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Ginevra Doglioni,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laura Bornes,
Division of Molecular Pathology, Oncode Institute, The Netherlands Cancer Institute, Amsterdam, the Netherlands

Marina Fukano,

Institute for Research in Immunology and Cancer (IRIC), University of Montreal, Montreal, Quebec, Canada; Faculty of Medicine and Health Sciences, McGill University, Montreal, Quebec, Canada; Rosalind & Morris Goodman Cancer Institute (GCI), McGill University, Montreal, Quebec, Canada

Anke Vandekeere,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Alejandro M. Cuadros,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Juan Fernández-García,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Carla Riera-Domingo,
Laboratory of Tumor Inflammation and Angiogenesis, Center for Cancer Biology (CCB), VIB, Leuven, Belgium; Laboratory of Tumor Inflammation and Angiogenesis, Department of Oncology, KU Leuven, Leuven, Belgium

Cristina Jauset,
Cancer Research UK Cambridge Institute, University of Cambridge, Li Ka Shing Centre, Cambridge, UK

Mélanie Planque,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

H. Furkan Alkan,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

David Nittner,
Histopathology Expertise Center, VIB-KU Leuven Center for Cancer Biology, Leuven, Belgium; Department of Oncology, KU Leuven, Leuven, Belgium

Dongmei Zuo,

Rosalind & Morris Goodman Cancer Institute (GCI), McGill University, Montreal, Quebec, Canada

Lindsay A. Broadfield,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Sweta Parik,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Antonino Alejandro Pane,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Francesca Rizzollo,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Gianmarco Rinaldi,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Tao Zhang,
Center for Proteomics and Metabolomics, Leiden University Medical Center, Leiden, the Netherlands

Shao Thing Teoh,
Department of Biochemistry and Molecular Biology, Michigan State University, East Lansing, MI, USA

Arin B. Aurora,
Children's Research Institute and Department of Pediatrics, University of Texas Southwestern Medical Center, Dallas, TX, USA

Panagiotis Karras,
Department of Oncology, KU Leuven, Leuven, Belgium; Laboratory of Molecular Cancer Biology, VIB Center for Cancer Biology, Leuven, Belgium

Ines Vermeire,

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Dorien Broekaert,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Joke Van Elsen,
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Maximilian M. L. Knott,
Max-Eder Research Group for Pediatric Sarcoma Biology, Institute of Pathology, Faculty of Medicine, LMU Munich, Munich, Germany

Martin F. Orth,
Max-Eder Research Group for Pediatric Sarcoma Biology, Institute of Pathology, Faculty of Medicine, LMU Munich, Munich, Germany

Sofie Demeyer,
Laboratory for Molecular Biology of Leukemia, VIB-KU Leuven, Leuven, Belgium

Guy Eelen,
Laboratory of Angiogenesis and Vascular Metabolism, Department of Oncology, KU Leuven, Leuven, Belgium; Laboratory of Angiogenesis and Vascular Metabolism, Center for Cancer Biology, VIB, Leuven, Belgium

Lacey E. Dobrolecki,
StemMed, Houston, TX, USA

Ayse Bassez,
Laboratory for Translational Genetics, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory for Translational Genetics, Department of Human Genetics, KU Leuven, Leuven, Belgium

Thomas Van Brussel,
Laboratory for Translational Genetics, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory for Translational Genetics, Department of Human Genetics, KU Leuven, Leuven, Belgium

Karl Sotlar,
Institute of Pathology, University Hospital Salzburg, Paracelsus Medical University, Salzburg, Austria

Michael T. Lewis,

StemMed, Houston, TX, USA

Harald Bartsch,
Institute of Pathology, Ludwig Maximilians University, Munich, Germany

Manfred Wuhrer,
Center for Proteomics and Metabolomics, Leiden University Medical Center, Leiden, the Netherlands

Peter van Veelen,
Center for Proteomics and Metabolomics, Leiden University Medical Center, Leiden, the Netherlands

Peter Carmeliet,
Laboratory of Angiogenesis and Vascular Metabolism, Department of Oncology, KU Leuven, Leuven, Belgium; Laboratory of Angiogenesis and Vascular Metabolism, Center for Cancer Biology, VIB, Leuven, Belgium; Center for Biotechnology, Khalifa University of Science and Technology, Abu Dhabi, United Arab Emirates; Laboratory of Angiogenesis and Vascular Heterogeneity, Department of Biomedicine, Aarhus University, Aarhus, Denmark

Jan Cools,
Laboratory for Molecular Biology of Leukemia, VIB-KU Leuven, Leuven, Belgium

Sean J. Morrison,
Children's Research Institute and Department of Pediatrics, University of Texas Southwestern Medical Center, Dallas, TX, USA; Howard Hughes Medical Institute, University of Texas Southwestern Medical Center, Dallas, TX, USA

Jean-Christophe Marine,
Department of Oncology, KU Leuven, Leuven, Belgium; Laboratory of Molecular Cancer Biology, VIB Center for Cancer Biology, Leuven, Belgium

Diether Lambrechts,
Laboratory for Translational Genetics, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory for Translational Genetics, Department of Human Genetics, KU Leuven, Leuven, Belgium

Massimiliano Mazzone,
Laboratory of Tumor Inflammation and Angiogenesis, Center for Cancer Biology (CCB), VIB, Leuven, Belgium; Laboratory of Tumor Inflammation and Angiogenesis, Department of Oncology, KU Leuven, Leuven, Belgium; Department of Molecular Biotechnology and Health Science, Molecular Biotechnology Centre, University of Torino, Torino, Italy

Gregory J. Hannon,
Cancer Research UK Cambridge Institute, University of Cambridge, Li Ka Shing Centre, Cambridge, UK

Sophia Y. Lunt,

Department of Biochemistry and Molecular Biology, Michigan State University, East Lansing, MI, USA; Department of Chemical Engineering and Materials Science, Michigan State University, East Lansing, MI, USA

Thomas G. P. Grünewald,
Max-Eder Research Group for Pediatric Sarcoma Biology, Institute of Pathology, Faculty of Medicine, LMU Munich, Munich, Germany; Hopp Children's Cancer Center (KiTZ), Heidelberg, Germany; Division of Translational Pediatric Sarcoma Research, German Cancer Research Center (DKFZ), German Cancer Consortium (DKTK), Heidelberg, Germany; Institute of Pathology, Heidelberg University Hospital, Heidelberg, Germany

Morag Park,
Faculty of Medicine and Health Sciences, McGill University, Montreal, Quebec, Canada; Rosalind & Morris Goodman Cancer Institute (GCI), McGill University, Montreal, Quebec, Canada

Jacco van Rheenen,
Division of Molecular Pathology, Oncode Institute, The Netherlands Cancer Institute, Amsterdam, the Netherlands

Sarah-Maria Fendt
Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Affiliations

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Division of Molecular Pathology, Oncode Institute, The Netherlands Cancer Institute, Amsterdam, the Netherlands

Institute for Research in Immunology and Cancer (IRIC), University of Montreal, Montreal, Quebec, Canada; Faculty of Medicine and Health Sciences, McGill University, Montreal, Quebec, Canada; Rosalind & Morris Goodman Cancer Institute (GCI), McGill University, Montreal, Quebec, Canada

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Tumor Inflammation and Angiogenesis, Center for Cancer Biology (CCB), VIB, Leuven, Belgium; Laboratory of Tumor Inflammation and Angiogenesis, Department of Oncology, KU Leuven, Leuven, Belgium

Cancer Research UK Cambridge Institute, University of Cambridge, Li Ka Shing Centre, Cambridge, UK

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Histopathology Expertise Center, VIB-KU Leuven Center for Cancer Biology, Leuven, Belgium; Department of Oncology, KU Leuven, Leuven, Belgium

Rosalind & Morris Goodman Cancer Institute (GCI), McGill University, Montreal, Quebec, Canada

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Center for Proteomics and Metabolomics, Leiden University Medical Center, Leiden, the Netherlands

Department of Biochemistry and Molecular Biology, Michigan State University, East Lansing, MI, USA

Children's Research Institute and Department of Pediatrics, University of Texas Southwestern Medical Center, Dallas, TX, USA

Department of Oncology, KU Leuven, Leuven, Belgium; Laboratory of Molecular Cancer Biology, VIB Center for Cancer Biology, Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium

Max-Eder Research Group for Pediatric Sarcoma Biology, Institute of Pathology, Faculty of Medicine, LMU Munich, Munich, Germany

Max-Eder Research Group for Pediatric Sarcoma Biology, Institute of Pathology, Faculty of Medicine, LMU Munich, Munich, Germany

Laboratory for Molecular Biology of Leukemia, VIB-KU Leuven, Leuven, Belgium

Laboratory of Angiogenesis and Vascular Metabolism, Department of Oncology, KU Leuven, Leuven, Belgium; Laboratory of Angiogenesis and Vascular Metabolism, Center for Cancer Biology, VIB, Leuven, Belgium

StemMed, Houston, TX, USA

Laboratory for Translational Genetics, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory for Translational Genetics, Department of Human Genetics, KU Leuven, Leuven, Belgium

Laboratory for Translational Genetics, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory for Translational Genetics, Department of Human Genetics, KU Leuven, Leuven, Belgium

Institute of Pathology, University Hospital Salzburg, Paracelsus Medical University, Salzburg, Austria

StemMed, Houston, TX, USA

Institute of Pathology, Ludwig Maximilians University, Munich, Germany

Center for Proteomics and Metabolomics, Leiden University Medical Center, Leiden, the Netherlands

Center for Proteomics and Metabolomics, Leiden University Medical Center, Leiden, the Netherlands

Laboratory of Angiogenesis and Vascular Metabolism, Department of Oncology, KU Leuven, Leuven, Belgium; Laboratory of Angiogenesis and Vascular Metabolism, Center for Cancer Biology, VIB, Leuven, Belgium; Center for Biotechnology, Khalifa University of Science and Technology, Abu Dhabi, United Arab Emirates; Laboratory of Angiogenesis and Vascular Heterogeneity, Department of Biomedicine, Aarhus University, Aarhus, Denmark

Laboratory for Molecular Biology of Leukemia, VIB-KU Leuven, Leuven, Belgium

Children’s Research Institute and Department of Pediatrics, University of Texas Southwestern Medical Center, Dallas, TX, USA; Howard Hughes Medical Institute, University of Texas Southwestern Medical Center, Dallas, TX, USA

Department of Oncology, KU Leuven, Leuven, Belgium; Laboratory of Molecular Cancer Biology, VIB Center for Cancer Biology, Leuven, Belgium

Laboratory for Translational Genetics, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory for Translational Genetics, Department of Human Genetics, KU Leuven, Leuven, Belgium

Laboratory of Tumor Inflammation and Angiogenesis, Center for Cancer Biology (CCB), VIB, Leuven, Belgium; Laboratory of Tumor Inflammation and Angiogenesis, Department of Oncology, KU Leuven, Leuven, Belgium; Department of Molecular Biotechnology and Health Science, Molecular Biotechnology Centre, University of Torino, Torino, Italy

Cancer Research UK Cambridge Institute, University of Cambridge, Li Ka Shing Centre, Cambridge, UK

Department of Biochemistry and Molecular Biology, Michigan State University, East Lansing, MI, USA; Department of Chemical Engineering and Materials Science, Michigan State University, East Lansing, MI, USA

Max-Eder Research Group for Pediatric Sarcoma Biology, Institute of Pathology, Faculty of Medicine, LMU Munich, Munich, Germany; Hopp Children's Cancer Center (KiTZ), Heidelberg, Germany; Division of Translational Pediatric Sarcoma Research, German Cancer Research Center (DKFZ), German Cancer Consortium (DKTK), Heidelberg, Germany; Institute of Pathology, Heidelberg University Hospital, Heidelberg, Germany

Faculty of Medicine and Health Sciences, McGill University, Montreal, Quebec, Canada; Rosalind & Morris Goodman Cancer Institute (GCI), McGill University, Montreal, Quebec, Canada

Division of Molecular Pathology, Oncode Institute, The Netherlands Cancer Institute, Amsterdam, the Netherlands

Laboratory of Cellular Metabolism and Metabolic Regulation, VIB-KU Leuven Center for Cancer Biology, VIB, Leuven, Belgium; Laboratory of Cellular Metabolism and Metabolic Regulation, Department of Oncology, KU Leuven and Leuven Cancer Institute (LKI), Leuven, Belgium