Name: Liran I. Shlush
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Citizenship: Israeli
DOB: May 21, 1975

Senior Scientist
Weizmann Institute of Science
Department of Immunology
Rehovot, Israel

Hematologist
Maccabi Healthcare
Molecular hematology clinic
Tel Aviv, Israel

A. **EDUCATION / TRAINING:**

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Technion – Israel Institute of Technology Medical School	PhD	2006-2012	Population Genetics
Technion – Israel Institute of Technology Medical School	MD	1996-1999	Medicine
Technion – Israel Institute of Technology	BSc (cum laude)	1993-1996	Medical Science

B. Positions and Honors (in chronological order)

Positions and Employment

Years	Position, Place
2020-Current	**Hematologist -** Molecular hematology clinic, Maccabi Healthcare Service, Tel Aviv Israel.
2016-Current	**Senior Scientist** Weizmann Institute of Science Department of Immunology Rehovot Israel.
2016-Current	**Visiting physician** hematology department Rambam healthcare campus Haifa Israel.
2017-2018	**Visiting physician** hematology Princess Margaret Cancer Center, University Health Network, Toronto Ontario Canada.
2014-2016	**Clinical fellow** leukemia program adult hematology Princess Margaret Cancer Center, University Health Network, Toronto Ontario Canada.
2012-2014	**Post-Doctoral Fellow** Campbell Family Cancer Research Institute, Ontario Cancer Institute, Princess Margaret Hospital, University Health Network, Toronto Ontario Canada (Supervisor John E. Dick).

2008-2012	**Internship** - Internal Medicine B Rambam Health Care Campus, Haifa Israel.
2006-2012	**PhD Medical Science**, Technion – Israel Institute of Technology (Supervisor Karl Skorecki).
2005 – 2008	**Deputy Director**, Israel Navy Medical Institute, Haifa, Israel.
2004-2005	**Medical Commander** of Golani Brigade Training Base, Northern Israel Command, Israel Defense Forces.
2002-2003	**Battalion Medical Officer**, Israel Defense Forces.
2000-2001	**Intern** – Hematology and Emergency Care, Rambam Hospital, Haifa, Israel.

Other Experience

Years	Position, Place
2000	Microbial taxonomy and Molecular Biology training, Baylor College, Houston, Texas.
2008	MATLAB Fundamentals and Programming Techniques, Systematics Tel Aviv.
2008	Statistical Analysis for Genetic Epidemiology (SAGE), Sharei Tzedek Medical Hospital, Jerusalem.
2010	Educational Commission for Foreign Medical Graduates (ECFMG) certified to practice medicine in the U.S.

Honors

2019	**Ernest and Bonnie Beutler Research Program of Excellence in Genomic Medicine Award 2019. 500,000$.**
2016	**Alon Award.** Israeli council for higher education.
2015	**Keating award.** University of Toronto, Divisions of Hematology & Hematopathology.
2014	**Paper of the year award.** Canadian Hematology Society.
2014	**ASH Scholar award 2015.** American Society of Hematology.
2013	**ASH Abstract Achievement Award**. 55th ASH Annual Meeting in New Orleans, LA.
2010	**Excellence Award,** Teaching, Faculty of Medicine Technion - Israel Institute of Technology.
2008	**The Itai Sharon Rambam Atidim Program and Award**.
2003	**Excellence Award,** First Response Military Medical Care.
2001	**Excellence Award,** Internship program, Rambam Hospital, Haifa, Israel.

Invited Talks:

1. Shlush LI. **Lineage analysis of single cancer cells.** Presented as a lecture in the genetic evolution of cancer International Society of Cellular Oncology (ISCO) annual meeting Dresden Germany 2010.
2. Shlush LI. **Preleukemia and convergent somatic evolution.** Workshop on Mathematical Oncology V: Heterogeneity and Plasticity in Cancer at the Fields Institute, Toronto Canada 2014.
3. Shlush LI. **AML an Acute Disease with Chronic evolution.** European Hematology Association (EHA) Milan Italy Jun 2014.
4. Shlush LI. **The Initiation and Progression of AML.** European Hematology Association (EHA) Milan Italy Jun 2014.
5. Shlush LI. **Preleukemia Clonal Hematopoiesis and the Aging Bone Marrow.** Tsukuba Global Science Week 2014. Tsukuba Japan Sep 2014.

6. Shlush LI**. AML relapse mechanisms.** Acute leukemia Forum March 2015 San Francisco.
7. Shlush LI. **Preleukemia. "Innovations in Hematology"**. Jerusalem June 2015.
8. Shlush LI. **Clonal Evolution Models of Tumor Heterogeneity.** 2015 ASCO Annual Meeting Chicago May 2015. As part of the Education Session, which included a chapter in the education book of the ASCO meeting.
9. Shlush LI. **Preleukemia the normal side of cancer.** International conference on Acute Myeloid Leukemia: "Molecular and Translational: Advances in Biology and Treatment". Budapest Sep 2015, the European School of Hematology.
10. Shlush LI. **On the origins of AML relapse.** The 77th Annual Meeting of the Japanese Society of Hematology Oct 2015, Kanazawa Japan.
11. Shlush LI. **On the origins of AML 2015.** Hematopoietic stem cell regulation symposium WIS Israel.
12. Shlush LI. **On the origins of AML relapse.** American Society of Hematology annual meeting Orlando FL 2015.
13. Shlush LI. **The aging of the human hematopoietic system 2016.** CEMMA seminar series Ulm University Germany.
14. Shlush LI. **AML clonal evolution.** The 29th scientific meeting of the Israeli association for bone marrow transplantation. Ramat-Gan Israel 2016.
15. Shlush LI. **The Implications of Leukemia Evolution on Diagnosis and Treatment.** Israel Society of hematology and transfusion medicine annual meeting. Nov 2016 Kfar Bloom.
16. Shlush LI. **Pre-Leukemic Versus Leukemic Cell of Origin.** American Society of Hematology annual meeting San Diego CA Dec 2016. Special Scientific Symposia.
17. Shlush LI. **Mutations That Initiate Leukemogenesis: Role of Epigenetic Modifiers.** American Society of Hematology annual meeting San Diego CA Dec 2016. Meet the scientist.
18. Shlush LI. **Leukemia evolution.** ACUTE LEUKEMIAS XVI Biology and Treatment Strategies Feb 2017 Munich.
19. Shlush LI. **Aging, clonal hematopoiesis and pre-leukemia.** European Hematology Association (EHA) Madrid Spain Jun 2017.
20. Shlush LI. **Aging, clonal hematopoiesis and pre-leukemia.** The future of medicine. Genova Italy June 2017.
21. Shlush LI. **AML Evolution and its Therapeutics Relevance.** ESMO, Madrid Spain Sep 2017.
22. Shlush LI. **Leukemia Evolution.** CNIO – Weizmann Institute of Science Joint Symposium. **New Insights in Cancer Discovery**
23. September Madrid Spain Aug 2017.
24. Shlush LI. **Early diagnosis and treatment of AML.** Faculty of biology seminar Bar-Ilan University Nov 2017.
25. Shlush LI. **Keynote speaker. AML early evolution.** International symposium Cancer evolution Munich Germany Mar 2018.
26. Shlush LI. **The Clinical Implications of Early Leukaemia Evolution.** The Danish Acute Leukemia Group Copenhagen Denmark Apr 2018.
27. Shlush LI. **Early detection and treatment of leukemia.**
28. 1st Greco-Israeli Hematology Meeting (GIHM 2018), Thessaloniki, Greece, April 26-28, 2018.
29. Shlush LI.
30. Shlush LI. **Leukemia evolution from preleukemia to relapse.** European Hematology Association (EHA) annual meeting Stockholm Sweden June 2018.
31. Shlush LI. **The early evolution of Leukemia**. King College London UK Sep 2018.

32. Shlush LI. **Early Diagnosis and Prevention of AML.** International Forum on Stem Cells (IFSC) Tian Jin China Oct 2018.
33. Shlush LI. **Early Diagnosis and Prevention of AML.** Festival della Scienza - Genoa, Italy October 2018.
34. Shlush LI. **Early Diagnosis and Prevention of AML.** The UK – Israel and the Dotan Center International Symposium. ADVANCES IN RESEARCH OF HEMATOLOGICAL MALIGNANCIES. Petah Tikva Israel. Nov 2018.
35. Shlush LI. **Early Diagnosis and Prevention of AML.** The annual meeting of the Israeli society of hematology and transfusion medicine. Kfar Bloom Israel Nov 2018.
36. Shlush LI. **Early Diagnosis and Prevention of AML.** International Symposium ACUTE LEUKEMIAS XVII Biology and Treatment Strategies. Munich Germany Feb 2019.
37. Shlush LI. **Early Diagnosis and Prevention of AML.** The 30th Annual Meeting of the German Society of Human Genetics. Weimar Germany Mar 2019.
38. Shlush LI. **Early Diagnosis and Prevention of AML.** 2019 Korean Society of Hematology International Conference. Seol South Korea Mar 2019.
39. Shlush LI. **Early Diagnosis and Prevention of AML.** American Association Cancer Research (AACR) Annual meeting education session. Atlanta USA Mar 2019.
40. Shlush LI. **Early Diagnosis and Prevention of AML.** The annual meeting of the Hematology Society of Taiwan and Taiwan Society of Blood and Marrow Transplantation. Taipei Taiwan Apr 2019.
41. Shlush LI. **Early Diagnosis and Prevention of AML.** Acute leukemia forum. Newport Beach USA. Apr 2019.
42. Shlush LI. **The origins of relapse in AML/MDS.** The 15th International Symposium on Myelodysplastic Syndromes. Copenhagen Denmark May 2019.
43. Shlush LI**. The aging of the Blood system and Leukemia Evolution.** The Key 16 conference: Origin of Cancer. Stockholm Sweden Sep 2019
44. Shlush LI. **Aging of the Blood system and early diagnosis of myeloid malignancies**. London UK UCL Cancer Institute Annual Conference Key note speaker Nov 2019.
45. Shlush LI **Early Diagnosis and Prevention of AML.** Sino-Israel Symposium on Precision Medicine. Changhai China Jan 2020.
46. Shlush LI **Early Diagnosis and Prevention of AML** ILANIT Eilat Israel Feb 2020.
47. MSK
48. Shlush LI. **The aging of the Blood system and Leukemia Evolution.** Broad-ISF symposium Virtual. June 2020.
49. Shlush LI. **Introduction to medical diagnostics**. 8400 course Tel Aviv Israel June 2020.
50. Shlush LI. **Early diagnosis of myeloid malignancies.** Sourasky medical center scientific seminar. Tel Aviv Israel. Oct 2020.
51. Shlush LI. **Early diagnosis of myeloid malignancies.** Rappaport Seminar. Technion Haifa Israel Nov 2020.
52. Shlush LI. **The 7th International Forum on Stem Cells (IFSC).** Tianjin China Virtual Nov 2020.
53. Shlush LI. **Clonal hematopoiesis and the early diagnosis and prevention of myeloid malignancies.** Dan and Betty Kahn Symposium- Vision 2020: Biomedical Research Frontiers of the Future. Michigan USA Dec 2020.
54. Shlush LI. **The aging of the blood system and clonal hematopoiesis. MSK Center for Hematologic Seminar Series**. Feb 2021.
55. Shlush LI. **The aging of the blood system.** Stem course for PhD. San Raffaele – Telethon Institute for Gene Therapy in Milan (Italy) Milano Apr 2021.
56. Shlush LI**. Recurrent deletions in clonal henatopoesis are due to a novel MMEJ pathway**. INTERNATIONAL eSYMPOSIUM on frontiers in Blood, cancer & development: systems to medicine. Virtual, India. Mar 2021.

57. Shlush LI**. Controversies and future directions in clonal hematopoiesis.** 3rd iwAL virtual workshop USA. Apr 2021.
58. Shlush LI. **Dynamics of preleukemic mutations.** EHA Virtual. June 2021.
59. Shlush LI. **Recurrent Deletions in Clonal Hematopoiesis are driven by Microhomology-mediated end joining (MMEJ)** FASEB The Hematologic Malignancies Conference (Virtual) Jul 2021.
60. Shlush LI **Clonal hematopoiesis as model of clonal progression.** 16th International Congress on Myelodysplastic Syndromes, Toronto Canada, (Sep 2021) Virtual.
61. Shlush LI **Mechanisms in clonal hematopoiesis.** Tisch Cancer Institute at the Icahn School of Medicine at Mount Sinai (Nov 2021), Virtual.
62. Shlush LI **Novel mechanisms in MPN**. Ninth International Conference on "Innovations in Hematology Tel Aviv Israel (Nov 2021).
63. Shlush LI. **Mutation mechanisms in clonal hematopoiesis and leukemia**. Molecular Genetics Colloquium University of Toronto Canada (Feb 2022) Virtual.

Conference organization/review.

1. ASH annual meeting Orlando 2015. Abstract reviewer and chaired a session on leukemia stem cells.

2. Gaps in the Translation of Basic Research to Effective Treatment in Hematological Malignancies. WIS May 2016. Scientific committee, session chair.

3. ASCO annual meeting Chicago 2016. Abstract reviewer for the educational session.

4. Precision medicine and aging British Council London 2018. Organizing committee.

5. ESMO annual meeting Abstract review and session chair HAEMATOLOGICAL MALIGNANCIES. Barcelona 2019.

6. EHA 2020 Abstract reviewer, Online conference Jun 2020.

7. Scientific Program Committee - Advisory Board (AB) for the 26th EHA Congress June 10 - 13, 2021 in Vienna, Austria.

8. Scientific Program Committee - Advisory Board (AB) for the 26th EHA Congress June 2022 in Vienna, Austria.

Editorial Boards

Heamatologica 2021-Current

Consultant to industry

Metasight diagnostics ltd 2020-Current

Sequentify ltd. 2021-Current

B. Publications

Peer-reviewed publications

Shlush, L.I., Behar, D.M., Zelazny, A., Keller, N., Lupski, J.R., Beaudet, A.L., Bercovich, D., **2002**. Molecular epidemiological analysis of the changing nature of a meningococcal outbreak following a vaccination campaign. Journal of Clinical Microbiology 40, 3565–3571. https://doi.org/10.1128/JCM.40.10.3565-3571.

Behar, D.M., **Shlush, L.I**., Maor, C., Lorber, M., Skorecki, K., **2006**. Absence of HIV-associated nephropathy in ethiopians. American Journal of Kidney Diseases 47, 88–94. https://doi.org/10.1053/J.AJKD.2005.09.023

Hershkovitz, T., Hassoun, G., Indelman, M., **Shlush, L.I**., Bergman, R., Pollack, S., Sprecher, E., **2006**. A homozygous missense mutation in PEPD encoding peptidase D causes prolidase deficiency associated with hyper-IgE syndrome. Clinical and Experimental Dermatology 31, 435–440. https://doi.org/10.1111/J.1365-2230.2006.02112.X

Bercovici, S., Geiger, D., **Shlush, L**., Skorecki, K., Templeton, A., **2008**. Panel construction for mapping in admixed populations via expected mutual information. Genome Research 18, 661–667. https://doi.org/10.1101/GR.073148.107

Itzkovitz, S., **Shlush, L.I.,** Gluck, D., Skorecki, K., **2008**. Population mixture model for nonlinear telomere dynamics. Physical Review E - Statistical, Nonlinear, and Soft Matter Physics 78. https://doi.org/10.1103/PHYSREVE.78.060902

Shlush, L.I., Atzmon, G., Weisshof, R., Behar, D., Yudkovsky, G., Barzilai, N., Skorecki, K., **2008a.** Ashkenazi Jewish centenarians do not demonstrate enrichment in mitochondrial haplogroup J. PLoS ONE 3. https://doi.org/10.1371/JOURNAL.PONE.0003425

Shlush, L.I., Behar, D.M., Yudkovsky, G., Templeton, A., Hadid, Y., Basis, F., Hammer, M., Itzkovitz, S., Skorecki, K., **2008b**. The druze: A population genetic refugium of the Near East. PLoS ONE 3.

Shlush, L.I., Bercovici, S., Wasser, W.G., Yudkovsky, G., Templeton, A., Geiger, D., Skorecki, K., **2010.** Admixture mapping of end stage kidney disease genetic susceptibility using estimated mutual information ancestry informative markers. BMC Medical Genomics 3. https://doi.org/10.1186/1755-8794-3-47

Shlush, L.I., Skorecki, K.L., Itzkovitz, S., Yehezkel, S., Segev, Y., Shachar, H., Berkovitz, R., Adir, Y., Vulto, I., Lansdorp, P.M., Selig, S., **2011b**. Telomere elongation followed by telomere length reduction, in leukocytes from divers exposed to intense oxidative stress - Implications for tissue and organismal aging. Mechanisms of Ageing and Development 132, 123–130.

Shlush, L.I., Itzkovitz, S., Cohen, A., Rutenberg, A., Berkovitz, R., Yehezkel, S., Shahar, H., Selig, S., Skorecki, K., **2011a**. Quantitative digital in situ senescence-associated β-galactosidase assay. BMC Cell Biology 12.

Reizel, Y., Chapal-Ilani, N., Adar, R., Itzkovitz, S., Elbaz, J., Maruvka, Y.E., Segev, E., **Shlush, L.I.,** Dekel, N., Shapiro, E., **2011**. Colon stem cell and crypt dynamics exposed by cell lineage reconstruction. PLoS Genetics 7. https://doi.org/10.1371/JOURNAL.PGEN.1002192

Shlush, L.I., Chapal-Ilani, N., Adar, R., Pery, N., Maruvka, Y., Spiro, A., Shouval, R., Rowe, J.M., Tzukerman, M., Bercovich, D., Izraeli, S., Marcucci, G., Bloomfield, C.D., Zuckerman, T., Skorecki, K., Shapiro, E., **2012**. Cell lineage analysis of acute leukemia relapse uncovers the role of replication-rate heterogeneity and microsatellite instability. Blood 120, 603–612. https://doi.org/10.1182/BLOOD-2011-10-388629

Chapal-Ilani, N., Maruvka, Y.E., Spiro, A., Reizel, Y., Adar, R., **Shlush, L.I.,** Shapiro, E., **2013.** Comparing Algorithms That Reconstruct Cell Lineage Trees Utilizing Information on Microsatellite Mutations. PLoS Computational Biology 9. https://doi.org/10.1371/JOURNAL.PCBI.1003297

Shouval, R., **Shlush, L.I.,** Yehudai-Resheff, S., Ali, S., Pery, N., Shapiro, E., Tzukerman, M., Rowe, J.M., Zuckerman, T., **2014.** Single cell analysis exposes intratumor heterogeneity and suggests that FLT3-ITD is a late event in leukemogenesis. Experimental Hematology 42, 457–463.

Shlush, L.I., Zandi, S., Mitchell, A., Chen, W.C., Brandwein, J.M., Gupta, V., Kennedy, J.A., Schimmer, A.D., Schuh, A.C., Yee, K.W., McLeod, J.L., Doedens, M., Medeiros, J.J.F., Marke, R., Kim, H.J., Lee, K., McPherson, J.D., Hudson, T.J., Brown, A.M.K., Trinh, Q.M., Stein, L.D., Minden, M.D., Wang, J.C.Y., Dick, J.E., **2014**. Identification of pre-leukaemic haematopoietic stem cells in acute leukaemia. Nature 506, 328–333. https://doi.org/10.1038/NATURE13038

Notta, F., Chan-Seng-Yue, M., Lemire, M., Li, Y., Wilson, G.W., Connor, A.A., Denroche, R.E., Liang, S. ben, Brown, A.M.K., Kim, J.C., Wang, T., Simpson, J.T., Beck, T., Borgida, A., Buchner, N., Chadwick, D., Hafezi-Bakhtiari, S., Dick, J.E., Heisler, L., Hollingsworth, M.A., Ibrahimov, E., Jang, G.H., Johns, J., Jorgensen, L.G.T., Law, C., Ludkovski, O., Lungu, I., Ng, K., Pasternack, D., Petersen, G.M., **Shlush, L.I**., Timms, L., Tsao, M.S., Wilson, J.M., Yung, C.K., Zogopoulos, G., Bartlett, J.M.S., Alexandrov, L.B., Real, F.X., Cleary, S.P., Roehrl, M.H., McPherson, J.D., Stein, L.D., Hudson, T.J., Campbell, P.J., Gallinger, S., **2016**. A renewed model of pancreatic cancer evolution based on genomic rearrangement patterns. Nature 538, 378–382. https://doi.org/10.1038/NATURE19823

Shlush, L.I., Mitchell, A., Heisler, L., Abelson, S., Ng, S.W.K., Trotman-Grant, A., Medeiros, J.J.F., Rao-Bhatia, A., Jaciw-Zurakowsky, I., Marke, R., McLeod, J.L., Doedens, M., Bader, G., Voisin, V., Xu, C., McPherson, J.D., Hudson, T.J., Wang, J.C.Y., Minden, M.D., Dick, J.E., **2017**. Tracing the origins of relapse in acute myeloid leukaemia to stem cells. Nature 547, 104–108. https://doi.org/10.1038/NATURE22993

Zipin-Roitman, A., Aqaqe, N., Yassin, M., Biechonski, S., Amar, M., van Delft, M.F., Gan, O.I., McDermott, S.P., Buzina, A., Ketela, T., **Shlush, L**., Xie, S., Voisin, V., Moffat, J., Minden, M.D., Dick, J.E., Milyavsky, M., **2017**. SMYD2 lysine methyltransferase regulates leukemia cell growth and regeneration after genotoxic stress. Oncotarget 8, 16712–16727.

Abelson, S., Collord, G., Ng, S.W.K., Weissbrod, O., Mendelson Cohen, N., Niemeyer, E., Barda, N., Zuzarte, P.C., Heisler, L., Sundaravadanam, Y., Luben, R., Hayat, S., Wang, T.T., Zhao, Z., Cirlan, I., Pugh, T.J., Soave, D., Ng, K., Latimer, C., Hardy, C., Raine, K., Jones, D., Hoult, D., Britten, A., McPherson, J.D., Johansson, M., Mbabaali, F., Eagles, J., Miller, J.K., Pasternack, D.,

Timms, L., Krzyzanowski, P., Awadalla, P., Costa, R., Segal, E., Bratman, S. v., Beer, P., Behjati, S., Martincorena, I., Wang, J.C.Y., Bowles, K.M., Quirós, J.R., Karakatsani, A., la Vecchia, C., Trichopoulou, A., Salamanca-Fernández, E., Huerta, J.M., Barricarte, A., Travis, R.C., Tumino, R., Masala, G., Boeing, H., Panico, S., Kaaks, R., Krämer, A., Sieri, S., Riboli, E., Vineis, P., Foll, M., McKay, J., Polidoro, S., Sala, N., Khaw, K.T., Vermeulen, R., Campbell, P.J., Papaemmanuil, E., Minden, M.D., Tanay, A., Balicer, R.D., Wareham, N.J., Gerstung, M., Dick, J.E., Brennan, P., Vassiliou, G.S., **Shlush, L.I., 2018**. Prediction of acute myeloid leukaemia risk in healthy individuals. Nature 559, 400–404. https://doi.org/10.1038/S41586-018-0317-6

Minzel, W., Venkatachalam, A., Fink, A., Hung, E., Brachya, G., Burstain, I., Shaham, M., Rivlin, A., Omer, I., Zinger, A., Elias, S., Winter, E., Erdman, P.E., Sullivan, R.W., Fung, L., Mercurio, F., Li, D., Vacca, J., Kaushansky, N., **Shlush, L**., Oren, M., Levine, R., Pikarsky, E., Snir-Alkalay, I., Ben-Neriah, Y., **2018**. Small Molecules Co-targeting CKIα and the Transcriptional Kinases CDK7/9 Control AML in Preclinical Models. Cell 175, 171-185.e25.

Luciani, G.M., Xie, L., Dilworth, D., Tierens, A., Moskovitz, Y., Murison, A., Szewczyk, M.M., Mitchell, A., Lupien, M., **Shlush, L**., Dick, J.E., Arrowsmith, C.H., Barsyte-Lovejoy, D., Minden, M.D., **2019**. Characterization of inv(3) cell line OCI-AML-20 with stroma-dependent CD34 expression. Experimental Hematology 69, 27–36. https://doi.org/10.1016/J.EXPHEM.2018.10.006

Wang, T.T., Abelson, S., Zou, J., Li, T., Zhao, Z., Dick, J.E., **Shlush, L.I**., Pugh, T.J., Bratman, S. v., **2019.** High efficiency error suppression for accurate detection of low-frequency variants. Nucleic Acids Research 47. https://doi.org/10.1093/NAR/GKZ474

Weiss, K., Ekhilevitch, N., Cohen, L., Bratman-Morag, S., Bello, R., Martinez, A.F., Hadid, Y., **Shlush, L.I.,** Kurolap, A., Paperna, T., Mory, A., Baris, H.N., Muenke, M., **2020**. Identification of a novel PCNT founder pathogenic variant in the Israeli Druze population. European Journal of Medical Genetics 63. https://doi.org/10.1016/J.EJMG.2019.03.007

Gabay, T.S., Chapal-Ilani, N., Moskovitz, Y., Biezuner, T., Oron, B., Brilon, Y., Fridman-Dror, A., Sabah, R., Balicer, R., Tanay, A., Mendelson-Cohen, N., Dann, E.J., Fineman, R., Kaushansky, N., Yehudai-Reshef, S., Zuckerman, T., **Shlush, L.I., 2020.** Donor cell leukemia: Is reappearance of gene mutations in donor cells more than an incidental phenomenon? Haematologica 105, 2861–2863. https://doi.org/10.3324/HAEMATOL.2019.242347

Abelson, S., Zeng, A.G.X., Nofech-Mozes, I., Wang, T.T., Ng, S.W.K., Minden, M.D., Pugh, T.J., Awadalla, P., **Shlush, L.I.,** Murphy, T., Chan, S.M., Dick, J.E., Bratman, S. v., **2020**. Integration of intra-sample contextual error modeling for improved detection of somatic mutations from deep sequencing. Science Advances 6. https://doi.org/10.1126/SCIADV.ABE3722

Tavor, S., Shalit, T., Ilani, N.C., Moskovitz, Y., Livnat, N., Groner, Y., Barr, H., Minden, M.D., Plotnikov, A., Deininger, M.W., Kaushansky, N., **Shlush, L.I., 2020.** Dasatinib response in acute myeloid leukemia is correlated with FLT3/ITD, PTPN11 mutations and a unique gene expression signature. Haematologica 105, 2795–2804. https://doi.org/10.3324/HAEMATOL.2019.240705

Lustig, Y., Keler, S., Kolodny, R., Ben-Tal, N., Atias-Varon, D., Shlush, E., Gerlic, M., Munitz, A., Doolman, R., Asraf, K., **Shlush, L.I.**, Vivante, A., 2021. Potential Antigenic Cross-reactivity Between Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and Dengue Viruses. Clinical Infectious Diseases 73, e2444–e2449. https://doi.org/10.1093/cid/ciaa1207

Mer, A.S., Heath, E.M., Madani Tonekaboni, S.A., Dogan-Artun, N., Nair, S.K., Murison, A., Garcia-Prat, L., **Shlush, L**., Hurren, R., Voisin, V., Bader, G.D., Nislow, C., Rantalainen, M., Lehmann, S., Gower, M., Guidos, C.J., Lupien, M., Dick, J.E., Minden, M.D., Schimmer, A.D., Haibe-Kains, B., **2021**. Biological and therapeutic implications of a unique subtype of NPM1 mutated AML. Nature Communications 12.

De-Morgan, A., Meggendorfer, M., Haferlach, C., **Shlush, L., 2021**. Male predominance in AML is associated with specific preleukemic mutations. Leukemia 35, 867–870. https://doi.org/10.1038/S41375-020-0935-5

Feldman, T., Bercovich, A., Moskovitz, Y., Chapal-Ilani, N., Mitchell, A., Medeiros, J.J.F., Biezuner, T., Kaushansky, N., Minden, M.D., Gupta, V., Milyavsky, M., Livneh, Z., Tanay, A., **Shlush, L.I., 2021.** Recurrent deletions in clonal hematopoiesis are driven by microhomology-mediated end joining. Nature Communications 12. https://doi.org/10.1038/S41467-021-22803-Y

Skead, K., Ang Houle, A., Abelson, S., Agbessi, M., Bruat, V., Lin, B., Soave, D., **Shlush, L.,** Wright, S., Dick, J., Morris, Q., Awadalla, P., **2021**. Interacting evolutionary pressures drive mutation dynamics and health outcomes in aging blood. Nature Communications 12, 4921. https://doi.org/10.1038/S41467-021-25172-8

Cohen, N.M., Schwartzman, O., Jaschek, R., Lifshitz, A., Hoichman, M., Balicer, R., **Shlush, L.I.,** Barbash, G., Tanay, A., **2021**. Personalized lab test models to quantify disease potentials in healthy individuals. Nature Medicine. https://doi.org/10.1038/S41591-021-01468-6

Biezuner, T., Brilon, Y., Arye, A. ben, Oron, B., Kadam, A., Danin, A., Furer, N., Minden, M.D., Dong, D., Kim, H., Shapira, S., Arber, N., Dick, J., Thavendiranathan, P., Moskovitz, Y., Kaushansky, N., Chapal-Ilani, N., **Shlush, L.I., 2022**. An improved molecular inversion probe based targeted sequencing approach for low variant allele frequency. NAR Genomics and Bioinformatics 4. https://doi.org/10.1093/nargab/lqab125

Medeiros, J.J.F., Capo-Chichi, J.-M., **Shlush, L.I.,** Dick, J.E., Arruda, A., Minden, M.D., Abelson, S., 2022. SmMIP-tools: a computational toolset for processing and analysis of single-molecule molecular inversion probes derived data. Bioinformatics. https://doi.org/10.1093/bioinformatics/btac081

Nachmias, B., Khan, D.H., Voisin, V., Mer, A.S., Thomas, G.E., Segev, N., St-Germain, J., Hurren, R., Gronda, M., Botham, A., Wang, X., Maclean, N., Seneviratne, A.K., Duong, N., Xu, C., Arruda, A., Orouji, E., Algouneh, A., Hakem, R., Shlush, L., Minden, M.D., Raught, B., Bader, G.D., Schimmer, A.D., 2022. IPO11 regulates the nuclear import of BZW1/2 and is necessary for AML cells and stem cells. Leukemia. https://doi.org/10.1038/s41375-022-01513-4

Accepted/Under review

Amos Tuval, Yardena Brilon, Hadas Azogy, Yoni Moshkovitz, Tamir Biezuner, Dena Leshkowitz, Tomer M Salame, Mark D Minden, Perry Tal, Varda Rotter, Moshe Oren, Nathali Kaushansky, **Liran I Shlush. 2021**. Pseudo-mutant p53 as a targetable phenotype of DNMT3A-mutated pre-leukemia. bioRxiv 2021.05.30.446347; doi: https://doi.org/10.1101/2021.05.30.446347 (In press)

Naama Zioni, Noa Chapal Ilani, Ekaterina Petrovich-Kopitman, Mehmet Saçma, Hartmut Geiger, Marina Scheller, Carsten Mueller-Tidow, Nathali Kaushansky, **Liran I. Shlush**. **2021.** Fatty Bone Marrow Positively Selects Pre-Leukemic HSPCs with a DNMT3A-mutation. https://doi.org/10.1182/blood-2021-149360. (under review Nature comm).

Su M*, T. Fleisher *, I. Grosheva, M. Bokstad-Horev, M. Olszewska, Y. Moskovich, H. Barr, A. Plotnikov, M. Minden, N. Chapal-Ilani, E. Papapetrou, T. Cheng, **N. Kaushansky**, B. Geiger# and **L.I Shlush#.**2022. Rock inhibitors target *SRSF2* leukemia by disrupting cell mitosis and nuclear morphology. *Co- first author, # Co- last author. *Blood* (in revision)

Review publications

Abramovich, A., **Shlush, L**., **2008**. Decompression sickness [1]. Aviation Space and Environmental Medicine 79, 67.

Shlush, L.I., Selig, S., **2013**. Digital image analysis of cells stained with the senescence-associated β-galactosidase assay. Methods in Molecular Biology 1048, 11–18. https://doi.org/10.1007/978-1-62703-556-9_2

Shlush, L.I., Zandi, S., Itzkovitz, S., Schuh, A.C., **2015.** Aging, clonal hematopoiesis and preleukemia: not just bad luck? International Journal of Hematology 102, 513–522. https://doi.org/10.1007/S12185-015-1870-5

Shlush, L.I., Hershkovitz, D., **2015**. Clonal Evolution Models of Tumor Heterogeneity. American Society of Clinical Oncology Educational Book e662–e665. https://doi.org/10.14694/EDBOOK_AM.2015.35.E662

Shlush, L.I., Minden, M.D., **2015**. Preleukemia: The normal side of cancer. Current Opinion in Hematology 22, 77–84.

Shlush, L.I., Mitchell, A., **2015**. AML evolution from preleukemia to leukemia and relapse. Best Practice and Research: Clinical Haematology 28, 81–89. https://doi.org/10.1016/J.BEHA.2015.10.004

Shlush, L.I., 2016. Change comes like a little wind: Tales in MDS evolution. Blood 128, 1162–1163. https://doi.org/10.1182/BLOOD-2016-07-722660

Heath, E.M., Chan, S.M., Minden, M.D., Murphy, T., **Shlush, L.I**., Schimmer, A.D., **2017**. Biological and clinical consequences of NPM1 mutations in AML. Leukemia 31, 798–807. https://doi.org/10.1038/LEU.2017.30

Shlush, L.I., 2018. Age-related clonal hematopoiesis. Blood 131, 496–504. https://doi.org/10.1182/BLOOD-2017-07-746453

Tuval, A., **Shlush, L.I., 2019**. Evolutionary trajectory of leukemic clones and its clinical implications. Haematologica 104, 872–880. https://doi.org/10.3324/HAEMATOL.2018.195289

Luis, T.C., Wilkinson, A.C., Beerman, I., Jaiswal, S., **Shlush, L.I., 2019**. Biological implications of clonal hematopoiesis. Experimental Hematology 77, 1–5.

Calvillo-Argüelles, O., Jaiswal, S., **Shlush, L.I**., Moslehi, J.J., Schimmer, A., Barac, A., Thavendiranathan, P., **2019**. Connections between Clonal Hematopoiesis, Cardiovascular Disease, and Cancer: A Review. JAMA Cardiology 4, 380–387. https://doi.org/10.1001/JAMACARDIO.2019.0302

Shlush, L.I., 2020. Clonal hematopoiesis sees Twin Peaks. Blood 135, 235–236. https://doi.org/10.1182/BLOOD.2019003869

Shlush, L.I., Feldman, T., **2021**. The evolution of leukaemia from pre-leukaemic and leukaemic stem cells. Journal of Internal Medicine 289, 636–649.

Furer, N., Kaushansky, N., **Shlush, L.I., 2021**. The vicious and virtuous circles of clonal hematopoiesis. Nature Medicine 27, 949–950. https://doi.org/10.1038/S41591-021-01396-5

C. Academic Activity:

Title	Dates	Institute	Name	Research area
MSC Students	2020-Current	The Weizmann Institute of Science	Ester Bnaya	Methylation changes after DNA double strand breaks.
	2018-2020	The Weizmann Institute of Science	Adi Danin	The role of transposable elements in preleukemia.
	2016-2018	The Weizmann Institute of Science	Maxim Kushnir	The functional phenotypic consequences of preleukemic mutations.
PhD Students	2018-2021	The Weizmann Institute of Science	Dr. Tzah Feldman (MD)	Functional and epigenetic consequences of preleukemic mutations
	2016-2021	The Weizmann Institute of Science	Dr. Amos Tuval (MD)	The Relative Contribution of Different Pre-Leukemic & Leukemic Mutation to Tumor Fitness
	2018-Current	The Weizmann Institute of Science	Dr. Nili Saar (MD)	The clonal structure of the hematopoietic system in health and disease
	2017-Current	The Weizmann Institute of Science	Namma Zioni	The aging human bone marrow microenvironment and ARCH
	2019-Current	The Weizmann Institute of Science	Aditee Kadam	Copy number variations and large deletions in the early stages of leukemia.
	2020-Current	The Weizmann Institute of Science	Tal Bacharach	The mechanisms of preleukemic mutations and their gender bias.
	2022-Current	The Weizmann Institute of Science	Gal Dadi (MD)	The role of mutation mechanisms in CH and in germline genome editing
Post Doctoral training	2016-2020	The Weizmann Institute of Science	De-Morgan Aviv	Gender Bias in preleukemia
	2016-2018	The Weizmann Institute of Science	Elisabeth Niemeyer	Minerva fellowship award

	2016-2017	Rmabam healthcare Campus	Yael Morgenstern	The role of bone marrow aging in clonal hematopoiesis
	2018-2021	The Weizmann Institute of Science	Fleischer Tom	Spliceosome mutations as target for AML prevention
	2017-Current	The Weizmann Institute of Science	Noa Chapal-Ilani	Long term AML remission, bioinformatics
	2021-Current	The Weizmann Institute of Science	Shay Shilo	The functional consequences of loss of heterozygosity in clonal hematopoesis
	2022-Current	The Weizmann Institute of Science	Elia Colin	Differentiation dynamics at the single cell level in healthy CH and AML
Lab	2016-Current	The Weizmann Institute of Science	Dr. Nathali Kaushansky	Research Associate

D. Old Grants:

1. **The Deborah grant from the Technion security program 2006.** Telomere Biology and DNA Damage in Divers and Cells Exposed to High Levels of oxygen. PI Karl Skorecki; Budget 21,000$.
2. **The Itai Sharon Rambam Atidim Program and Grant 2008.** PI Karl Skorecki; Budget 38,000$.
3. **Israel cancer association 2010-2012.** Phylogentic analysis of single leukemia cells, in the study of relapse mechanisms**.** PI Tsila Zuckerman; Budget 30,000$.
4. **McEwen Centre for Regenerative Medicine Postdoctoral Fellowship grant 2011-2016.** Identification of genetically diverse subpopulations and their evolutionary relationship within human AML and leukemic stem cells using clonal analysis of diagnosis, relapse and Xenograft samples. PI John Dick; Budget 220,000 CAD.
5. **Leukemia & Lymphoma Society Quest for CURES (QFC) 2014.** Assessing risk of leukemic progression in individuals carrying preleukemic mutations as a guide to early diagnosis and treatment in acute myeloid leukemia (AML). PI Mark Minden **CO-investigator Liran Shlush,** Jean Wang. Budget 800,000 USD.
6. **Princess Margaret Cancer Center startup grant 2014-2016**.The preleukemia program PI Liran Shlush. Budget 386,000 CAD.
7. **Sponsored Research Agreement with Imago Biosciences 2015.** The preleukemia program in AML, PI Liran Shlush. Budget 40,000 CAD.
8. **The Itai Sharon Rambam Atidim Program and Grant 2016.** PI Liran Shlush; Budget 60,000 USD.
9. **Abisch Frenkel Grant 2016.** Budget 45,000 USD.
10. **Weizmann institute of science startup grant 2015-2018.** Budget 1,250,000 USD**.**

11. **BIARX 2017-2020.** Towards stem cell based therapies of leukemia: understanding the functional consequences of preleukemic mutations on hematopoietic stem cells. PI Liran Shlush CO-PI Elisa Laurenti. Budget 381,174 Pound for 3 years.
12. **IMOS 2017-2020 Personalize medicine.** Monitoring leukemia in remission. PI Liran Shlush. CO-PI Shai Israeli Budget 1,200,000 NIS for 3 years.

E. Active Grants

13. **ERC-2016-2021-STG grant**. Understanding the mechanisms of human acute myeloid leukaemia (AML) evolution (Proposal 714731 - MAMLE). 1,750,000 Euro. Start Jan 2017 for 5 years.
14. **RTFCCR/LLS Cancer Prevention Research Grant for Blood Cancer.** Early diagnosis and treatment of pre-leukemia. PI Liran Shlush. 1,200,000 USD. Starts Oct 2018-2023 for 5 years.
15. **ISF NSFC 2018-2021** The role of spliceosome mutations and the aging of the bone marrow microenvironment in leukemia early evolution**.** PI Liran Shlush Co-PI Tao Cheng. 300,000 USD Starts Oct 2018 for 3 years.
16. **Israeli Precision Medicine Partnership (ISF) 2019-2023.** Multi-dimensional analysis and the human aging blood system. PI Liran Shlush Co-PIs: Amos Tanay Yinon Ben neriya Ron Shamir. 6,000,000 NIS for 4 years.
17. **ISF 1123/21.** The interaction between the aging bone marrow microenvironment and clonal hematopoiesis. **Total 400,000 USD for 5 years 2021-2026.**

E. Intellectual property

1. Pre-cancerous cells and their identification in the prevention and treatment of cancer. 2015. Inventors: John Dick, Mark Minden, Jean C. Y. WANG, Liran Shlush, Sasan Zandi. CA2842635A1.

2. Prevention of age related clonal hematopoiesis and diseases associated therewith. 2020. Inventors: Liran Shlush and Omar Abdel-wahab. WO2020089892A1.

3. Inhibitors of MMEJ pathway for prevention and treatment of pre-myeloid and myeloid malignancies. Inventors Liran Shlush Tzah Feldman. WO2021084540A1.