30.4.2017

1. Personal Data

Name: **Aviv Shaish**
email: aviv.shaish@sheba.health.gov.il *or* avivsha@netvision.net.il

2. Education

Post-Doctoral training 1993-1996:
Washington University School of Medicine, St. Louis, USA. Atherosclerosis and Lipid Research. Topic: "The effect of antioxidants on atherosclerosis".
Supervisors: Prof. Jay W. Heinecke and The late Prof. Gustav Schonfeld.

Ph.D. 1988-1993:
The Weizmann Institute of Science, Department of Biochemistry. Rehovot, Israel.
Thesis topic: "The biosynthesis of β-carotene in the alga *Dunaliella bardawil"*.
Supervisors: The late Prof. Mordhay Avron, Prof. Ami Ben-Amotz and Prof. Uri Pick.

M.Sc. 1985-1987:
M.Sc. with distinction in plant physiology. Ben-Gurion University of the Negev, Beer-Sheva.
Thesis topic: "The effect of carbon dioxide on respiration and energy level in epidermis and its consequence on stomatal movement".
Supervisors: Prof. Nurit Roth-Bejerano and Prof. Chanan Itai.

B.Sc. 1982-1985:
B.Sc. with distinction, in plant physiology. Ben-Gurion University of the Negev, Beer-Sheva.

3. Employment History

2017-
Lecturer, Achva Academic College

1996-present
Senior researcher at the Bert W. Strassburger Lipid Center.

1999- 2016
Visiting Lecturer, Achva Academic College (until 2009 under the academic auspices of the Ben-Gurion University in the Negev).

4. Professional activities:

a. Professional consulting

1998-Present: Scientific consultant to Israeli Biotechnology Research Ltd (I.B.R) Biotechnology. Company.

2001-Present: Scientific consultant to Vascular Biogenic Ltd (VBL) Biotechnology Company.

b. Memberships in scientific societies:
2000-Present: The Israeli Society for Research, Prevention and Treatment of Atherosclerosis.
2010- Present: International Carotenoid Society

c. Editorial board member:
a. International Scholarly Research Network "Vascular Medicine", Hindawi Publishing Corporation.
b. International Scholarly Research Network "Nutrition", Hindawi Publishing Corporation.

5. Educational Activities

a. Courses taught:

2017- Present	Algae – biology and industrial applications
2009-2016	Basic Biology (plant), Achva Academic College.
2009-present	Biological systems laboratory, Achva Academic College.
1999-2009	Botanica, Achva Academic College, Under the Academic Auspices of Ben-Gurion University.
1999-2009	Botanica laboratory, Achva Academic College, Under the Academic Auspices of Ben-Gurion University.
1999-2000	Plant molecular biology, Achva Academic College, Under the Academic Auspices of Ben-Gurion University.

b. Research Mentor at the Bert W. Strassburger Lipid Center (Supervisor- Prof. Dror Harats):

MD students:

1998 Yoav Keidar- "Effect of Colchicine on Atherosclerosis in LDL-Receptor deficient mice"

1998 Yaniv Sherer- "Magnesium fortification of drinking water and atherosclerosis in LDL-receptor KO mice"

2001 Ayana Dvir- "The effect of omapatrilat on atherogensis in a combined atherosclerosis – diabetes mouse model in LDL receptor deficient streptozotocin treated mice"

M.Sc. Students:

1998-2000	Ayelet Gonen- "Adenoviral gene therapy to neovascular tumoral-endothelial cells"
2002-2005	Daniela Marko- "The effects of 9 cis retinoic acid on the lipid profile of human apo A1 transgenic mice"
2003-2005	Anat Shelezinger- "The effect of the oxidized phospholipid analogue on clinical outcome and inflammatory markers in a rat model of rheumatoid arthritis"
2005-2007	Liron Frishman- "Selective targeting of synovial neovascularization inhibits early disease progression in murine collagen-induced arthritis"
2005-2007	Keren Rofe- "Angiogenesis induced by adenovirous expressing a stabilized constitutively active form of HIF-1 alpha in ischemia"
2007-2008	Einav Meir- "characterization of IL-1alpha and IL-1beta deficient macrophages: implications for atherosclerosis"
2009-2010	Sarita Olteanu- "The role of hepatic IL-1 in steatohepatitis"
2008-2010	Shai Shemesh- "The role of IL-1 receptor type I in atherosclerosis"
2008-2010	Noa Relevi- "The effect of 9-cis-β-carotene on plasma lipid profile, inflammation and atherosclerosis in mice"
2012-2014	Sapir Bechor- "The effect of all trans β-carotene and 9-cis β-carotene on reverse cholesterol transport (RCT)"
2013-2015	Reut Shnerb- "The impact of factor XI deficiency on atherogenesis in apolipoprotein E/Factor XI double knockout - a unique mouse model" (Supervisor- Prof. Ophira Salomon).
2016-present	Mimi Yehuda Tzdaka "The effect of 9-cis retinoids on reverse cholesterol transport from macrophages"
2016-present	Lidor Mahler "The effect of 9-cis on cholesterol efflux from macrophages to apoAI"

Ph.D. Students:

1995-2001	Nira Blum- "Tissue specific gene therapy to neovascular tumoral-endothelial cells"
1997-2000	Pnina Keren- Graduated Cum Laude "Diabetes in transgenic mouse model of atherosclerosis"

1999-2002	Keren Levanon MD/Ph.D.-"Adenoviral gene therapy for induction of angiogenesis and vessel maturation"
1999-2006	Greenberger Shoshi MD- "Induction of apoptosis in endothelial cells"
2001-2006	Ayelet Gonen- "The effect of Allicin derivatives on atherosclerosis mode of actions"
2001-2005	Israel Hodish MD- "Engineering of adeno-viral vector containing the HSV-TK gene under the control of murine pre-proendothelin promoter for the treatment of cancer"
2002-2008	Ayelet Harari- "The effect of the natural isomer mixture of β-carotene from the alga *Dunaliella* on the lipid metabolism and atherosclerosis. Studies in apoE deficient mice and humans"
2003-2008	Michael Peled MD/Ph.D.- "Adenoviral vectors targeted to tumor angiogenesis"
2003-2008	Reshef Tal MD/Ph.D.- "Adenovirus-mediated vascular-specific therapy for ischemia using modified PPE-1 promoter"
2003-2008	Dikla Ben-Shushan- "Inhibition of carcinogenesis by endothelial cell expression of 15-lipoxygenase"
2005-2009	Yehuda Kamari MD- "The role of IL-1 in atherosclerosis"
2007-2012	Maya Sultan- "The molecular mechanism of tumorogenesis inhibition by 15-lipoxygenase over expression in endothelial cells"
2010-2014	Noa Relevi- "The effect of *Dunaliella* carotenoids and their cleavage products on the nuclear receptor RXR activation and atherosclerosis in mouse model"
2014-present	Rachel Greenberg "The effect of 9-cis beta-carotene on Alzheimer disease in a mouse model"
2016-present	Reut Shnerb- "The impact of factor XI deficiency on atherogenesis in apolipoprotein E/Factor XI double knockout - a unique mouse model" (Supervisor- Prof. Ophira Salomon).

Resident's basic science projects:

1997	Peer Dar Zitser-	(Asaf-Harofe) "15 Lipoxygenase overexpression reduces fertility in Tg mice"
1999	Eyal Leibovitz-	(Wollfson) "The Association between the polymorphism of the human Paraoxonase gene with plasma Paraoxonase activity and coronary artery disease in Israeli Jewish population"

1999 Lea Hananashvili- (Wollfson) "Efficacy of the combination of Fibrates and 9 cis retinoic acid on the lipid profile of human ApoA1 transgenic mice"

2000 Roy Ilan- (Sheba) "Amplification of gene expression in transfected cardiomyocytes by ultrasound"

2000 Levi Zohar- (Meir) "The effect of the natural isomer mixture of β-carotene from the alga *Dunaliella* on the degree and extent of atherosclerosis in apoE-deficient mice"

2001 Marunich Anastasya- (Wollfson)- "The effect of the natural isomer mixture of β-carotene from the alga *Dunaliella* on the degree and extent of atherosclerosis in apoE deficient mice "

2003 Brener Ronen (Sheba) "The effect of the enzyme 15-lipoxygenase on endothelial cells"

2008 Arbel Yaron- (Tel-Aviv Medical Center)- "Assessment of hepatic lipids, inflammation and fibrosis in a mouse of model of diet-induced steatosis and steatohepatitis: The role of macrophage interleukin IL-1alpha and IL-1beta in steatohepatitis"

6. Awards, Prizes and Research Fellowships

a. Honors, Citation Awards

1983 Ben-Gurion University of the Negev, certificate of merit.
1984 Ben-Gurion University of the Negev, certificate of merit.
2008 Distinguished lecturer, Achva Academic College.
2010 Excellent Worker Award, Sheba Medical Center.
2010 Distinguished lecturer, Achva Academic College.
2014 Distinguished lecturer, Achva Academic College

b. Fellowships

1987 Ben-Gurion University of the Negev, Pulver scholarship.

7. Scientific Publications

a. Chapters in collective volumes

1. C. Itai, A. Nejidat, **A. Shaish** and N. Roth-Bejerano **(1988)** Phytochrome involvement in stomatal movement pp 95-101. In: Time scales and water stress-Proc. 5th Int. Conf. on Mediterranean Ecosystem. Di. Castri F., Floret Ch., Rambais S., Roy J. (Eds.) I.U.B.S Paris.

2. **Shaish A**. M. Avron and A. Ben-Amotz. **(1990)** Effect of inhibitors on the formation of stereoisomers in the biosynthesis of β-carotene in *Dunaliella bardawil.* 9th International Symposium on Carotenoids. Kyoto, Japan.

3. **Shaish A**, G. Schonfeld and J.W. Heinecke **(1994)** All trans and 9-cis β-carotene inhibit LDL and HDL oxidation by aqueous peroxyl radical. Circulation 90:I-409.

4. R.A.K. Srivastava, N. Srivastava, **A. Shaish**, G. Schonfeld. **(1995)** Cholic acid lowers plasma apoAI levels in non-transgenic and in apoAI transgenic mice at posttranslational loci of regulation. Circulation Supplement 92:1672.

5. D. Harats, J. George, A. Afek, B. Gilburd, H. Levkovitz, **A. Shaish**, I. Goldberg, Y. Kopolovic, Y. Shoenfeld. **(1997)** Hyperimmunization of chow-fed ApoE deficient mice with homologous oxidized low-density lipoprotein suppresses early atherosclerosis. Atherosclerosis 134:18.

6. **Shaish A.**, J. George, A. Afek, B. Gilburd, H. Levkovitz, I. Goldberg, Y. Kopolovic, Y. Shoenfeld, D. Harats. **(1997)** Induction of early atherosclerosis in LDL-receptor deficient mice immunized with Beta 2 glycoprotein I. Atherosclerosis 134:39.

7. D. Harats, H. Kurihara, H. Levkovitz, **A. Shaish**, E. Sigal. **(1997)** 15-lipoxygenase overexpression induces atherosclerosis in LDL deficient mice. Atherosclerosis 134:279.

8. Harats, D, Kurihara, H., **Shaish, A**., Sigal, E. **(1997)** 15-Lipoxygenase overexpression induces atherosclerosis in LDL -receptor deficient mice. Circulation, (96) 8: I 167

9. Harats, D., George, J., Afec, A., Gillburd, B., Levkovitz, H., **Shaish, A**., Goldberg, I., Kopolovitz, Y., Shoenfeld, Y. **(1997)** Hyperimmunization of chow fed ApoE defficient mice with homologous oxidized Low Density Lipoprotein suppresses early atherogenesis. Circulation 134:18.

10. Harats, D., **Shaish**, **A**., George, J., Afec, A., Gillburd, B., Kopolovitz,Y., Shoenfeld, Y. **(1997)** Induction of early atherosclerosis in LDL-receptor deficient mice immunized with beta 2 GPI. Circulation 134:39-40.

11. Harats, D, **Shaish**, **A**., Levkovitz., Sigal, E., Bloom, VN**. (1998)** Tissue specific gene therapy to the vascular wall. In the proceedings of the Keystone Symposia on Gene-Therapy Keystone, USA.

12. Harats, D., George, J., Afek, A., Gillburd, B., Levkovitz, H., **Shaish, A**., Kopolovitz, Y., Wick, G., Shoenfeld, Y. **(1998)** Immunomodulation of atherogenesis. In the proceedings of the 70th European Atherosclerosis society, Geneva, Switzerland, 61.

13. **Shaish, A**., Levkovitz, H., George, J., Gillburd, B., Keren, P., Harats, D. **(1998)** Antioxidant vitamins do not inhibit atherogenesis in an Apolipoprotein E-deficient mouse model. In the proceedings of the 70th European Atherosclerosis society, Geneva, Switzerland, 34,

14. George, J., Shoenfeld, Y., Afek, A., Gillburd, B., Keren, P., **Shaish, A**., Kopolovitz, Y., Wick, G., and Harats, D. **(1998)** "Enhanced fatty streak formation in C57BL/6 mice by immunization with heat-shock protein 65" In the proceedings of the 70th European Atherosclerosis society, Geneva, Switzerland, 131.

15. Bloom, VN., **Shaish, A**., Levkovitz., Sigal, E., Harats, D. **(1998)** Tissue specific gene therapy to the vascular wall. In the proceedings of the Scientific Meeting of the Society for Research, Prevention and Treatment of Atherosclerosis, Ashkelon, Israel.

16. George, J., Shoenfeld, Y., Afek, A., Gillburd, B., Keren, P., **Shaish, A**., Kopolovitz, Y., Wick, G., and Harats, D. **(1998)** "Enhanced fatty streak formation in C57BL/6 mice by immunization with heat-shock protein 65" In the proceedings of the Scientific Meeting of the Society for Research, Prevention and Treatment of Atherosclerosis, Ashkelon, Israel.

17. **Shaish, A**., George, J., Gillburd, B., Keren, P., Levkovitz, H., Harats, D. **(1998)** Dietary B-carotene and alpha-tocopherol combination dose not inhibit atherogenesis in an Apolipoprotein E-deficient mouse model. In the proceedings of the Scientific Meeting of the Society for Research, Prevention and Treatment of Atherosclerosis, Ashkelon, Israel.

18. **Shaish A**, Y. Sherer, H. Levkovitz, Y. Shoenfeld, D. Harats. **(1999)** Magnesium fortification of drinking water suppresses atherogenesis in male LDL-receptor knockout mice. Atherosclerosis 144:96.

19. Keren P., J. George, **A. Shaish**, H. Levkovitz, B. Gilburd, Z. Janackovic, G. Green, Y. Shoenfeld, D. Harats. **(1999)** Combined hyperlipidemic hyperglycemic model of atherosclerosis in apoE deficient mice. Atherosclerosis 144:97.

20. D. Harats, J. George, B. Gilburd, A. Afek, **A. Shaish**, Y. Shoenfeld. **(1999)** β2-glucoprotein I (apolipoprotein-H) as an influential determinant in atherosclerosis. Atherosclerosis 144:122.

21. George, J., Harats, D., Afek, A., Gillburd, B., **Shaish, A**., Shoenfeld, Y. **(1999)** The Role of Heat Shock Protein 65 (HSP) in Murine Atherosclerosis. J. of Autoimmunity Suppl. 7.

22. Harats, D., George, J., Gillburd, B., Afek, A., **Shaish, A**., Shoenfeld, Y. **(1999)** b2-Glycoprotein I (Apolipoprotein-H) as an Influencial Determinant in Atherosclerosis. J.of Autoimmunity Suppl. 7.

23. Leibovitz, E., Gavish, D., Roitelman, **Y., Shaish**, A., Harats, D. **(1999)** The association of GLN-ARG 192 and MET-LEU 54 polymorphism of human paroxonase (PON1) gene with coronary artery disease in Israeli Jewish population. In the proceedings of the 5th Int. Symposium: Multiple risk factors in cardiovascular disease, Venice, Italy, 29.

24. **Shaish, A**., Sherer, Y., Levkovitz, H., Shoenfeld,Y., Harats, D. **(1999)** Magnesium fortification of drinking water suppresses atherogenesis in male LDL-Receptor knockout mice Atherosclerosis Suppl. 96.

25. Keren, P., George, J., **Shaish**, **A**., Levkovitz, H., Gilbrud, B., Janakovic, Z., Keren, G., Shoenfeld, Y.,Harats, D. **(1999)** Combined hyperlipidemic hyperglycemic model of Atherosclerosis in Apo-E Deficient Mice: Atherosclerosis Suppl. 97.

26. George, J., Harats, D., Gillburd, B., Afek, A., Levy, Y., **Shaish, A**., Barshak, I., Shneiderman, J., Kopolovic, J., Shoenfeld, Y. **(1999)** Immunolocalization of beta 2 glycoprotein I (Apolipoprotein-H) to human atherosclerotic plaques: Potential implication for lesion progression. Atherosclerosis Suppl. 122. **(84 citations)**

27. Harats, D., George, J., Gillburd, B., Afek, A., **Shaish, A**., Shoenfeld, Y. **(1999)** Beta 2 glycoprotein I (Apolipoprotein-H) as an influential determinant in atherosclerosis. Atherosclerosis Suppl. 122.

28. N. Varda-bloom, **A. Shaish**, A. Gonen, S. Ferber, H. Levkovitz, D. Harats. **(2000)** Vascular specific gene therapy to tumor neovascularization. Molecular Therapy 1:5 S153.

29. Nira Varda-Bloom, **Aviv Shaish**, Ayelet Gonen, Hana Levkovitz and Dror Harats. **(2000)** The preproendothelin-1 promoter as a tool for specific gene therapy to angiogenic vascular endothelial cells. J. Israel Heart Society 10 (supplement).

30. **Aviv Shaish**, David Mirelman, Dana Abramovitz, Talia Miron, Aharon Rabinkov, Meir Wilchek, Michael Eldar, Zvi Vered, Hana Levkovitz, Dror Harats. **(2002)** Allicin reduces atherosclerosis in mice and inhibits LDL degradation in isolated mouse macrophages. J. Israel Heart Society 51 (supplement).

31. P. Keren, **A. Shaish**, J. George, D. Harats. **(2002)** The effect of ß-carotene and α-tocopherol supplementation on accelerated atherosclerosis in diabetic apoE-deficient mice J. Israel Heart Society 86 (supplement).

32. **A. Shaish**, K.. Levanon, N. Varda-Bloom, S. Greenberger, I. Barshak, A. Orenstein, E. Breitbart, D. Harats. **(2002)** PPE-1 regulated endothelial-specific gene therapy using VEGF&PDGF-B induced angiogenesis and vessel maturation in ischemic limb model. Atherosclerosis Suppl. 3:121

33. I. Grosskopf, H. Cohen, **A. Shaish**, D. Harats. **(2006)** Apoa5 affects lipolysis of triglyceride-rich lipoproteins and liver uptake of their remnants. Atherosclerosis Supplements.7:38.

34. Y. Kamari, R. Werman-Venkert, **A. Shaish**, A. Harari, A. Gonen, E. Grossman, Y. Iwakura, C.A. Dinarrelo, R.N. Apte, D. Harats. **(2006)** Interleukin-1 alpha deficiency inhibits atherogenesis in hypercholeterolemic mice: the role of macrophage IL-1 alpha. Atherosclerosis Supplements.7:169.

35. Differential role and tissue specificity of interluekine-1α gene expression on atherosclerosis and lipid metabolism. **(2006)** Dror Harats, Yehuda Kamari, Rachel Werman-Venkert, **Aviv Shaish**, Ariel Werman, Ayelet Harari, Ayelet Gonen, Elena Voronov, Ehud Grossman, Yehonatan Sharabi, Ron Apte. Circulation (supplement):114:II-321.

36. Constitutive actovation of hypoxia-inducible factor 1α (HIF-1α) C transactivation domain is essential for optimal transcription and angiogenesis. **(2006)** Reshef Tal, Aviv Shaish, Keren Rofe, Michael Peled, Livnat Bangio, Eyal Breitbart, Dror Harats. Circulation (supplement):114:II-327.

37. The Effect of 9-cis β-carotene on Plasma Lipid Profile and Atherosclerosis in LDL Receptor-Deficient Mice. **(2011)** Noa Relevy, Ayelet Harari, Iris Barshack, Ami Ben Amotz, Dror Harats and **Aviv Shaish**. Acta Biologica Cracoviensia 16th International Symposium on Carotenoids, Krakow, Poland. (supplement) 53:71

b. Refereed articles in scientific journals

1. **Shaish**, N. Roth-Bejerano and C. Itai **(1989)** The response of stomata to CO_2 relates to its effect on respiration and ATP level. *Physiologia. Plantarum.* 76:107-111.

2. Ben-Amotz, **A. Shaish** and M. Avron **(1989)** Mode of action of the massively accumulated β-carotene of *Dunaliella bardawil* in protecting the alga against damage by excess irradiation. *Plant. Physiol*ogy. 91:1041-1043. **(142 Citations)**

3. **Shaish**, M. Avron and A. Ben-Amotz **(1990)** Effect of inhibitors on the formation of stereoisomers in the biosynthesis of β-carotene in *Dunaliella bardawil*. *Plant Cell Physiol.* 31:689-696.

4. Ben-Amotz, **A. Shaish** and M. Avron **(1991)** The biotechnology of cultivating *Dunaliella* for the production of β-carotene rich algae. *Bioresource Technol*ogy. 38:233-235.

5. **Shaish**, A. Ben-Amotz and M. Avron **(1991)** Production and selection of high β-carotene mutants of *Dunaliella bardawil*. *J. Phycology*. 27:652-656.

6. **Shaish**, M. Avron, U. Pick and A. Ben-Amotz. **(1993)** Are active oxygen species involved in induction of β-carotene accumulation in *Dunaliella bardawil*. *Planta* 190:363-368.

7. H. Levi, T. Tal, **A. Shaish** and A. Zamir **(1993)** Cbr, an algal homolog of plant early light-induced proteins, is a putative zeaxanthin binding protein. *Journal of Biological Chemistry* 268:20892-20896. **(76 Citations)**

8. **Shaish**, **A**. Daugherty, F. O'Sullivan, G. Schonfeld, J. Heinecke. **(1995)** Beta-carotene inhibits atherosclerosis in hypercholesterolemic rabbits. *J. Clinical. Investigation*. 96:2075-2082. **(148 Citations)**

9. M. Zelazny, **A. Shaish**, U. Pick**. (1995)** Plasma membrane sterols are essential for sensing osmotic changes in the halotolerant alga *Dunaliella*. *Plant. Physiology*.109:1395-1403.

10. X. Zhu, D. Noto, R. Seip, **A. Shaish**, A. Daugherty, and G. Schonfeld. **(1997)** Organ loci of catabolism of short truncations of ApoB. *Arteriosclerosis Thrombosis and Vascular Biology* 17:1032-1038.

11. **Shaish**, M. Pape, T. Rea, R.K. A. Srivastava, M. Latour, and G. Schonfeld. **(1997)** Alcohol increases diet-induced atherogenic lipoproteins and atherosclerosis lesions in rabbits. *Arteriosclerosis Thrombosis and Vascular Biology* 17:1091-1097.

12. Leeuwenburgh, P. Hansen, N., **A. Shaish**, J.O. Holloszy, J.W. Heinecke. **(1998)** Markers of protein oxidation by hydroxyl radical and reactive nitrogen species in tissues of aging rats. *American J. of Physiology*. 274:453-461. **(102 Citations)**

13. J. George A. Afek, B. Gilburd, H. Levkovitz, **A. Shaish**, I. Goldberg, Y. Kopolovic, G. Wick, Y. Shoenfeld, D. Harats **(1998)** Hyperimmunization of Apo-E-deficient mice with homologous malondialdehyde low density lipoprotein (MDA-LDL) suppresses early atherogenesis. *Atherosclerosis* 138:147-152. **(217 Citations)**

14. J. George, A. Afek, B. Gilburd, M. Blank, Y. Levy, A. Aron-Maor, H. Levkovitz, **A. Shaish**, J. Kopolovic, I. Goldberg, D. Harats, Y. Shoenfeld. **(1998)** Induction of early atherosclerosis in LDL-receptor deficient mice immunized with beta 2 glycoprotein I. *Circulation* 98:1108-1115. **(141 Citations)**

15. J. George, Y. Shoenfeld, A. Afek, B. Gilburd, P. Keren, **A. Shaish**, J. Kopolovitc, D. Harats. **(1999)** Enhanced fatty streak formation in C57BL/6 mice by immunization with heat-shock-protein 65. *Arteriosclerosis Thrombosis and Vascular Biology* 19:505-510. **(147 Citations)**

16. Afek, J. George, Y. Shoenfeld, B. Gilburd, Y. Levi, **A. Shaish**, P. Keren, I. Goldberg, J. Kopolovitc, D. Harats. **(1999)** Enhancement of atherosclerosis in beta 2 glycoprotein I immunized apo-E deficient mice. *Pathobiology* 67:19-25.

17. **Shaish** J. George, H. Levkovitz, , B. Gilburd, P. Keren, D. Harats. **(1999)** Dietary β-carotene and α-tocopherol combination does not inhibit atherogenesis in an apoE-deficient mouse model. *Arteriosclerosis Thrombosis and Vascular Biology* 19:1470-1475.

18. Y. Sherer, **Shaish A**, H. Levkovitz, Y. Shoenfeld, D. Harats. **(1999)** Magnesium fortification of drinking water suppresses atherogenesis in male LDL-receptor knockout mice. *Pathobiology* 67:207-213.

19. P. Keren, J. George, **A. Shaish**, H. Levkovitz, Z. Janakovic,A. Afek, I. Goldberg, J. kopolovic, G. Keren, D. Harats. **(2000)** Effect of hyperglycemia and hyperlipidemia on atherosclerosis in LDL-receptor deficient mice: establishement of a combined model and association with heat shock protein65 immunity. *Diabetes* 49:1064-1069.

20. Y. Sherer, Y. Shoenfeld, **A. Shaish**, H. Levkovitz, R. Bitzur, D. Harats. **(2000)** Suppression of atherosclerosis in female low-density lipoprotein receptor knockout mice following magnesium fortification of drinking water: the importance of diet. *Pathobiology* 68:93-98.

21. D. Harats, **A. Shaish**, J. George, M. Mulkins, H. Kurihara, H. Levkovitz E. Sigal**,**. **(2000)**

Overexpression of 15-lipoxygenase in vascular endothelium accelerates early atherosclerosis in LDL receptor-deficient mice. *Arteriosclerosis Thrombosis and Vascular Biology* 20:2100-2105.

22. J. George, D. Harats, B. Gilburd, A. Afek, **A. Shaish,** J. Kopolovitc, Y. Shoenfeld. **(2000)** Adoptive transfer of beta(2)-glycoprotein I-reactive lymphocytes enhances early atherosclerosis in LDL receptor-deficient mice. *Circulation* 102:1822-1827. **(105 Citations)**

23. George J, Shoenfeld Y, Gilburd B, Afek A, **Shaish A**, Harats D. **(2000)** Requisite role for interleukin-4 in the acceleration of fatty streaks induced by heat shock protein 65 or Mycobacterium tuberculesis. *Circulation Research.* 86:1203-1210.

24. George J, Mulkins M, **Shaish A**, Casey S, Schatzman R, Sigal E, Harats D. **(2000)** Interleukin (IL)-4 deficiency does not influence fatty streak formation in C57BL/6 mice. *Atherosclerosis* 153:403-411.

25. Sharabi Y, Grossman E, Sherer Y, **Shaish A**, Levkovitz H, Bitzur R, D. Harats. **(2000)** The effect of renin-angiotensin axis inhibition on early atherosclerosis in LDL-receptor-deficient mice. *Pathobiology* 68:270-274.

26. Varda -Bloom N. **A. Shaish**, A. Gonen, K. Levanon, S. Greenberger, S. Ferber, H. Levkovitz, D. Castel, I. Goldberg, A. Afek, Y. Kopolovitc, D. Harats. **(2001)** Tissue-specific gene therapy directed to tumor angiogenesis. *Gene Therapy* 8:819-827. **(169 Citations)**

27. D. Harats, O. Yodfat, R. Doolman, S. Gaumendo, D. Marko, **A. Shaish**, S. Ben-Ami. **(2001)** Homocysteine elevation with fibrates: is it a class effect? *The Israel Medical Association Journal* 3:243-246.

28. Dar P, Strassburger D, **Shaish A**, Levkovitz H, Halperin R, Harats D. **(2001)** Reduced reproduction with increased abortion rate in transgenic mice that overexpress 15-lipoxygenase. *Gynecologic and Obstetric Investigation*. 52:18-21.

29. Y. Sherer, R. Bitzur, H. Cohen, **A. Shaish**, D. Varon, Y. Shoenfeld, D. Harats. **(2001)** Mechanism of action of the anti-atherogenic effect of magnesium: lessons from a mouse model. *Magnesium Research* 14:173-179.

30. George J, Afek A, **Shaish A**, Levkovitz H, Bloom N, Cyrus T, Zhau L, Funk CD, Sigal E, Harats D. **(2001)** 12/15-Lipoxygenase gene disruption attenuates atherosclerosis in LDL receptor-deficient mice. *Circulation* 104:1646-1650.

31. **A. Shaish**, G. Keren, P. Chouraqui, H. Levkovitz, D. Harats. **(2001)** Imaging of the aortic atherosclerotic lesions by ^{125}I-LDL, ^{125}I-oxidized-LDL, ^{125}I-HDL and ^{125}I-BSA. *Pathobiology* 69:225-229.

32. Hofit Cohen, Yariv Sherer, **Aviv Shaish**, Yehuda Shoenfeld, Hana Levkovitz, Refael Bizur, Dror Harats. **(2002)** Atherogenesis inhibition induced by magnesium-chloride fortification of drinking water. *Biological Trace Element Research* 1-3:251-269.

33. Zohar Levy, **Aviv Shaish**, Niva Yacov, Hana Levkovitz, Svetlana Trestman, Yariv Gerber, Hofit Cohen, Ayana Dvir, Rita Rhachamani and Dror Harats. **(2003)** Rosiglitazone (PPARγ-agonist) attenuates atherosclerosis with no effect on hyperglycemia in a combined diabetes-atherosclerosis mouse model. *Diabetes, Obesity and Metabolism* 5:1-6. **(67 Citations)**

34. Gonen A, **Shaish A**, Leikin-Frenkel A, Gilat T, Dror Harats. **(2003)** The fatty acid bile acid conjugates (FABACs) inhibits atherosclerosis in C57BL/6 model. *Pathobiology* 70:215-218.

35. Levy Z, Dvir A, **Shaish A**, Trestman S, Cohen H, Levkovietz H, Rhachmani R, Ravid M, Harats D. **(2003)** Omapatrilat, an Angiotensin-Converting Enzyme and Neutral Endopeptidase Inhibitor, Attenuates Early Atherosclerosis in Diabetic and in Nondiabetic Low-Density Lipoprotein Receptor-Deficient Mice. *Experimental Diabetes Research*. 4:59-64.

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c. <u>Chapters in Books</u>

1. A. Ben-Amotz and **A. Shaish**. **(1992)** β-carotene synthesis. In: *Dunaliella*: Physiology, Biochemistry and Biotechnology (A. Ben-Amotz ed.) CRC Press Inc. pp.206-216.

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3. Sherer, Y., Blank, M., Varrala, O., **Shaish, A**., Shoenfeld, Y., Harats, D. (**2001)**. Anti-prothrombin antibodies in thrombosis and atherosclerosis. In: Atherosclerosis and

Autoimmunity; Elsevier, 185-190,

4. **Aviv Shaish**, Ayelet Harari, Gustav Schonfeld, Dror Harats. (**2009**). "Application of *Dunaliella* in Atherosclerosis" in: "The Alga *Dunaliella*: Biodiversity, Physiology, Genomica &Biotechnology" (A. Ben-Amotz ed.) CRC Press Inc.

5. Liki Von Oppel Bezalel, **Aviv Shaish**. (**2009**). "Application of the Colorless Carotenoids, Phytoene, and Phytofluene in Cosmetics, Wellness, Nutrition, and Therapeutics" in: "The Alga *Dunaliella*: Biodiversity, Physiology, Genomica &Biotechnology" (A. Ben-Amotz ed.) CRC Press Inc.

H index and Ranking of journal according to the SJR

Periodical	No of articles	H index (2013)	Ranking (2011)
American Journal of Pathology	1	206	**Q1**
American Journal of Physiology - Heart and Circulatory Physiology	1	140	**Q1**
Annals of Allergy, Asthma and Immunology	1	79	**Q1**
Archives of Medical Research	1	51	**Q1**

Arteriosclerosis, Thrombosis, and Vascular Biology	6	202	**Q1**
Atherosclerosis	6	123	**Q1**
Archives of Internal Medicine (JAMA Ophthalmology)	1	211	**Q1**
Biochemical and Biophysical Research Communications	1	195	**Q2**
Biochimica et Biophysica Acta - Molecular and Cell Biology of Lipids	1	114	**Q1**
Biological Trace Element Research	1	47	**Q2**
BioMed Research International	1	37	**Q2**
Bioresource Technology	1	152	**Q1**
British Journal of Ophthalmology	1	103	**Q1**
Cancer Letters	1	115	**Q1**
Cancer Biology and Therapy	1	69	**Q2**
Cancer Gene Therapy	1	68	**Q2**
Cardiovascular Research	2	155	**Q1**
Cell Cycle	1	91	**Q1**
Circulation	3	460	**Q1**
Circulation Research	1	244	**Q1**
Clinical Cancer Research	1	217	**Q1**
Diabetes	1	244	**Q1**
Diabetes and Vascular Disease Research	1	31	**Q1**
Diabetes Care	1	250	**Q1**
Diabetes, Obesity and Metabolism	1	70	**Q1**
Digestive and Liver Disease	1	58	**Q1**
European Journal of Internal Medicine	1	38	**Q1**
Experimental Diabetes Research	1	28	**Q1**
Experimental Hematology	1	94	**Q1**
Gene Therapy	1	132	**Q1**
Gynecologic and Obstetric Investigation	1	44	**Q2**
Hepatology	1	253	**Q1**
Hypertension Research	1	61	**Q1**
Israel Medical Association Journal	1	38	**Q2**
Journal of Applied Phycology	1	56	**Q2**

Journal of Atherosclerosis and Thrombosis	2	49	**Q1**
Journal of Biological Chemistry	1	396	**Q1**
Journal of Cardiovascular Pharmacology	1	76	**Q2**
Journal of Clinical Investigation	2	362	**Q1**
Journal of Nutrition	1	174	**Q1**
Journal of Phycology	1	84	**Q1**
Journal of the American College of Nutrition	1	86	**Q1**
Magnesium Research	1	28	**Q3**
Microvascular Research	1	64	**Q1**
Molecular Reproduction and Development	1	87	**Q1**
Molecular Therapy	1	117	**Q1**
Neurobiology of Aging	1	125	**Q1**
Nutrients	1	38	**Q1**
Obesity Surgery	1	103	**Q1**
Pathobiology	9	37	**Q3**
Plos One	1	127	**Q1**
Prostaglandins Other Lipid Mediators	1	53	**Q2**
Physiologia Plantarum	1	95	**Q1**
Planta	1	105	**Q1**
Plant and Cell Physiology	1	97	**Q1**
Plant Foods for Human Nutrition	1	40	**Q1**
Plant Physiology	2	193	**Q1**
Thrombosis and Haemostasis	2	147	**Q1**

Summary: 61 articles with Journal Ranking of **Q1**, 10 of **Q2, 10 of Q3,** 1 not ranked.
"Top 10" cited publications are underlined
Total Citations: 3,360
Research Gate (RG) Score 40.11

Number of refereed articles in scientific journals:

First author	10
Second author	20
Last author	15
Others	48
Total	**93**

Chapters in Books:

First author	2
Last author	2
Others	1
Total	**5**

8. **Presentations at Meetings**

1. **Shaish A**. M. Avron and A. Ben-Amotz. **(1990)** Effect of inhibitors on the formation of stereoisomers in the biosynthesis of β-carotene in *Dunaliella bardawil.* 9th International Symposium on Carotenoids. Kyoto, Japan.
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8. **A. Shaish**, K.. Levanon, N. Varda-Bloom, S. Greenberger, I. Barshak, A. Orenstein, E. Breitbart, D. Harats. **(2002)** PPE-1 regulated endothelial-specific gene therapy using VEGF&PDGF-B induced angiogenesis and vessel maturation in ischemic limb model. Atherosclerosis Suppl. 3:121
9. **Aviv Shaish**, Ayelet Harari , Lea Hananshvili, Hofit Cohen, Rafi Bizur, Tami Lubish, Esphir Ulman1, Zohar Levi1, Ayelet Gonen1, Ami Ben-Amotz, Moria Golan4, Dov Gavish, Dror Harats1 **(2003)** Improvement of Fibrate Action by a Combination Treatment of the Drug Plus

9-Cis β-Carotene-Rich Powder of the Alga *Dunaliella Bardawil*. Meeting of the Society for Research, Prevention and Treatment of Atherosclerosis, Eilat.

10. The Effect of 9-cis β-carotene on Plasma Lipid Profile and Atherosclerosis in LDL Receptor-Deficient Mice. **(2011)** Noa Relevy, Ayelet Harari, Iris Barshack, Ami Ben Amotz, Dror Harats and **Aviv Shaish**. Acta Biologica Cracoviensia 16th International Symposium on Carotenoids, Krakow, Poland. (supplement) 53:71

9. Selected Patents:

1. U.S Patent No. 7,264,813B "Therapeutic Uses of *Dunaliella* Powder" in the name of 1. Nikken Sohonsha Corporation. 2. Tel Hashomer Medical Research Infrastructure and Service Ltd. Inventors: **Aviv Shaish** and Dror Harats.
2. U.S Patent No. 7,763,255 "Therapeutic Uses of *Dunaliella* Powder" in the name of 1. Nikken Sohonsha Corporation. 2. Tel Hashomer Medical Research Infrastructure and Service Ltd. Inventors: **Aviv Shaish** and Dror Harats.
3. Japan Patent 5020463 "Therapeutic Uses of *Dunaliella* Powder" in the name of 1. Nikken Sohonsha Corporation. 2. Tel Hashomer Medical Research Infrastructure and Service Ltd. Inventors: **Aviv Shaish** and Dror Harats.
4. European Patent EP 1522310 B1. "Therapeutic uses of *Dunaliella* powder" in the name of Nikken Sohonsha Corporation. 2. Tel Hashomer Medical Research Infrastructure and Service Ltd. Inventors: **Aviv Shaish** and Dror Harats.
5. Hong Kong Patent EP HK1071845. "Therapeutic uses of *Dunaliella* powder" in the name of 1. Nikken Sohonsha Corporation. 2. Tel Hashomer Medical Research Infrastructure and Service Ltd. Inventors: **Aviv Shaish** and Dror Harats.
6. United States Patent 6383474, "Carotenoid preparation" I.B.R. Israeli Biotechnology Research Ltd. Inventors: Lea Bezalel, Inon Perry, Etienne Soudant, Hedva Shickler, Judith paltiel, Ami Ben-Amotz, **Aviv Shaish**.
7. WO/2000/013654 "A Carotenoid composition containing phytoene and phytofluene". Inventors: Soudant Etienne, Bezalel Lea, Schickler Hedva, Paltiel Judith, Ben-Amotz Ami, **Shaish Aviv**, Perry Inon.
8. Israeli Patent Application No. 162987 "Pharmaceutical composition comprising *Dunaliella* powder for treating diabetes, atherosclerosis and plasma lipid levels" in the name of 1. Nikken Sohonsha Corporation. 2. Tel Hashomer Medical Research Infrastructure and Service Ltd. Inventors: **Aviv Shaish** and Dror Harats.
9. U.S. Patent Application No. 12/777,757 Divisional Application of U.S. Patent Application No.

11/882,786 "Therapeutic Uses of Dunaliella Powder"Co-Patentees: 1. Nikken Sohonsha Corporation 2. Tel Hashomer Medical Research Infrastructure and Services Ltd. Inventors: **Aviv SHAISH** & Dror HARATS.

10. Japanese Patent Application No. 2011-506828 *"Methods of treating ophthalmic disorders"* in the names of: 1. Nikken Sohonsha Corporation 2. Tel Hashomer Medical Research Infrastructure and Services Ltd. Inventors: Michael BELKIN, **Aviv SHAISH**, Dror HARATS and Ygal ROTENSTREICH
11. USProv 61/897,990 filed on 31/10/2013 " Methods for Treating Reproductive Disorders"
    PCT appl PCT/IL2014/050942 filed on 30/10/2014 " Interleukin-1 (il-1) inhibitors for treating fertility disorders" Inventors: Yehuda Kamari, Ruth Shalgi, Shiri Uri, Dror Harats, **Aviv Shaish**

10. Research Grants

1997 "Tiber" scholarship. "The Role of the Human Lipid Oxidizing Enzyme 15-Lipoxygenase in Atherogenesis". A Study in Transgenic Mice. 2000$

1999 Ministry of Health, Chief Scientist's Office, Jerusalem. "The Effect of Antioxidants on Atherosclerosis in apoE-Deficient Mice" no. 4055. 100,000 IS.

1999 Green Foundation. Tel-Aviv University 3,000 $.

2000 "Recanaty" foundation, Tel-Aviv University, Tissue Specific Gene Therapy to Neovascular Tumoral Cells, 50,000 $.

2001 Ministry of Health, The Division of Budgeting, Planning and Pricing 150,000 IS. הרג תאי אנדותל באנגיוגנזה של גידולים סרטניים ע"י גנים פרו-אפופטוטיים 159/2000

2003 "Nikken Sohonsha Corporation" a research grant, 150,000$.

2004 Israel Cancer Association. The Creation of Conditionally Replicating Adenoviruses Targeted to Tumor Angiogenesis. Research Grant 20040021-B 45,000 IS.

2005 Nikken Sohonsha Corporation" a research grant, 350,000$.

2005 Ministry of Health, Chief Scientist's Office, Jerusalem. "The effect of apoAIV on atherosclerosis" no. 6216, 3-1863; 80,000 IS.

2007 The Program of Science and Technology Infrastructure Development. "Drug Screening Platform and Experimental Models of Heart Diseases in Human Embryonic Stem Cells-Derived Cardiomyocytes" 368,286IS.

2007 March of Dimes "Defining the Essential Roles of Maternal and Fatal Apolipoprotein-E and Interleukin-1 alpha in Parturition" 354,823$.

2008 Ministry of Health, Chief Scientist's Office, Jerusalem. "The role of IL-1in atherosclerosis" 100,000 IS.

2008 Nikken Sohonsha Corporation" a research grant, 350,000$.

2009 Nikken Sohonsha Corporation" a research grant, 100,000$.

2011 Nikken Sohonsha Corporation" a research grant, 210,000$.

2013 Nikken Sohonsha Corporation" a research grant, 30,000$.

2014 Nikken Sohonsha Corporation" a research grant, 100,000$.

11. Scientific Activity

I am currently a senior researcher at the Bert W. Strassburger Lipid Center, of Sheba Medical Center, a lecturer in Achva Academic College and consultant to biotechnology companies. I received my B.Sc and M.Sc. with distinction from Ben-Gurion University in 1985 and 1987, respectively and obtained a Ph.D. degree in 1993 from the Biochemistry department at the Weizmann Institute of Science. After

the post-doctoral work at .W Washington University School of Medicine in Saint-Louis, MO, I was appointed as a senior researcher at the Sheba Medical Center, in 1996. I am a member of the Israeli Medical Association-Society for Research, Prevention and Treatment of Atherosclerosis.

In my Ph.D. studies, I investigated the biosynthesis pathway of beta-carotene in the alga *Dunaliella* and this research led me, in my Post Doctorate research, to study the effect of carotenoids and other antioxidants on atherosclerosis. The main conclusion of my research was that beta-carotene does not act as an antioxidant in atherosclerosis and therefore, I hypothesized that it inhibits atherogenesis via its conversion to other active metabolites. My major research interest since 1996 is in prevention and treatment of atherosclerosis, with emphasis on the use of the alga *Dunaliella* as a therapeutic means in atherosclerosis and diseases related to it. Under appropriate conditions, the algae accumulates massive amounts of 9-cis beta-carotene and my research is focused on the effect of this beta-carotene isomer on atherosclerosis and its risk factors including effects on plasma lipids, the process of reverse cholesterol transport and obesity-associated co-morbidities. The research highlighted the importance of the 9-cis beta-carotene isomer over the synthetic, all-trans, and demonstrated that it has beneficial effects on atherogenesis. Aiming to elucidate the mode of action of 9-cis beta-carotene, I currently study the effect of beta-carotene metabolites on activation of the nuclear receptor RXR and on atherosclerosis in mouse models, on the process of reverse cholesterol transport in macrophages and on obesity-associated insulin resistance and non-alcoholic fatty liver disease. In addition, I investigate the hypothesis that dietary beta-carotene is a better source for retinoids in our body than dietary vitamin A.

I have several collaborations associated with beta-carotene or atherosclerosis: I. The effect of 9-cis beta-carotene rich capsules of the alga *Dunaliella* on Retinitis Pigmentosa. II. The effect of 9-cis beta-carotene rich powder of the alga *Dunaliella* on Alzheimer in transgenic mice. III. The role of the coagulation Factor XI in early and advanced atherosclerosis by using apolipoproteinE/FactorXI double knockout mice. IV. The role of apoA5 in atherosclerosis development by using

apolipoproteinE/apoAVI transgenic mice. V. The role of the interleukin-1 alpha in atherosclerosis and steatohepatitis- studies in mouse models and in cell cultures. VI. The role of FAT10 in atherosclerosis- studies in mouse models and cell cultures.

My research is the outcome of knowledge in biochemistry of algae, chemistry, biochemistry and atherosclerosis development. The experiments performed in our research group utilize cell-culture, animal models and human subjects. One of the goals of the research is development of new treatments for atherosclerosis, which has provided several patents and more than 95 publications.