KARI KUSTAA ALITALO

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EDUCATION

1976	Educational Commission for Foreign Medical Graduates (USA) - exam
1977	M.D., University of Helsinki
1980	M.Sc.D. (basic sciences, corresponding to Ph.D. degree), University of Helsinki

PRESENT POSITIONS

1993-	Academy Professor, Research Council for Health, The Academy of Finland

PREVIOUS PROFESSIONAL APPOINTMENTS

1977-1982	Research and teaching assistantships, Departments of Pathology and Virology, The Finnish Academy of Sciences, Helsinki, Finland
1981-1982	Visiting Scientist, Department of Biochemistry, University of Washington, Seattle, USA
1982-1983	Visiting Scientist, Department of Microbiology and Immunology, University of California, San Francisco, USA
1983-1986	Research Fellow, Senior RF, State Medical Research Council, Finland
1986-1987	Professor of Medical Biochemistry, University of Turku, Finland
1987-1988	Research Professor, The Finnish Cancer Institute, Helsinki, Finland
1988-1993	Professor of Cancer Biology, University of Helsinki, Helsinki, Finland
1993-	Academy Professor, Research Council for Health, The Academy of Finland
1999-2007	Director, Molecular/Cancer Biology Research Program, University of Helsinki
2000-2011	Director, Academy of Finland Center of Excellence in Cancer Biology, University of Helsinki
2007-2012	Scientific Director, Molecular/Cancer Biology Research Program, University of Helsinki

JOURNAL EDITORIAL BOARD MEMBERSHIP

EMBO Molecular Medicine, Molecular Cancer Research, Journal of Clinical Investigation, Trends in Molecular Medicine, The FASEB Journal, International Journal of Cancer, Journal of Experimental Medicine, Molecular Oncology, Cancer Discovery, Cancer Cell

SELECTED COMMITTEE/MEMBERSHIP ACTIVITIES (SAB: Scientific Advisory Board)

Executive board, Finnish Association of Pathology, 1985-1992, Chairman 1989-1991
Member, The Scientific Council, IARC/WHO, 1992-1995
Member, EMBO Fund Committee, 1994-1997
SAB, Lymphatic Research Foundation, 1999-
Member, Biocentrum Helsinki, Finland, 2000-2012
Board member, Biomedicum Helsinki, 2000-2005
SAB, Center for Transgene Technology & Gene Therapy, Belgium, 2001-2005
SAB, Institute for Cancer Research and Treatment, Turin, Italy, 2001-2008
SAB, Fondation Lefoulon-Delalande, Institute De France, 2002-
SAB, Circadian Technologies Ltd/Vegenics 2007-
SAB, North American Vascular Biology Organization, 2008-
Board member, Biocenter Oulu, 2009-20.
Member, Academia Europaea, The Academy of Europe, 2011-
Member, European Academy of Tumor Immunology, 2011-
Member, Swedish Royal Academy of Sciences, 2012-

MENTOR FOR DOCTORAL TRAINING: 41 completed theses

1. Robert Winqvist: Chromosomal analysis of amplified oncogenes and myc protein, 1986.
2. Kalle Saksela: myc genes in human lung cancer: regulation and amplification, 1989.
3. Lea Sistonen: Regulation of gene expression by c-Ha-ras and neu oncoproteins, 1990.
4. Heikki Lehväslaiho: Functional analysis of the neu oncoprotein by recombinant DNA techniques, 1991.
5. Laura Lehtola: Analysis of the neu oncoprotein and other tyrosine kinases expressed in breast cancer cells, 1991.
6. Päivi Koskinen: Regulation and roles of c-myc and other growth factor-responsive genes, 1991.
7. Tomi Mäkelä: Studies on myc family and associated proteins: identification of the rlf-L-myc rearrangement, 1991.
8. Juha Partanen: Molecular cloning and characterization of novel tyrosine kinases expressed in K562 human leukemia cells, 1992.
9. Elina Armstrong: Analysis of chromosomal location and expression of novel leukemia cell receptor tyrosine kinase genes, 1993.
10. Harri Hirvonen: Of Myc and Men - expression of MYC proto-oncogenes in human fetal development, leukemias and brain tumors, 1993.
11. Liisa Pertovaara: Gene regulation by transforming growth factor-ß and inducers of tumor cell differentiation, 1994.
12. Jaana Korhonen: Characterization of endothelial receptor tyrosine kinases Tie and Flt4 in angiogenesis, 1995.
13. Katri Pajusola: Cloning and characterization of a new endothelial receptor tyrosine kinase Flt-4 and two novel VEGF-like growth factors VEGF-B and VEGF-C, 1996.
14. Imre Västrik: Max, ΔMax and Mad1 as regulations of Myc proteins, 1996.
15. Satu Vainikka: Signal Transduction and expression of FGF receptor-4, 1996.
16. Erika Hatva: Receptor tyrosine kinases and growth factors in human brain tumors and vascular malformations, 1996.
17. Arja Kaipainen: Molecular control of lymphangiogenesis: Role of VEGF-C and its receptors, 1997.
18. Juha Klefström: Oncogenes as regulators of tumor necrosis factor induced cell death, 1997.
19. Petri Salven: Angiogenic molecules and cancer. Role of the vascular endothelial growth factor family, 1998.

20. Birgitta Olofsson: Studies of the vascular endothelial growth factors, VEGFs, and their receptors focusing on VEGF-B, 1999.
21. Athina Lymboussaki: Vascular endothelial growth factors and their receptors in embryos, adults and tumors, 1999.
22. Eola Valdre: Endothelial-specific regulation of vessel formation: Role of receptor tyrosine kinases, 2000.
23. Taina Partanen: Lymphatic vs blood vascular endothelial growth factors and receptors in human tissues and diseases, 2000.
24. Lotta Jussila: VEGFR-3 in angiogenesis and lymphangiogenesis, 2001
25. Marika Karkkainen: VEGFR-3 in primary lymphedema, 2001.
26. Taija Makinen: Molecular mechanisms of lymphangiogenesis: role of VEGFR-3 mediated signaling, 2002
27. Tanja Veikkola: Dissecting VEGFR-2 and VEGFR-3 function: VEGFR-3 mediates lymphangiogenic signals, 2002.
28. Anne Saaristo: In vivo effects and therapeutic potential of VEGF-C, 2002.
29. Michael Jeltsch: VEGFR-3 ligands and Lymphangiogenesis, 2002.
30. Niklas Ekman: The Bmx tyrosine kinase: A signal mediator in hematopoietic and endothelial/epithelial cells, 2003.
31. Karri Paavonen: Vascular endothelial growth factors and the Bmx tyrosine kinase in the regulation of angiogenesis and lymphangiogenesis, 2003.
32. Bernt Enholm: Vascular Endothelial Growth Factors B and -C: Gene Regulation and Gene Transfer in Vivo, 2004.
33. Marko Uutela: PDGF-D : a novel member of the platelet-derived growth factor family, 2004
34. Iiro Rajantie: Bone marrow progenitor cells and vascular endothelium: studies on the in vivo differentiation capacity and the role of Bmx tyrosine kinase, 2004
35. Kristiina Iljin: Transcriptional regulation of endothelial cell-specific Tie1 and Vegfr3 genes, 2004
36. Terhi Kärpänen: Lymphatic vessels in health and disease: Role of the VEGF-C/VEGFR-3 pathway and the transcription factor FOXC2, 2006
37. Maria Wirzenius: VEGFR-2 and VEGFR-3 specific signaling in lymphangiogenesis and angiogenesis, 2007
38. Tuomas Tammela: VEGFR-3 and Tie pathways in vascular network formation, 2008
39. Paula Haiko: VEGF-C/VEGFR-3 and PDGF-B/PDGFR-ss pathways in embryonic lymphangiogenesis, 2008
40. Marja Lohela: VEGF-C and angiopoietins in lymphangiogenesis, 2008
41. Camilla Norrmén: Lymphatic vascular maturation: roles of FOXC2, NFATc1 and liprin β1, 2009

HONORS/AWARDS

1981

1. Primus Doctorum in the X Promotion of The Medical Faculty, University of Helsinki

1987

2. The Anders Jahre Prize for Young Investigator, Norway
3. Farmos Oy Science Prize, Turku, Finland

1990

4. The Medix Prize for the Best Finnish Paper in the Biosciences in 1989
5. Member, European Molecular Biology Organization (EMBO)

1991

6. Member, The Finnish Academy of Science and Letters

1998

7. The Äyräpää Prize, Finland
8. The Medix Prize for the Best Finnish Paper in the Biosciences in 1997

1999

9. Europe Medicine Senior Prize

2002

10. The Lundbeck Foundation Nordic Prize, Denmark

2003

11. Leopold Griffuel Prize, France

2005

12. Pfizer Advances in Oncology Award
13. Eric K Fernström Foundation's Nordic Prize, Sweden

2006

14. Louis-Jeantet Prize For Medicine, Switzerland

2009

15. Member, The Finnish Society of Science and Letters
16. The InBev-Baillet Latour Health Prize, Belgium
17. Fellow of The European Academy of Cancer Sciences

2010

18. The Michael O'Connor Award, Mayo Clinic, USA
19. The Anders Jahre Senior Medical Prize, Norway

2011

20. Moosa Plenary Award and Lecture, South Korea
21. Earl P. Benditt Award and Lecture, USA
22. The Medix Prize for the Best Finnish Paper in the Biosciences in 2010

INVITED PRESENTATIONS

About 400 invited talks in international meetings since 1984.

PUBLICATIONS

426 original publications in peer-reviewed journals, 123 reviews and editorials. Publications cited 50378 times according to the Institute of Scientific Information. H-index: 125.

Research interests and major accomplishments

My laboratory is interested in pathophysiology of cancer, tumor angiogenesis and metastasis. We have unravelled the molecular basis of lymphangiogenesis, the formation of lymphatic vessels and their involvement in tumor metastasis. We identified by molecular cloning several receptors and growth factors that govern the development and maintenance of blood vessels and lymphatic vessels. In fact, three of the currently known five vascular

endothelial growth factors and two of the five endothelial-specific growth factor receptors were identified in studies of our and our collaborators.

Lymphatic vessels have been known for long, but the lack of molecular tools has prevented studies of the molecular basis of lymphangiogenesis and the development of therapeutic strategies to treat disorders where these vessels are involved. This changed with our most significant discovery concerning the growth factor/receptor system that controls the development of lymphatic vessels and lymphatic metastasis. We first discovered of the lymphatic growth factor receptor, VEGFR-3, and then isolated its first ligand VEGF-C. We greatly contributed to the characterization of the second ligand, VEGF-D, and to the discovery of VEGF-B, a coronary vessel growth factor. We used gene targeting and transgenic mouse experiments to establish the developmental and cancer-related roles of these factors. Most importantly, we initiated studies showing that lymphangiogenic factors in tumors greatly enhance tumor metastasis. Furthermore, we simultaneously showed that this can be inhibited by blocking the VEGF-C/VEGF-D - VEGFR-3 interaction and later demonstrated that such inhibition also increases the efficiency of anti-angiogenic therapy. Two antibodies from our studies are now in phase I clinical trials against cancer. We furthermore developed growth factor therapy for lymphedema that is now entering clinical trials.

List of 20 annotated key publications:

1. Tammela T, Zarkada G, Nurmi H, Jakobsson L, Heinolainen K, Tvorogov D, Zheng W, Franco CA, Murtomäki A, Aranda E, Miura N, Ylä-Herttuala S, Fruttiger M, Mäkinen T, Eichmann A, Pollard JW, Gerhardt H, Alitalo K. VEGFR-3 controls tip to stalk conversion at vessel fusion sites by reinforcing Notch signalling. ***Nature Cell Biol.*** 13: 1202-1213, 2011.

The mechanism of ligand-independent VEGFR-3 function in blood vessel fusions.

2. Tammela T, Saaristo A, Holopainen T, Ylä-Herttuala S, Andersson LC, Virolainen S, Immonen I, Alitalo K. Photodynamic ablation of lymphatic vessels and intralymphatic cancer cells prevents metastasis. *Sci Transl Med.* 3: 69ra11, 2011.

A new method to inhibit in transit/satellite metastasis.

3. Tvorogov D, Anisimov A, Zheng W, Leppänen V-M, Tammela T, Laurinavicius S, Holnthoner W, Heloterä H, Holopainen T, Jeltsch M, Kalkkinen N, Lankinen H, Ojala P, Alitalo K. Effective Suppression of Vascular Network Formation by Combination of Antibodies Blocking VEGFR Ligand Binding and Receptor Dimerization. Cancer Cell 18:630-40, 2010.

These results indicate that VEGF receptor directed antibodies that inhibit ligand binding and receptor dimerization have additive or even synergistic effects.

4. V-M Leppänen, A Prota, M Jeltsch, A Anisimov, N Kalkkinen, T Strandin, H Lankinen, A Goldman, K Ballmer-Hofer and K Alitalo: Structural determinants of growth factor binding and specificity by VEGF-Receptor 2. Proc. Natl. Acad. Sci., USA, 107: 2425-2430, 2010.

The structure of VEGF-C, and its complex with the main angiogenic receptor VEGFR-2.

5. Petrova TV, Nykanen A, Norrmen C, Ivanov KI, Andersson LC, Haglund C, Puolakkainen P, Wempe F, von Melchner H, Gradwohl G, Vanharanta S, Aaltonen LA, Saharinen J, Gentile M, Clarke A, Taipale J, Oliver G, Alitalo K: Transcription factor PROX1 induces colon cancer progression by promoting the transition from benign to highly dysplastic phenotype. ***Cancer Cell***. 13:407-19, 2008.

Discovery of the involvement of a transcription factor and lymphatic marker in the malignant conversion of colonic tumors.

6. Tammela T, Zarkada G, Wallgard E, Murtomäki A, Suchting S, Wirzenius M, Waltari M, Hellström M, Schomber T, Peltonen R, Freitas C, Duarte A, Isoniemi H, Laakkonen P, Christofori G, Ylä-Herttuala S, Shibuya M, Pytowski B, Eichmann A, Betsholtz C, Alitalo K. Blocking VEGFR-3 suppresses angiogenic sprouting and vascular network formation. ***Nature*** 454:656-60, 2008.

This paper reveals a new mechanism involved in blood vessel sprouting and provides an additional target for angiogenesis inhibition.

7. Tammela T, Saaristo A, Holopainen T, Lyytikkä J, Kotronen A, Pitkonen M, Abo-Ramadan U, Ylä-Herttuala S, Petrova TV, Alitalo K. Therapeutic differentiation and maturation of lymphatic vessels after lymph node dissection and transplantation. ***Nature Medicine*** 13:1458-66, 2007.

The first evidence that collecting lymphatic vessels can differentiate from lymphatic capillaries in adults and that VEGF-C gene therapy induces this process.

8. He Y, Rajantie I, Pajusola K, Jeltsch M, Holopainen T, Yla-Herttuala S, Harding T, Jooss K, Takahashi T, Alitalo K. Vascular endothelial cell growth factor receptor 3-mediated activation of lymphatic endothelium is crucial for tumor cell entry and spread via lymphatic vessels. **Cancer Res.** 65:4739-46, 2005.

The mechanism of VEGF-C induced lymphatic sprouting towards as well as dilation of the draining lymphatic vessels, both contributing to lymphatic metastasis. These processes were blocked dose-dependently by inhibition of VEGFR-3.

9. Petrova TV, Karpanen T, Norrmen C, Mellor R, Tamakoshi T, Finegold D, Ferrell R, Kerjaschki D, Mortimer P, Yla-Herttuala S, Miura N, Alitalo K. Defective valves and abnormal mural cell recruitment underlie lymphatic vascular failure in lymphedema distichiasis. ***Nature Medicine*** 10:974-81, 2004.

Mechanism of development of Lymphedema distichiasis.

10. Karkkainen MJ, Haiko P, Sainio K, Partanen J, Taipale J, Petrova TV, Jeltsch M, Jackson DG, Talikka M, Rauvala H, Betsholtz C, Alitalo K. Vascular endothelial growth factor C is required for sprouting of the first lymphatic vessels from embryonic veins. ***Nature Immunology*** 5:74-80, 2004.

The results of this paper indicate that VEGF-C is the paracrine factor essential for lymphangiogenesis, and that both Vegfc alleles are required for normal lymphatic development.

11. He Y, Kozaki K, Karpanen T, Koshikawa K, Yla-Herttuala S, Takahashi T, Alitalo K. Suppression of tumor lymphangiogenesis and lymph node metastasis by blocking

vascular endothelial growth factor receptor 3 signaling. ***J Natl Cancer Inst.*** 94: 819-25, 2002.

Development of VEGFR-3 signaling inhibitor for suppression of tumor lymphangiogenesis and metastasis to regional lymph nodes.

12. Mäkinen, T., Jussila, L., Veikkola, T., Kärpänen, T., Kettunen, M.I., Pulkkanen, K.J., Kauppinen, R., Jackson, D.G., Kubo, H., Nishikawa, S.-I., Ylä-Herttuala, S. and Alitalo, K.: Inhibition of lymphangiogenesis with resulting lymphedema in transgenic mice expressing soluble VEGF receptor-3. ***Nature Medicine*** 7: 199-205, 2001.

Demonstration that a soluble form of VEGFR-3 is a potent inhibitor of VEGF-C/VEGF-D signaling and lymphangiogenesis.

13. Mandriota SJ, Jussila L, Jeltsch M, Compagni A, Baetens D, Prevo R, Banerji S, Huarte J, Montesano R, Jackson DG, Orci L, Alitalo K, ChristoforiG, Pepper MS. Vascular endothelial growth factor-C-mediated lymphangiogenesis promotes tumour metastasis. ***EMBO J.*** 20:672-82, 2001.

Demonstration that VEGF-C-induced lymphangiogenesis mediates tumour cell dissemination and the formation of lymph node metastases.
Note the Acknowledgements:" The project presented in this manuscript was conceived and started in Helsinki, and the work is the result of an equal contribution from the laboratories in Helsinki, Vienna and Geneva, together with a major contribution from the Oxford group." This project was thus started in 1995 in Dr. Alitalo's laboratory.

14. Karpanen T, Egeblad M, Karkkainen MJ, Kubo H, Yla-Herttuala S, Jaattela M, Alitalo K. Vascular endothelial growth factor C promotes tumor lymphangiogenesis and intralymphatic tumor growth. ***Cancer Res.*** 61:1786-90, 2001.

These data show that VEGF-C facilitates tumor metastasis to the lymphatic vessels and that tumor spread is inhibited by blocking the interaction between VEGF-C and its receptor.

15. Karkkainen MJ, Saaristo A, Jussila L, Karila KA, Lawrence EC, Pajusola K, Bueler H, Eichmann A, Kauppinen R, Kettunen MI, Yla-Herttuala S, Finegold DN, Ferrell RE, Alitalo K. A model for gene therapy of human hereditary lymphedema. ***Proc Natl Acad Sci U S A*** 98:12677-82, 2001.

First demonstration that growth factor gene therapy would be applicable to human lymphedema and provide a paradigm for other diseases associated with mutant receptors.

16. Karkkainen, M.J., Ferrell, R.E., Lawrence, E.C., Kimak, M.A., Levinson, K.L., McTigue, M.A., Alitalo, K. and Finegold, D.N.: Missense mutations interfere with VEGFR-3 signalling in primary lymphoedema. ***Nature Genetics*** 25: 153-159, 2000.

Heterozygous missense mutations of VEGFR-3 were shown to inactivate the tyrosine kinase and downstream gene activation in primary lymphedema, indicating that mutations interfering with VEGFR-3 signal transduction are a cause of primary lymphoedema.

17. Dumont, D.J., Jussila, L., Taipale, J., Lymboussaki, A., Mustonen, T., Pajusola, K., Breitman, M. and Alitalo, K. Cardiovascular failure in mouse embryos deficient in VEGF receptor-3. ***Science*** 282: 946-949, 1998.

This paper shows that VEGFR-3 has an essential role in the development of the embryonic cardiovascular system before the emergence of the lymphatic vessels.

18. Cao, Y., Linden, P., Farnebo, J., Cao, R., Eriksson, A., Kumar, V., Qi, J.-H., Claesson-Welsh, L., Alitalo, K.: Vascular endothelial growth factor-C induces angiogenesis in vivo. ***Proc. Natl. Acad. Sci. 95***: 14389-14394, 1998.

Demonstration of the angiogenic activity of mature VEGF-C, suggesting that this factor could participate in the development and progression of angiogenic diseases in addition to lymphangiogenesis.

19. Jeltsch, M., Kaipainen, A., Joukov, V., Meng, X., Lakso, M., Rauvala, H., Swartz, M., Fukumura, D., Rakesh, K.J. and Alitalo, K.: Hyperplasia of lymphatic vessels in VEGF-C transgenic mice. ***Science*** 276: 1423-1425, 1997.

Transgenic overexpression of VEGF-C was found to induce lymphatic, but not vascular, endothelial proliferation and vessel growth. VEGF-C was predicted to play a role in disorders involving the lymphatic system.

20. Joukov, V., Sorsa, T., Kumar, V., Jeltsch, M., Claesson-Welsh, L., Cao, Y, Saksela, O., Kalkkinen, N. and Alitalo, K.: Proteolytic processing regulates receptor specificity and activity of VEGF-C. ***EMBO J.*** 16: 3898-3911, 1997.

Effects of post-translational processing in VEGF-C secretion and function, as well as the structure of the mature VEGF-C.

FULL LIST OF PUBLICATIONS:

1. Alitalo K, Paavolainen P, Franssila K, Ritsilä V. Clear-cell sarcoma of tendons and aponeuroses. ***Acta Orthoped Scand.*** 48: 241-244, 1977.

2. Hedman K, Kurkinen M, Alitalo K, Vaheri A, Johansson S, Höök M. Isolation of the pericellular matrix of human fibroblast cultures. ***J Cell Biol.*** 81: 83-91, 1979.

3. Kurkinen M, Alitalo K, Vaheri A, Stenman S, Saxen L. Fibronectin in the development of embryonic chick eye. ***Dev Biol.*** 69: 589-600, 1979.

4. Kurkinen M, Alitalo K. Fibronectin and procollagen produced by a clonal line of Schwann cells. ***FEBS Lett.*** 102: 64-68, 1979.

5. Krieg T, Timpl R, Alitalo K, Kurkinen M, Vaheri A. Type III procollagen is the major collageneous component produced by a continuous rhabdomyosarcoma cell line. ***FEBS Lett.*** 104: 405-409, 1979.

6. Ekblom P, Alitalo K, Vaheri A, Timpl R, Saxen L. Induction of a basement membrane glycoprotein in embryonic kidney; possible role of laminin in morphogenesis. ***Proc Natl Acad Sci.*** USA 77: 485-489, 1980.

7. Alitalo K, Kurkinen M, Vaheri A, Krieg T, Timpl R. Extracellular matrix components synthesized by human amniotic epithelial cells in culture. ***Cell*** 19: 1053-1062, 1980.

8. Alitalo K, Hovi T, Vaheri A. Fibronectin is produced by human macrophages. ***J Exp Med.*** 151: 602-613, 1980.

9. Alitalo K. Production of both interstitial and basement membrane procollagens by fibroblastic WI-38 cells from human embryonic lung. ***Biochem Biophys Res Commun.*** 93: 873-880, 1980.

10. Alitalo K, Vaheri A, Krieg T, Timpl R. Biosynthesis of two subunits of type IV procollagen and of other basement membrane proteins by a human tumor cell line. ***Eur J Biochem.*** 109: 247-255, 1980.

11. Alitalo K, Kurkinen M, Vaheri A, Virtanen I, Rohde H, Timpl R Basal lamina glycoproteins are produced by neuroblastoma cells. ***Nature*** 287: 465-466, 1980.

12. Saksela O, Alitalo K, Kiistala U, Vaheri A. Basal lamina components in experimentally induced skin blisters. ***J Invest Dermatol.*** 77: 283-286, 1981.

13. Myllylä R, Alitalo K, Vaheri A, Kivirikko KI. Regulation of post-translational modification of collagen in transformed human and chick-embryo cells. ***Biochem J.*** 196: 683-692, 1981.

14. Alitalo K, Keski-Oja J, Vaheri A. Extracellular matrix proteins characterize human tumor cell lines. ***Int J Cancer*** 27: 7545-761, 1981.

15. Pihlajaniemi T, Myllylä R, Alitalo K, Vaheri A, Kivirikko KI. Posttranslational modifications in the biosynthesis of collagen type IV by a human tumor cell line. ***Biochemistry*** 20: 7409-7415, 1981.

16. Leivo I, Alitalo K, Risteli L, Vaheri A, Timpl R, Wartiovaara J. Basal lamina glycoproteins laminin and type IV collagen are assembled into a fine-fibered matrix in cultures of a teratocarcinoma-derived cell line. ***Exp Cell Res.*** 137: 15-23, 1982.

17. Alitalo K, Kuismanen E, Myllylä R, Kiistala U, Asko-Seljavaara S, Vaheri, A. Extracellular matrix proteins of human epidermal keratinocytes and feeder 3T3 cells. ***J Cell Biol.*** 94: 947-505, 1982.

18. Alitalo K, Kurkinen M, Virtanen I, Mellström K, Vaheri A. Deposition of basement membrane proteins in attachment and neurite formation of cultured murine C-1300 neuroblastoma cells. ***J Cell Biochem.*** 18: 25-35, 1982.

19. Alitalo K, Halila H, Vesterinen E, Vaheri A. Endo- and ecto-cervical human uterine epithelial cells distinguished by fibronectin production and keratinization in culture. ***Cancer Res.*** 42: 1142-1146, 1982.

20. Hedman K, Alitalo K, Vaheri A, Timpl R. Deposition of an intermediate from of procollagen type III (pN-collagen) into fibrils in the matrix of amniotic epithelial cells. ***EMBO J.*** 1: 47-52, 1982.

21. Keski-Oja J, Gahmberg CG, Alitalo K. Pericellular matrix and cell surface glycoproteins of virus-transformed mouse epithelial cells. ***Cancer Res.*** 42: 1147-1153, 1982.

22. Alitalo K, Keski-Oja J, Hedman K, Vaheri A. Loss of different pericellular matrix components of rat cells transformed by a T-class ts-mutant of Rous sarcoma virus. ***Virology*** 119: 347-357, 1982.

23. Majamaa K, Myllylä R, Alitalo K, Vaheri A. Regulation of proline 3-hydroxylation and prolyl 3-hydroxylase and 4-hydroxylase activities in transformed cells. ***Biochem J.*** 206: 499-503, 1982.

24. Alitalo K, Myllylä R, Sage H, Pritzl P, Vaheri A, Bornstein P. Biosynthesis of type V collagen by A204, a human rhabdomyosarcoma cell line. ***J Biol Chem.*** 257: 9016-9024, 1982.

25. Alitalo K, Bornstein P, Vaheri A, Sage H. Biosynthesis of an unusual collagen type by human astrocytoma cells *in vitro*. ***J Biol Chem.*** 258: 2653-2661, 1983.

26. Sovova V, Travnicek M, Hlozanek I, Cerna H, Alitalo K, Vaheri A. Evidence for p15 cleavage site in *myc*-specific proteins of avian MC29 and OK10 viruses. ***J Cell Biochem.*** 28: 265-272, 1985.

27. Alitalo K, Keski-Oja J, Bornstein P Effects of Zn2+ ions on protein phosphorylation in epithelial cell membranes. ***J Cell Physiol.*** 115: 305-312, 1983.

28. Courtneidge S, Ralston R, Alitalo K, Bishop JM. Subcellular location of an abundant substrate (p36) for tyrosine-specific protein kinases. ***Mol Cell Biol.*** 3: 340-350, 1983.

29. Alitalo K, Bishop JM, Smith DH, Chen EY, Colby WW, Levinson AD. Nucleotide sequence of the v-*myc* oncogene of avian retrovirus MC29. ***Proc Natl Acad Sci.*** USA, 80: 100-104, 1983.

30. Alitalo K, Schwab M, Lin CC, Varmus H, Bishop JM. Homogeneously staining chromosomal regions contain amplified copies of an abundantly expressed cellular oncogene (c-*myc*) in malignant neuroendocrine cells from a human colon carcinoma. ***Proc Natl Acad Sci USA*** 80: 1707-1711, 1983.

31. Schwab M, Alitalo K, Varmus H, Bishop JM, George D. A cellular oncogene (c-Ki-*ras*) is amplified, overexpressed and located within karyotypic abnormalities in mouse adrenocortical tumour cells. ***Nature*** 303: 497-501, 1983.

32. Alitalo K, Ramsay GM, Bishop J, Pfeifer-Ohlsson S, Colby WW, Levinson AD. Identification of nuclear proteins encoded by viral and cellular *myc*-oncogenes. ***Nature*** 306: 274-277, 1983.

33. Schwab M, Alitalo K, Klempnauer K-H, Gilbert F, Brodeur G, Trent JT, Varmus HE, Bishop JM. Amplified DNA with limited homology to *myc* cellular oncogene is shared by human neuroblastoma cell lines and a neuroblastoma tumour. ***Nature*** 305: 245-248, 1983.

34. Alitalo K, Winqvist R, Lin CC, de la Chapelle A, Schwab M, Bishop JM. Aberrant expression of an amplified c-*myb* oncogene in two cell lines from a colon carcinoma. ***Proc Natl Acad Sci USA*** 81: 4534-4538, 1984.

35. Lehto V-P, Virtanen I, Ralston R, Paasivuo R, Alitalo K. The p36 substrate of tyrosine-specific protein kinases co-localizes with non-erythrocyte alpha-spectrin antigen, p230, in surface lamina of cultured fibroblasts. ***EMBO J.*** 2: 1701-1705, 1983.

36. Winqvist R, Saksela K, Alitalo K. *myc*-proteins are not associated with chromatin in mitotic cells. ***EMBO J.*** 3: 2947-2950, 1984.

37. Keski-Oja J, Alitalo K, Hautanen A, Rapp UR. Transformation of cultured epithelial cells by ethylnitrosourea: altered expression of type I procollagen chains. ***Biochem Biophys Acta*** 803: 153-162, 1984.

38. Alitalo K, Ralston RR, Keski-Oja J. Distribution of the 36 000 dalton tyrosine protein kinase substrate in drug- and epidermal growth factor-treated epithelial cells. ***Exp Cell Res.*** 150: 177-186, 1984.

39. Lin CC, Alitalo K, Schwab M, George D, Varmus HE, Bishop M. Evolution of karyotypic abnormalities and c-*myc* oncogene amplification in a human colonic carcinoma. ***Chromosoma*** 92: 11-15, 1985.

40. Saksela K, Bergh J, Lehto V-P, Nilsson K, Alitalo K. Aplification of the c-*myc* oncogene is characteristic of a subpopulation of human small cell lung cancer. ***Cancer Res.*** 45: 1823-1827, 1985.

41. Winqvist R, Knuutila S, Leprince D, Stehelin D, Alitalo K. Mapping of amplified c-*myb* oncogene, sister chromatid exchanges and karyotypic analysis of the COLO 205 colon carcinoma cell line. ***Cancer Genet Cytogenet.*** 18: 251-264, 1985.

42. Pohjanpelto P, Hölttä E, Jänne O, Knuutila S, Alitalo K. Amplification of ornithine decarboxylase gene in response to polyamine starvation in CHO cells. ***J Biol Chem.*** 260: 8532-8537, 1985.

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