EXHIBIT 1

CURRICULUM VITAE

NAME: **Joseph Schlessinger, Ph.D.**

BORN: March 26, 1945

LABORATORY ASSIGNMENT: Yale University School of Medicine
Department of Pharmacology
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EDUCATION:

1965 - 1968	B.Sc. in Chemistry and Physics, Magna Cum Laude The Hebrew University, Jerusalem
1968 - 1969	M.Sc. in Chemistry, Magna Cum Laude The Hebrew University, Jerusalem
1970 -1974	Ph.D. Thesis on "Study of Chemical and Biological Systems by Circular Polarization of Fluorescence," Department of Chemical Physics, The Weizmann Institute of Science, Rehovot, Israel

CAREER:

1974 - 1976	Postdoctoral Associate at the School of Applied and Engineering Physics and Department of Chemistry, Cornell University, Ithaca, NY
1977 - 1978	Visiting Scientist at the Immunology Branch of the National Cancer Institute of the National Institutes of Health, Bethesda, MD
1978 - 1980	Senior Scientist, Department of Chemical Immunology The Weizmann Institute of Science, Rehovot, Israel
1980 - 1985	Associate Professor, Department of Chemical Immunology The Weizmann Institute of Science, Rehovot, Israel
1985 - 1991	Professor, Department of Chemical Immunology The Ruth and Leonard Simon Professor of Cancer Research The Weizmann Institute of Science, Rehovot, Israel
1985 - 1990	Research Director, Rorer Biotech. Inc., Rockville, MD. and King of Prussia, PA
1991	Founder, SUGEN, Inc.
1990 - 2001	Professor and Chairman, Department of Pharmacology The Milton and Helen Kimmelman Chair NYU Medical Center
1998 - 2001	Director of the Skirball Institute for Biomolecular Medicine NYU Medical Center
2001	Founder, Plexxikon Inc.
2001 - Present	Professor and Chairman, Department of Pharmacology The William H. Prusoff Professor and Chair Yale University School of Medicine
2008	Founder, Kolltan, Inc.

PROFESSIONAL HONORS AND NAMED LECTURES:

1973 Michael Landau Prize for Ph.D. Thesis
1980 Sara Leedy Prize
1982 Elected to EMBO
1983 Hestrin Prize
1984 Levinson Prize
1986 Keynote Presidential Lecture of the Endocrine Society
1988 The Fourth Kroc Lecture, Joslin Center, Harvard Medical School
1993 The E.J. Cohn Lecture, Harvard Medical School
1993 The E. Fisher Lecture, University of Geneva
1993 The Lamport Lecture, University of Seattle, Washington
1994 The Harvey Lecture, Rockefeller University, New York
1994 The Deans lecture, Mount Sinai Medical School, New York
1994 Opening Keynote Lecture, American Society for Biochemistry and Molecular Biology, Washington, D.C.
1994 The Feigen Lecture, Stanford University Medical School
1994 The Randall Lecture, University of Pennsylvania
1995 Sigma-Tau Lecture, Rome
1995 Opening Keynote Lecture: HHMI Symposium on Signal Transduction
1995 Opening Keynote Lecture, Whitehead Institute Symposium
1995 The Ciba-Drew Award
1995 Antoine Lacassagne Prize
1996 The Lindner Lecture, Weizmann Institute
1997 The Burroughs Wellcome Lecture, Indiana University
1998 The Juan March Lecture, Madrid, Spain
1999 The Distinguished Service Award, Miami Nature Biotechnology
1999 The Bayer Lecture, University of California, Berkeley
1999 The Sixth Ray A. and Robert L. Kroc Lecture University of Massachusetts Medical School
1999 Honorary Member, The Japanese Biochemical Society
2000 Elected to Neurosciences Research Program, La Jolla, California
2000 The NIH Director's Lecture
2000 The Distinguished Speaker Program, University of Texas Health Science Center
2000 Elected to the National Academy of Science
2000 Sixteenth Annual Kenneth F. Naidorf Memorial Lecture, Columbia University
2000 The Taylor Prize
2000 The Severo Ochoa Lecture, Madrid, Spain
2001 Elected to the American Academy of Arts and Sciences
2001 The First Alton Meister Memorial Lecture, Weil Medical College of Cornell University
2001 The Fritz Lipmann Lecture, German Society for Biochemistry and Molecular Biology
2002 Honorary Doctor of Philosophy, Honoris Causa, University of Haifa
2003 Aventis Perspective Lecture, Frankfurt, Germany
2003 The Karl Beyer Lectures, University of Wisconsin, Madison
2003 The Asher Rothstein Lecture, The Hospital of Sick Children Research Institute, Toronto, Canada
2004 Elected to the European Academy of Sciences
2005 Elected to the Institute of Medicine of the National Academies
2005 Distinguished Lecture on Molecular Targets for Cancer Prevention, AACR, Baltimore, Maryland
2006 The 33rd Annual Calbiochem–UCSD Lectureship Series
2006 Dan David Prize
2006 The 13th John F. Enders Lecture, Harvard Medical School
2006 The 41st Annual Mager Lecture, Hebrew University
2006 Elected as a foreign member of the Russian Academy of Sciences
2006 Inaugural Pfizer Lecture, Ann Arbor, Michigan
2006 The Keith Porter Lecture, ASCB Annual Meeting, San Diego, California

2008 Elected as a foreign member of the Croatian Academy of Science
2008 NIH-WALS Lecture, Bethesda, Maryland.
2008 Helen Coley-Nauts Lecture, Moscow State University
2008 24th Medical Scientist Lecture Series, UC Irvine
2009 Medal of Danica Hrvatska Order, Republic of Croatia
2009 Ef Racker Lecture in Biology and Medicine, Cornell University

EDITORIAL BOARDS (Past and present):

EMBO Journal
Cell
Molecular Cell
Genes and Development
Molecular and Cellular Biology
Molecular Biology of the Cell
Journal of Biological Chemistry
Cancer Research
Journal of Cell Biology
Growth Factors
Protein Engineering
Cell Growth & Differentiation
Journal of Cell Physiology

PUBLICATIONS:

1. A.Y. Meyer and J. Schlessinger. Three chromophore compounds. I. Reductive transformations of the 3,5-diaryl-2cyclohexen-1-ones. Israel J. Chem. 8, 671 (1970).
2. A.Y. Meyer, J. Schlessinger and E.D. Bergmann. Composes a trois chromophores. II. Analyze geometriques des cyclohexanones flexibles. Chim. Phys. 68, (1971).
3. A.Y. Meyer and J. Schlessinger. Three chromophore compounds. III. Stereochemical studies of 3,5-disubstituted cyclohexanones. Tetrahedron 27, 2191 (1971).
4. J. Schlessinger and I.Z. Steinberg. Circular polarization of fluorescence of probes bound to chymotrypsin. Change in asymmetric environment upon electronic excitation. Proc. Natl. Acad. Sci. USA 69, 769 (1972).
5. A. Gafni, J. Schlessinger and I.Z. Steinberg. Fluorescence and optical activity of acridine dyes bound to poly-A and DNA. Israel J. Chem. 11, 423 (1973).
6. J. Schlessinger and A. Levitzki. Molecular basis of negative cooperativity in rabbit muscle glyceraldehyde-3-phosphate dehydrogenase. J. Mol. Biol. 82, 547 (1974).
7. J. Schlessinger, I.Z. Steinberg and I. Pecht. Antibody-hapten interactions: Circular and linear polarization of the fluorescence of dansyl bound to anti-dansyl antibodies. J. Mol. Biol. 87, 725 (1974).
8. I.Z. Steinberg, J. Schlessinger and A. Gafni. Application of circular polarization of luminescence to the study of peptides, polypeptides and proteins. In: Peptides, Polypeptides and Proteins, eds. E.R. Blout, F.A. Bovey, M. Goodman and N. Lotan (John Wiley & Sons, Inc., 1974) pp. 351-369.
9. J. Schlessinger and A. Warshel. Calculation of CD and CPL spectra as a tool for evaluation of the conformational differences between ground and excited states of chiral molecules. Chem. Phys. Lett. 28, 380 (1974).
10. J. Schlessinger, A. Gafni and I.Z. Steinberg. Optical rotary power in the ground state and electronically excited state of diketopiperazines containing aromatic side-chains. J. Am. Chem. Soc. 96, 7396 (1974).
11. A. Levitzki and J. Schlessinger. Cooperative ligand binding in a dimerizing system. Biochemistry 13, 5214 (1974).
12. D. Givol, I. Pecht, J. Hochman, J. Schlessinger and I.Z. Steinberg. Conformational changes in the Fab and Fc of the antibody as a consequence of antigen binding. In: Progress in Immunology II, Vol. 1, eds. Brent and Holbrow (North-Holland Publ. Co., 1974) pp. 39-48.
13. J. Schlessinger, I.Z. Steinberg and A. Levitzki. A comparative study of NAD+ binding sites in dehydrogenases by circular polarization of fluorescence. J. Mol. Biol. 91, 523-528 (1975).
14. J. Schlessinger, R.S. Roche and I.Z. Steinberg. A study of subtilisin types Novo and Carlsberg by circular polarization of fluorescence. Biochemistry 14, 255-262 (1975).
15. A. Grinvald, J. Schlessinger, I. Pecht and I.Z. Steinberg. Homogeneity and variability in the structure of azurin molecules studied by fluorescence decay and circular polarization. Biochemistry 14, 1921 (1975).
16. A. Gafni, H. Hardt, J. Schlessinger and I.Z. Steinberg. Circular polarization of chlorophyll in solution and in native structure. Biophys. Biochem. Acta 387, 256-264 (1975).
17. J. Schlessinger, I.Z. Steinberg, D. Givol, J. Hochman and I. Pecht. Antigen induced conformational changes in antibodies and their Fab fragments studied by circular polarization of fluorescence. Proc. Natl. Acad. Sci. USA 72, 2775-2779 (1975).
18. J. Schlessinger, I.Z. Steinberg, D. Givol and J. Hochman. Subunit interaction in antibodies and antibody fragments studied by circular polarization of fluorescence. FEBS Lett. 52, 231-235 (1975).
19. J.-C. Jaton, H. Huser, D.G. Braun, D. Givol, I. Pecht, and J. Schlessinger. Conformational changes induced in a homogeneous anti-type III pneumoccocal antibody by oligoaccharides of increasing size. Biochemistry 14, 5312-5325 (1975).
20. A. Gafni, J. Schlessinger and I.Z. Steinberg. Variation of the linear polarization across the emission band of nicotinamide 1,N°-ethenoadenid dinucleotide bound to dehydrogenases. J. Am. Chem. Soc. 101, 463-467 (1979).
21. J.-C. Jaton, H. Huser, W.F. Riesen, J. Schlessinger and D. Givol. The binding of complement by complexes formed between a rabbit antibody and oligosaccharides of increasing size. J. Immunol. 116, 1363-1366 (1976).
22. W.F. Riesen, J. Schlessinger and J.-C. Jaton. Binding of phosphorylcholin to an IgM Waldenstrom studied by fluorescence spectroscopy and circular dichroism. Biochemistry 15, 3391-3395 (1976).
23. J. Schlessinger, D.E. Koppel, D. Axelrod, K. Jacobson, W.W. Webb and E.L. Elson. Lateral transport on cell membranes. The mobility of Concanavalin A receptors on myoblasts. Proc. Natl. Acad. Sci. USA 73, 2409-2413 (1976).

24. E.L. Elson, J. Schlessinger, D.E. Koppel, D. Axelrod and W.W. Webb. Measurement of lateral transport on cell surfaces. In: Membranes and Neoplasia: New Approaches and Strategies. (Alan R. Liss. Inc., N.Y. 1976) pp. 137-147.
25. D. Axelrod, D.E. Koppel, J. Schlessinger, E.L. Elson and W.W. Webb. Mobility measurements by analysis of fluorescence photobleaching recovery kinetics. Biophys. J. 16, 1055-1069 (1976).
26. J. Schlessinger, D. Axelrod, D.E. Koppel, E.L. Elson and W.W. Webb. Lateral transport of proteins and lipid probe on myoblast plasma membrane. Science 195, 307-309 (1977).
27. D.E. Koppel, D. Axelrod, J. Schlessinger, E.L. Elson and W.W. Webb. Dynamics of fluorescence marker as a probe of mobility. Biophys. J. 16, 1315-1329 (1976).
28. D. Axelrod, P. Ravdin, D.E. Koppel, J. Schlessinger, W.W. Webb, E.L. Elson and T.R. Podleski. Lateral motion of fluorescent-labeled acetyocholine receptors in membrane of developing muscle fibers. Proc. Natl. Acad. Sci. USA 73, 4594-4598 (1976).
29. J. Schlessinger, H. Metzger, W.W. Webb and E.L. Elson. The lateral motion and valence of Fc receptors on rat peritoneal mast cells. Nature 264, 550-552 (1976).
30. H. Metzger, E.L. Elson, C. Isersky, M. Mendoza, S. Newman, G. Rossi and J. Schlessinger. Valence, mobility and membrane integration of the cell surface receptor for immunoglobulin. Proc. IX Int. Congr. Allergology, Buenos Aires (Oct. 1977).
31. J. Schlessinger, E.L. Elson, W.W. Webb, I. Yahara, U. Rutishauser and G.M. Edelman. Receptor diffusion on cell surface after modulation by locally bound Con A. Proc. Natl. Acad. Sci. USA 74, 1100-1114 (1977).
32. J. Schlessinger, L.S. Barak, G.G. Hames, K.M. Yamada, I. Pastan, W.W. Webb and E.L. Elson. Mobility and distribution of a cell surface glycoprotein and its interaction with other membrane components. Proc. Natl. Acad. Sci. USA 74, 2909-2913 (1977).
33. D. Wolf, J. Schlessinger, E.L. Elson, W.W. Webb, R. Blumenthal and P. Henkart Diffusion and patching of macromolecules on planar lipid bilayer membranes. Biochemistry 16, 3476-3483 (1977).
34. E.L. Elson and J. Schlessinger. Long range motions on cell surfaces. In: The Neurosciences: Fourth Study Program. eds. F.O. Schmidt and F. Worden, Cambridge, Ma.: (The MIT Press) pp. 691-701 (1979).
35. J. Schlessinger and I.Z. Steinberg. Heterogeneity of protein fluorescence as revealed by CPL spectroscopy. Biophys. J. 19, 80-82 (1977).
36. Y. Shechter, J. Schlessinger, S. Jacobs, K.S. Chang and P. Cuatrecasas. Fluorescent labeling of hormone receptors on viable cells: The preparation and properties of highly fluorescent derivatives of epidermal growth factor and insulin. Proc. Natl. Acad. Sci. USA 75, 2135-2139 (1978).
37. J. Schlessinger, Y. Shechter, M.C. Willingham and I. Pastan. Direct visualization of the binding aggregation and internalization of insulin and epidermal growth factor on living fibroblastic cells. Proc. Natl. Acad. Sci. USA 75, 2659-2663 (1978).
38. J. Schlessinger, Y. Shechter, P. Cuatrecasas and I. Pastan. Quantitative determination of the lateral diffusion coefficients of the hormone receptor complexes of insulin and epidermal growth factor on the plasma membrane of cultured fibroblasts. Proc. Natl. Acad. Sci. USA 75, 5353-5357 (1978).
39. F.R. Maxfield, J. Schlessinger, Y. Shechter, I. Pastan and M.C. Willingham. Insulin, epidermal growth factor and macroglobulin rapidly collect in the same patches on the surface of cultured fibroblasts and are internalized together. Cell 14, 805-810 (1978).
40. J. Schlessinger. Receptor aggregation as a mechanism for transmembrane signaling: Models for hormone action. In: Physical Chemical Aspects of Cell Surface Events in Cellular Regulation (eds. R. Blumenthal and C. Delisi, Elsevier North Holland, Amsterdam) pp. 89-111 (1979).
41. Y. Shechter, L. Hernandez, J. Schlessinger and P. Cuatrecasas. Epidermal growth factor: Local aggregation of hormone receptor complexes is required for activation. Nature 278, 835 (1979).
42. S.W. deLaat, P.T. Van der Saag, E.L. Elson and J. Schlessinger. Lateral mobility or membrane lipids and proteins during the cell cycle of neuroblastoma cells. Proc. Natl. Acad. Sci. USA 77, 1526-1528 (1980).
43. S.W. deLaat, P.T. Van der Saag, E.L. Elson and J. Schlessinger. Lateral mobility of membrane components in differentiating neuroblastoma cells. Biochim. Biophys. Acta 558, 247-250 (1979).
44. P. Dragsten, P. Henkart, R. Blumenthal, J. Weinstein and J. Schlessinger. Lateral diffusion of surface immunoglobulin, Thy-1 antigen, and A lipid probe in lymphocyte plasma membrane. Proc. Natl. Acad. Sci. USA 76, 5163-5167 (1979).
45. J. Schlessinger and E.L. Elson. Fluorescence methods for studying membrane dynamics. In: Biophysics methods of Exp. Physics. eds. E. Ehrenstein and H. Lecar, Academic Press, N.Y., 20, 197-226 (1982).
46. J. Schlessinger and Y. Shechter. Possible role for receptor motion in the mechanism of action of insulin and epidermal growth factor. In: Hormonal Control of Epithelial Transport. INSERM 85, 55-62 (1979).

47. T.R. Podleski, J. Greenberg, J. Schlessinger and K.M. Yamada. Fibronectin delays the fusion of L6 myoblasts. Exp. Cell. Res. 122, 317-326 (1979).
48. J. Schlessinger and E.L. Elson. Quantitative methods for studying the mobility and distribution of receptors on viable cells. In: Receptors and Recognition. eds. P. Cuatrecasas and M.F. Greaves, Chapman and Hall, London 9, 158-170 (1980).
49. F.R. Maxfield, M.C. Willingham, J. Schlessinger, P.J.A. Davies and I. Pastan. In: Hormones and Cell Cultures. Cold Spring Harbor Conferences on Cell Proliferation 6, 159-167 (1979).
50. A. Levi, Y. Shechter, E.J. Neufeld and J. Schlessinger. Mobility, clustering and transport of nerve growth factor in embryonal sensory cells and in a sympathetic cell line. Proc. Natl. Acad. Sci. USA 77, 3465-3473 (1980).
51. J. Schlessinger, A. Levi, I. Yuli, M. Gabbay and Y. Shechter. Common and distinct aspects in the regulation of action of specific growth factors. In: Control Mechanism in Animal Cells. (eds. L. Jimenez de Asua, R. Levi- Montalcini, R. Shields and S. Iacobelli. Raven Press, N.Y.) pp. 27-34 (1980).
52. J. Schlessinger, E. Van Obberghen and G.R. Kahn. Insulin and antibodies against insulin receptors cap on the membrane of cultured human lymphocytes. Nature 286, 729-731 (1980).
53. J. Schlessinger. The mechanism and role of hormone-induced clustering of membrane receptors. Trends in Biochem. Sci. 5, 210-214 (1980).
54. Y. Yarden, M. Gabbay and J. Schlessinger. Primary amines do not prevent the endocytosis of epidermal growth factor into 3T3 fibroblasts. Biophys. Biochem. Acta 674, 188-203 (1981).
55. J. Schlessinger. Dynamics of hormone receptors on cell membrane. Ann. N.Y. Acad. Sci. 366, 274-284 (1981).
56. J. Schlessinger and B. Geiger. Epidermal growth factor induces redistribution of actin and -Actinin in human epidermal carcinoma cells. Exp. Cell. Res. 134, 273-279 (1981).
57. D. Tramontano, A. Avivi, F.S. Ambesi-Impiombato, L. Barak, B. Geiger and J. Schlessinger. Thyrotropin induces changes in the morphology and the organization of microfilament structure in cultured thyroid cells. Exp. Cell. Res. 137, 269-275 (1982).
58. A.B. Schreiber, I. Lax, Y. Yarden, Z. Eshhar and J. Schlessinger. Monoclonal antibodies against the receptor for epidermal growth factor induce early and delayed effects of epidermal growth factor. Proc. Natl. Acad. Sci. USA 78, 7535-7539 (1981).
59. A.B. Schreiber, Y. Yarden, Z. Eshhar and J. Schlessinger. A non-mitogenic analogue of epidermal growth factor, enhances the phosphorylation of endogenous membrane proteins. Biochim. Biophys. Res. Commun. 101, 517-523 (1981).
60. J. Schlessinger, Y. Yarden, L. Barak, I. Lax, M. Gabbay and B. Geiger. Epidermal growth factor: New facts concerning its mode of action. Hormone and Cell Regulation 5, 197-207 (1981). eds. J.E. Dumont and J. Nunez, Elsevier/North Holland, Biomedical Press.
61. A. Avivi, D. Tramontano, F.S. Ambesi-Impiombato and J. Schlessinger. Direct visualization of membrane clustering and endocytosis of thyrotropin into cultured thyroid cells. Mol. Cell Endocrin. 25, 55-71 (1982).
62. A. Avivi, D. Tramontano, F.S. Ambesi-Impiombato and J. Schlessinger. cAMP modulates thyrotropin-receptor clustering and thyrotropin-activity in cultured thyroid cells. Science 214, 1237-1239 (1981).
63. R. Zidovetzki, Y. Yarden, J. Schlessinger and T. Jovin. Rotational diffusion of epidermal growth factor complexed to its surface receptor reflects the rapid microaggregation and endocytosis of occupied receptors. Proc. Natl. Acad. Sci. USA 78, 6981-6985 (1981).
64. I. Vlodavsky, A. Levi, I. Lax, Z. Fuks and J. Schlessinger. Induction of cell attachment and morphological differentiation in a pheochromocytoma cell line and embryonal sensory cells by the extracellular matrix. Dev. Biol. 93, 285-300 (1982).
65. J. Schlessinger, A.B. Schreiber, I. Lax, Y. Yashu-Gan, T.A. Libermann, G.M. Hillman, A. Levi and Y. Yarden. Molecular steps in the action and regulation of epidermal growth factor: A cellular mitogen. In: Membranes in Growth and Development. Prog. in Clin. and Biol. Res. eds. L. Bolis and J.F. Hoffman. Alan R. Liss, Inc., N.Y. 91, 359-429 (1982).
66. Y. Yarden, A.B. Schreiber and J. Schlessinger. A non-mitogenic analogue of epidermal growth factor induces various early responses mediated by epidermal growth factor. J. Cell Biol. 92, 687-693 (1982).
67. G.M. Hillman and J. Schlessinger. The lateral diffusion of epidermal growth factor complexes to its surface receptors does not account for the thermal sensitivity of patch formation, and endocytosis. Biochemistry 21, 1667-1672 (1982).
68. W.H. Moolenaar, Y. Yarden, S.W. deLaat and J. Schlessinger. Epidermal growth factor-induced Na+ influx in human fibroblasts is electrically silent. J. Biol. Chem. 257, 8502-8506 (1982).

69. A. Avivi, J. Schlessinger, M. Shemesh and B. Geiger. The interaction of cultured thyroid cells of early bovine embryos with TSH and thyroglobulin. Endocrinology 111, 589-598 (1982).
70. B. Geiger, Z. Avnur and J. Schlessinger. Restricted mobility of membrane constituents in cell-substrate focal contacts of chicken fibroblasts. J. Cell Biol. 93, 495-500 (1982).
71. T.E. Kreis, B. Geiger and J. Schlessinger. The mobility of microinjected fluorescently labeled actin within specific domains of living chicken gizzard cells. Cell 29, 835-845 (1982).
72. J. Schlessinger, A.B. Schreiber, A. Levi, I. Lax, T. Libermann and Y. Yarden. Regulation of cell proliferation by epidermal growth factor. Critical reviews in Biochemistry (CRC), 14, 93-112 (1983).
73. J. Schlessinger, A.B. Schreiber, T.A. Libermann, I. Lax, A. Avivi and Y. Yarden. Polypeptide hormone induced receptor clustering and internalization. In: Cell Membranes: Methods and Reviews. eds. E.L. Elson,W. Frazier and L. Glaser. Plenum Publishing Corp., N.Y., 1, 117-144 (1983).
74. A.B. Schreiber, T. Libermann, I. Lax, Y. Yarden and J. Schlessinger. Biological role of EGF-receptor clustering: Investigation with monoclonal anti-EGF-receptor antibodies. J. Biol. Chem. 258, 846-853 (1983).
75. J. Schlessinger. The lateral and rotational diffusion of the EGF-receptor complex: Relationship to receptor mediated endocytosis. Biopolymers 22, 347-353 (1983).
76. A.B. Schreiber, J. Schlessinger and M. Edidin. Interaction between major histocompatibility complex antigens and epidermal growth factor receptor on human cells. J. Cell Biol. 84, 725-731 (1984).
77. J. Hapgood, T.A. Libermann, A.B. Schreiber, I. Lax, Y. Yarden, Z. Naor and J. Schlessinger. Monoclonal antibodies against EGF-receptor induce prolactin synthesis incultured rat pituitary cells. Proc. Natl. Acad. Sci. USA 80, 645-650 (1983).
78. T. Sherson, T.E. Kreis, J. Schlessinger, U.Z. Littauer, G.G. Borisy and B. Geiger. Dynamic interactions of fluorescently labeled microtubule associated proteins in living cells. J. Cell Biol. 99, 425-434 (1984).
79. A. Komoriya, M. Hortsch, C. Meyers, M. Smith, H. Kanety and J. Schlessinger Biologically active fragments of epidermal growth factor: Localization of a major binding region. Proc. Natl. Acad. Sci. USA 81, 1351-1355 (1984).
80. J. Schlessinger. Mobilities of cell membrane proteins: How are they modulated by the cytoskeleton. Trends in Neuro. Sci. 6, 360-363 (1983).
81. T.A. Libermann, N. Razon, A.D. Bartal, Y. Yarden, J. Schlessinger and M. Soreq Expression of epidermal growth factor receptors in human brain tumors. Cancer Res. 44, 753-760 (1984).
82. Y. Yarden and J. Schlessinger. Phosphoamino acid specificity of the EGF-receptor kinase system in normal mitogenically responsive human cells. Cell Biol. Int. Report 7, 533-534 (1983).
83. M. Hortsch, J. Schlessinger, E. Gootwine and C.G. Webb. Appearance of a functional EGF-receptor kinase during Rodent Embryogenesis. EMBO J. 2, 1937-1941 (1983).
84. C.Ho. Gooi, J. Schlessinger, I. Lax, Y. Yarden, T.A. Libermann and T. Feizi Monoclonal antibody reactive with the human epidermal growth factor receptor recognizes the blood-group A antigen. Bioscience Reports 3, 1045-1052 (1984).
85. M. Burmeister, A. Avivi, J. Schlessinger and M. Soreq. Production of EGF-containing polypeptides in Xenopus oocytes microinjected with submaxillary gland mRNA. EMBO J. 3, 1499-1505 (1984).
86. H. Meiri, I. Zeitoun, H.H. Grunhagen, V. Lev-Ram, A. Eshhar and J. Schlessinger. Monoclonal antibodies associated with sodium channel block nerve impulse and stain nodes of Ranvier. Brain Res. 310, 168-173 (1984).
87. I. Lax, M. Bar-Eli, Y. Yarden, T.A. Libermann and J. Schlessinger. Antibodies to two defined regions of pp60src interact specifically with the EGF-receptor kinase system. Proc. Natl. Acad. Sci. USA 81, 5911-5915 (1984).
88. S. Spiegel, J. Schlessinger and P.H. Fishman. Incorporation of fluorescent ganglosides into human fibroblasts: Mobility, fate and interaction with fibronectin. J. Cell Biol. 99, 699-704 (1984).
89. J. Downward, Y. Yarden, E. Mayes, G. Scrace, N. Totty, P. Stockwell, A. Ullrich, J. Schlessinger and M.D. Waterfield. Close similarity of epidermal growth factor receptor and v-erb-B oncogene protein sequences. Nature 307, 521-526 (1984).
90. J. Schlessinger, I. Lax, Y. Yarden, H. Kanety and T.A. Libermann. Monoclonal antibodies against the membrane receptor for epidermal growth factor: A versatile tool for structural and mechanistic studies. In: Receptors and Recognition Volume on "Antibodies to Receptors: Probes for Receptor, Structure and Function. "Chapman and Hall, London, ed. M. Greaves. 17, 279-303 (1984).
91. J. Schlessinger, I. Lax, S. Gill, R. Kris, T.A. Libermann, M. Bar-Eli, I. Harari and Y. Yarden. The membrane receptor for EGF: Structural and functional studies In: Mechanisms of Receptor Regulation, a

volume in the Smith Kline and French Laboratories Research Symposia. eds. S.T. Crooke and G. Poste. Plenum Press, N.Y. (1984).

92. Y. Yarden, I. Harari and J. Schlessinger. Purification of an active EGF-receptor kinase with monoclonal anti-receptor antibodies. J. Biol. Chem. 260, 315-319 (1985).
93. A. Ullrich, L. Coussens, J.S. Hayflick, T.J. Dull, A. Gray, J. Schlessinger, J. Downward, E.L.V. Mayes, N. Whittle, M.D. Waterfield and P.H. Seeburg. Human epidermal growth factor receptor cDNA sequence and aberrant expression of the amplified gene in A-431 epidermoid carcinoma cells. Nature 309, 418-425 (1984).
94. R. Kris, A. Avivi, M. Bar-Eli, P. Carmi, J. Schlessinger and A. Raz. The expression of Ki-ras oncogene in tumor cell variants exhibiting different metastatic capabilities. Inter. J. Cancer 35, 227-230 (1985).
95. T.A. Libermann, H.R. Nussbaum, N. Razon, R. Kris, I. Lax, M. Soreq, N. Whittle, M.D. Waterfield, A. Ullrich and J. Schlessinger. Amplification, enhanced expression and possible rearrangement of the EGF-receptor gene in primary human brain tumors of glial origin. Nature 313, 144-147 (1985).
96. H.C. Gooi, E.F. Hounsell, I. Lax, R.M. Kris, T.A. Libermann, J. Schlessinger, J.D. Sato, T. Kawamoto, J. Mendelsohn and T. Feizi. Bioscience Reports 5, 83-94 (1985).
97. R. Kris, I. Lax, M. Gullick, M.D. Waterfield, A. Ullrich, M. Fridkin and J. Schlessinger. Antibodies against a synthetic peptide as a probe for the kinase activity of the avian EGF-receptor and V-erb-B proteins. Cell 40, 619-625 (1985).
98. Y. Yarden and J. Schlessinger. EGF-receptor self phosphorylation is mediated by an intermolecular allosteric process. Growth Factors in Biology and Medicine. Pitman Publishing Ltd. London. 116, 23-45 (1985).
99. B. Geiger, Z. Avnur, T.E. Kreis, and J. Schlessinger. The dynamics of cytoskeletol organization in areas of cell contact in "Cell and Muscle mortality", ed. Jerry W. Shaw, Plenum Press New York and London. 5, 195-228 (1984).
100. T.E. Kreis, Z. Avnur, J. Schlessinger and B. Geiger. The dynamic properties of membrane-cytoskeleton interaction in cell substrate focal contacts of cultured fibroblasts. Proc. of Cold Spring Harbor Symposia (1984).
101. R.M. Kris, T.A. Libermann, A. Avivi and J. Schlessinger. Growth factors, growth factor receptors and oncogenes. Biotechnology 3, 135-140 (1985).
102. Lax, R. Kris, I. Sasson, A. Ullrich, M.J. Hayman, H. Beug and J. Schlessinger. Activation of C-erb-B in avian leukosis virus-induced erythroblastosis leads to the expression of a truncated EGF-receptor kinase. EMBO J. 4, 3179-3182 (1985).
103. E. Livneh, L. Glazer, D. Segal, J. Schlessinger and B.-Z. Shilo. The Drosphila EGF-receptor gene homolog: Conversion of both hormone binding and kinase domains. Cell 40, 599-607 (1985).
104. J. Schlessinger. Purification and functional analysis of EGF-receptor with immunological probes in "Monoclonal antibodies 84: Biological and clinical applications" Kurtis, Milano, Ed. A. Pinchera, G. Doria, F. Dammacco, A. Bargellesi, pp. 313-329 (1984).
105. T.A. Libermann, H.R. Nussbaum, N. Razon, R. Kris, I. Lax, H. Soreq, N. Whittle, M.D. Waterfield, A. Ullrich and J. Schlessinger. Amplification and overexpression of the EGF-receptor gene in primary human glioblastomas. In "Growth Factors: Structure and Function: C.R. Hopkins and C.R. Hughes. The Company of Biologists, Ltd., J. Cell Sci. Suppl. 3, 161-173 (1985).
106. L. Coussens, T.L. Yang-Feng, Y.-C. Liao, E. Chen, A. Gray, J. McGrath, P.H. Seeburg, T.A. Libermann, J. Schlessinger, U. Francke, A. Levinson and A. Ullrich. Tyrosine-kinase receptor with extensive homology to EGF-receptor shares chromosomal location with neu oncogene. Science 230, 1132-1139 (1985).
107. P.J. Parker, J. Downward, H.S. Earp, W. Gullick, P. Seeburg, A. Ullrich, R. Kris, J. Schlessinger, and M.D. Waterfield. Structure and function of the EGF receptor and its interaction with protein kinases A and C. In: Cancer Cells 3: Growth Factors and Transformation, Cold Spring Harbor Laboratory, New York, 353-358. (1985).
108. W.J. Guillick, J. Downward, P.J. Parker, N. Whittle, R. Kris, J. Schlessinger, A. Ullrich, and M.D. Waterfield. The structure and function of the epirdermal growth factor receptor studied by using antisynthetic peptide antibodies. Proceedings of the Royal Society of London 226, 127-134. (1985).
109. A. Ullrich, A.W. Tam, M.D. Waterfield, Y. Yarden, T.A. Libermann, and J. Schlessinger. Structural features of epidermal growth factor precursor and receptor domains and their possible significance. In: Leukemia: Recent Advances in Biology and Treatment, Alan R. Liss, Inc., 277-292. (1985).
110. K. Miller, J. Beardmore, H. Kanety, J. Schlessinger and C.R. Hopkins. Localization of the epidermal growth factor (EGF) receptor within the endosome of EGF-stimulated epidermoid carcinoma (A-431) cells. J. Cell Biol. 102, 500-509 (1986).

111. E.G. Bremer, J. Schlessinger and S. Itiroh Hakamori. Ganglioside-mediated modulation of cell growth: Specific effects of GM3 on tyrosine phosphorylation of the epidermal growth factor receptor. J. Biol. Chem. 261, 2434-2440 (1986).
112. R. Zidovezki, Y. Yarden, J. Schlessinger and T.M. Jovin. Micro-aggregation of hormone-occupied epidermal growth factor receptors on plasma membrane preparations. EMBO J. 5, 247-250 (1986).
113. E. Livneh, M. Benveniste, R. Prywes, S. Felder, Z. Kam and J. Schlessinger. Large deletions in the cytoplasmic kinase domain of EGF-receptor do not affect its lateral mobility. J. Cell Biol. 103, 327-331 (1986).
114. E. Livneh, R. Prywes, O. Kashles, N. Reiss, I. Sasson, Y. Mory, A. Ullrich and J. Schlessinger. Reconstitution of the human EGF-receptor and its deletion mutants in cultured hamster cells. J. Biol. Chem. 261, 12490-12497 (1986).
115. R. Prywes, E. Livneh, A. Ullrich and J. Schlessinger. Mutations in the cytoplasmic domain of EGF-receptor affect EGF-binding and receptor internalization. EMBO J. 5, 2179-2190 (1986).
116. H. Reidel, T.J. Dull, J. Schlessinger and A. Ullrich. A chimeric receptor allows insulin to stimulate tyrosine kinase activity of epidermal growth factor receptor. Nature 324, 68-70 (1986).
117. N. Reiss, H. Kanety and J. Schlessinger. Five enzymes of the glycolytic pathway serve as substrates for purified EGF-receptor kinase. Biochem. J. 239, 691-697 (1986).
118. J. Schlessinger. Regulation of cell growth by the EGF-receptor in "Oncongenes and growth control" eds. Kahn, P. and Graf., T. Springer-Verlag, Heidelberg, 116. 77-84 (1986).
119. J. Schlessinger. Allosteric regulation of the EGF-receptor kinase. J. Cell Biol. 103, 2067-2072 (1986).
120. Y. Yarden and J. Schlessinger. Self-phosphorylation of EGF-receptor: Evidence for a model of intermolecular allosteric activation. Biochemistry 26, 1434-1442 (1987).
121. Y. Yarden and J. Schlessinger. Epidermal growth factor induces rapid, reversible aggregation of the purified EGF-receptor. Biochemistry 26, 1443-1451 (1987).
122. J.L. Carpentier, A.R. Rees, M. Gregoriou, R. Kris and J. Schlessinger. Subcellular distribution of external and internal domains of EGF-receptor in A-431 cells. Exp. Cell Res. 166, 312-326 (1986).
123. E. Chen, L. Coussens, Y.C. Liao, D. Smith, T.L. Yang-Feng, J. McGrath, C. Van Beversen, I. Verma, T. Libermann, J. Schlessinger, A. Francke, A. Levinson and A. Ullrich. Structural features of growth factor receptors with oncogenic potential. Biochem. Soc. Symp. 52, 65-82 (1986).
124. M. Popliker, A. Shatz, A. Avivi, A Ullrich, J. Schlessinger and C. Webb. Onset of endogenous synthesis of epidermal growth factor in neonatal mice. Develop. Biol. 119, 38-44 (1987).
125. A. Ullrich, H. Riedel, Y. Yarden, L. Coussens, A. Gray, T. Dull, J. Schlessinger, M.D. Waterfield, and P.J. Parker. Protein Kinases in cellular signal transduction: Tyrosine kinase growth factor receptors and protein kinase C. Cold Spring Harbor Symposia on Quantitative Biology. 51, 713-724. (1986).
126. H. Riedel, Y. Yarden, L. Coussens, L. Lee, A. Gray, T. Dull, J. Schlessinger, A. Ullrich. Structural and functional analysis of cell surface receptors with tyrosine kinase activity. In: Cell Cylce and Oncogenes, Tanner, W. and Gallwitz, D., Springer Verlag, Heidelberg, 157-171.
127. H. Reidel, J. Schlessinger and A. Ullrich. A chimeric ligand binding v-erb-B/EGF-receptor retains transforming potential. Science 236, 197-200 (1987).
128. O. Bernard, B. Fazekas de St. Groth, A. Ullrich, W. Greene and J. Schlessinger Specific interleukin-2 binding to an oncogenic hybrid interleukin 2-epidermal growth factor receptor molecule. Proc. Natl. Acad. Sci. USA 84, 2125-2129 (1987).
129. T.A. Libermann, R. Friesel, M. Jaye, R.M. Lyall, B. Westermark, W. Drohan, A. Schmidt, T. Maciag and J. Schlessinger. An angiogenic growth factor is expressed in human glioma cells. EMBO J. 6., 1627-1632 (1987).
130. M. Tal, C.R. King, M.H. Kraus, A. Ullrich, J. Schlessinger and D. Givol. The human HER2 (neu) promoter: evidence for multiple mechanisms for transcriptional initiation. Mol. Cell Biol. 7, 2597-2601 (1987).
131. E. Livneh, N. Reiss, E. Berent, A. Ullrich and J. Schlessinger. An insertional mutant of EGF-receptor allows dissection of diverse receptor functions. EMBO J. 6, 2669-2676 (1987).
132. R.M. Kris, R. Hazan, J. Villines, T. Moody and J. Schlessinger. Identification of the bombesin-receptor on murine and human cells by cross-linking experiments. J. Biol. Chem. 262, 11215-11220 (1987).
133. M. Bajaj, M.D. Waterfield, J. Schlessinger, W.R. Taylor, and T. Blundel. On the tertiary structure of the extracellular domains of the epidermal growth factor and insulin receptors. Biochem. Biophys. Acta 916, 220-226 (1987).
134. Y. Yarden, W.J. Kuang, T. Yang-Feng, L. Coussens, S. Munemitsu, T.J. Dull, J. Schlessinger, U. Francke and A. Ullrich. Human proto-oncogene c-kit: A new cell surface receptor-tyrosine kinase for an unidentified ligand. EMBO J. 6, 3341-3351 (1987).

135. A.M. Honegger, T.J. Dull, S. Felder, E. Van-Obberghen, F. Bellot, D. Szapary, A. Schmidt, A. Ullrich and J. Schlessinger. Point mutation in the ATP binding site of EGF-receptor abolishes protein tyrosine-kinase activity and alters normal receptor cellular routing. Cell 51, 199-209 (1987).

136. A.M. Honegger, D. Szapary, A. Schmidt, E. Van-Obberghen, T.J. Dull, S.L. Massoglia, A. Ullrich and J. Schlessinger. A mutant EGF-receptor with defective tyrosine-kinase is unable to stimulate proto-oncogene expression and DNA synthesis. Mol. Cell Biol. 7, 4568-4571 (1987).

137. R.M. Hudziak, J. Schlessinger and A. Ullrich. Increased expression of the putative growth factor receptor p185HER2 causes transformation and tumorigenesis of NIH-3T3 cells. Proc. Natl. Acad. Sci. USA 6, 3341-3351 (1987).

138. P.P. DiFiore, J.H. Pierce, T.P. Fleming, R. Hazan, A. Ullrich, C.R. King, J. Schlessinger and S.A. Aaronson. Overexpression of the human EGF-receptor confers an EGF-dependent transformed phenotype to NIH-3T3 cells. Cell 51, 1063-1070 (1987).

139. J.H. Pierce, M. Ruggiero, T.P. Fleming, P.P. DiFiore, J.S. Greenberger, J. Schlessinger, G. Rovera and S.A. Aaronson. Signal transduction through the EGF-receptor transfected into interleukin-3 dependent hematopoietic cells. Science 239, 628-631 (1988).

140. I. Lax, W.H. Burgess, F. Bellot, A. Ullrich, J. Schlessinger and D. Givol. Localization of a major receptor binding domain for epidermal growth factory by affinity labeling. Mol. Cell Biol. 8, 1831-1834 (1988).

141. E. Livneh, T.J. Dull, R. Prywes, A. Ullrich and J. Schlessinger. Release of phorbol ester-induced mitogenic block by mutation at Thr654 of EGF-receptor. Mol. Cell Biol. 8, 2302-2308 (1988)

142. M. Nister, T.A. Libermann, C. Betsholtz, M. Pettersson, L. Claesson-Welsh, C.H. Heldin, J. Schlessinger and B. Westermark. Expression of messenger RNAs for platelet-derived growth factor and transforming growth factor- and their receptors in human malignant glioma cell lines. Cancer Research 48, 3910-3918 (1988).

143. M. Tal, M. Wetzler, Z. Josepberg, A. Deutch, M. Gutman, D. Assaf, A.Ullrich, Y. Shiloh, D. Givol and J. Schlessinger. Sporadic amplification of the HER2/neu proto-oncogene in adenocarcinoma of various tissues. Cancer Research (1988) 48, 1517-1520 (1988).

144. W.H. Moolenaar, A.J. Bierman, B.C. Tilly, I. Verlaan, A.M. Honegger, A. Ullrich and J. Schlessinger. A point mutation at the ATP binding site of the EGF-receptor abolishes signal transduction. EMBO J. 7, 707-710 (1988).

145. C. Cochet, O. Kashles, E.M. Chambaz, I. Borrello, C.R. King and J. Schlessinger. Demonstration of EGF-induced receptor dimerization in living cells using a chemical covalent cross-linking agent. J. Biol. Chem. 263, 3290-3295 (1988).

146. H. Riedel, S. Massoglia, J. Schlessinger and A. Ullrich. Ligand activation of overexpressed EGF-receptor transforms NIH-3T3 cells. Proc. Natl. Acad. Sci. USA 85, 1477-1481 (1988).

147. M. Jaye, R.M. Lyall, R. Mudd, J. Schlessinger and N. Sarver. Expression of acidic fibroblast growth factor cDNA confers growth advantage and tumorigenesis to Swiss 3T3 cells. EMBO J. 7, 963-969 (1988).

148. T. Moody, R. Kris, M. Berg, G. Fiskum, C.O. Linden and J. Schlessinger. Characterization of receptors for Bombesin/GRP in human and murine cells. Methods Enzymol. (1988).

149. C.R. King, I. Borrello, F. Bellot, P. Comoglio and J. Schlessinger. EGF binding to its receptor triggers a rapid tyrosine phosphorylation of the erbB-2 protein in the mammary tumor cell line (SK-BR-3). EMBO J. 7, 1647-1651 (1988).

150. M. Benveniste, E. Livneh, J. Schlessinger and Z. Kam. Overexpression of epidermal growth factor in NIH-3T3 transfected cells slows its lateral diffusion and rate of endocytosis. J. Cell Biol. 106, 1903-1909 (1988).

151. J. Schlessinger. Epidermal growth factor receptor as a multifunctional allosteric protein. Biochemistry 27, 3119-3123 (1988).

152. I. Lax, A. Johnson, R. Howk, J. Sap, F. Bellot, M. Winkler, A. Ullrich, B. Vennstrom, J. Schlessinger and D. Givol. Chicken EGF-receptor: cDNA cloning expression and differential binding of EGF and TGFa. Mol. Cell Biol. 8, 1970-1978 (1988).

153. A.M. Honegger, T.J. Dull, F. Bellot, E. Van-Obberghen, D. Szapary, A.Schmidt, A. Ullrich and J. Schlessinger. Biological activities of EGF-receptor mutants with individually altered autophosphorylation sites. EMBO J. 7, 3045-3052 (1988).

154. A.M. Honegger, F. Bellot, R. Kris, D. Szapary, E. Van-Obberghen, A.Komoriya, T.J. Dull, A. Ullrich and J. Schlessinger. Kinetic parameters of the tyrosine kinase activity of EGF-receptor mutants with individually altered autophosphorylation sites. EMBO J. 7, 3053-3060 (1988).

155. M. Ruta, R. Howk, G. Ricca, W. Drohan, M. Zabelshanky, G. Laureys, D. Barton, U. Francke, J. Schlessinger and D. Givol. A novel protein tyrosine kinase gene whose expression is modulated during endothelial cell differentiation. Oncogene 3, 9-15 (1988).

156. R. Seger, Y. Yarden, O. Kashles, D. Goldblat, J. Schlessinger and S. Shaltiel. The epidermal growth factor as a substrate for a kinase-splitting membranal proteinase. J. Biol. Chem. 263, 3496-3500 (1988).

157. O. Kashles, D. Szapary, F. Bellot, A. Ullrich, J. Schlessinger and A. Schmidt. Ligand-induced stimulation of EGF-receptor mutants with altered transmembrane regions. Proc. Natl. Acad. Sci. USA 85, 9567-9571 (1988).

158. E. Aboud-Pirak, E. Hurwitz, M.E. Pirak, F. Bellot, J. Schlessinger and M. Sela. Efficacy of antibodies to epidermal growth factor receptor against KB carcinoma in vitro and in nude mice. J. Natl. Cancer Inst. 80, 1605-1611 (1988).

159. K. Khazaie, T. Dull, T. Graf, J. Schlessinger, A. Ullrich, B. Vennstrom. Truncation of the human EGF receptor leads to differential transforming potentials in primary avian fibroblasts and erythroblasts. EMBO J. 7, 3061-3971 (1988).

160. J. Schlessinger. Signal transduction by allosteric receptor oligomerization. Trends in Biochem. Sci. 13, 443-447 (1988).

161. J. Schlessinger, A. Ullrich, A.M. Honegger and W. Moolenaar. Signal transduction by epidermal growth factor. Cold Spring Harbor Symposia on Quantitative Biology. Molecular Biology of Signal Transduction 53, 515-521 (1988).

162. A.M. Honegger, R. Kris, A. Ullrich and J. Schlessinger. Evidence that authophosphorylation of solubilized EGF-receptors is mediated by intermolecular cross-phosphorylation. Proc. Natl. Acad. Sci. USA 86, 925-929 (1989).

163. J. Lee, T.J. Dull, I. Lax, J. Schlessinger and A. Ullrich. HER2 cytoplasmic domain generates normal mitogenic and transforming signals in a chimeric receptor. EMBO J. 8, 176-178 (1989).

164. I. Lax, F. Bellot, R. Howk, A. Ullrich, D. Givol and J. Schlessinger. Functional analysis of the ligand binding site of EGf-receptor utilizing chimeric human/chicken receptor molecules. EMBO J. 8, 421-427 (1989).

165. C.R. King, I. Borrello, L. Porter, P. Comoglio and J. Schlessinger. Ligand-independent self-phosphorylation of EGF receptor and the erbB-2/neu proto-onconge is induced by hypersosmotic shock. Oncogene 4, 13-18 (1989) .

166. J. Lammers, A. Gray, J. Schlessinger and A. Ullrich. Differential signalling potential of insulin-and IGF-1 receptor cytoplasmic domains. EMBO J. 8, 1369-1375 (1989).

167. J.-C. Scimeca, R. Ballotti, F. Alengrin, A.-M. Honegger, A. Ullrich, J. Schlessinger and E. Van Obberghen. Metabolic effects induced by EGF in cells expressing EGF receptor mutants. J. Biol. Chem. 264, 6831-6835 (1989).

168. H. Riedel, S.L. Massaglia, J. Schlessinger and A. Ullrich. Cytoplasmic domain defines biological signal specificity of a chimeric insulin-EGF-receptor. EMBO J. 8, 2942-2954 (1989).

169. I. Lax, F. Bellot, A.M. Honegger, A. Schmidt, A. Ullrich, D. Givol and J. Schlessinger. Domain deletion in the extracellular portion of the EGF-receptor reduces ligand binding and impairs cell surface expression. Cell Regulation 1, 173-188 (1990).

170. E. Aboud-Pirak, E. Hurwitz, F. Bellot, J. Schlessinger, and M. Sela. Inhibition of human tumor growth in nude mice elicited by monoclonal anti EGF-receptor antibodies conjugated with Doxorubicin. Proc. Nat. Acad. Sci. USA 86, 3778- (1989).

171. B.L. Margolis, I. Lax, R. Kris, M. Dombalagian, A.M. Honegger, R. Howk, D. Givol, A. Ullrich and j. Schlessinger. All autophosphorylation sites of EGF receptor and HER2/neu are located in their carboxy-terminal tails: identification of a novel site in EGF receptor. J. Biol. Chem. 264, 10667-10671 (1989).

172. R. Balloti, R. Lammers, J.-C. Scimeca, T. Dull, J. Schlessinger, A. Ullrich, and E. Van Obberghen. Intermolecualr transphosphorylation between insulin receptors and EGF-insulin receptor chimerae. EMBO J. 8, 3303-3309 (1989).

173. R.M. Lyall, A. Zilberstein, A. Gazit, C. Gilon, A. Levitzki and J. Schlessinger. Tyrphostins inhibit EGF-receptor tyrosine kinase activity in living cells and EGF-stimulated cell proliferation. J. Biol. Chem. 264, 14503-14509 (1989).

174. B. Margolis, S.-G. Rhee, S. Felder, R. Lyall, A. Levitzki, A. Ullrich, A. Zilberstein, and J. Schlessinger. EGF-induced tyrosine phosphorylation of phospholipase C-II: a potential mechanism for EGF-receptor signalling. Cell 57, 1101-1107 (1989).

175. M. Benveniste, J. Schlessinger and Z. Kam. Characterization of internalization and endosome formation of EGF in transfected NIH-3T3 cells by computerized image-intensified three-dimensional fluorescence microscopy. J. Cell. Biol. 109, 2105-2115 (1989).

176. F. Bellot, W. Moolenaar, R. Kirs, B. Mirakhur, I. Verlaan, A. Ullrich, J. Schlessinger, and S. Felder. High Affinity epidermal growth factor binding is specifically reduced by a monoclonal antibody, and appears necessary for early responses. J. Cell. Biol. 110, 491-502 (1989).

177. J. R. Downing, B.L. Margolis, A. Zilberstein, R.A. Ashmun, A. Ullrich, C.J. Sherr, and J. Schlessinger. Phospholipase Cγ: A substrate for PDGF receptor kinase, is not phosphorylated on tyrosine during the mitogenic response to CSF-1. EMBO J. 8, 3345-3350 (1989).

178. M. Ruta, W. Burgess, D. Givol, J. Epstein, N. Neiger, J. Kaplow, G. Crumley, C. Dionne, M. Jaye, and J. Schlessinger. The receptor for acidic fibroblast growth factor is related to flg tyrosine kinase. Proc. Natl. Acad, Sci. USA. 86 8722-8726 (1989).

179. B. Margolis, F. Bellot, A.M. Honegger, A. Ullrich, J. Schlessinger, and A. Zilberstein. Tyrosine kinase activity is essential for the association of phospholipase C-γ with the epidermal growth factor receptor. Mol. Cell. Biol. 10, 435-441 (1989).

180. S. Paik, R. Hazan, J. Schlessinger, B. Fisher, E.R. Fisher, R.E. Sass, C. Redmond, J.M. You, S. Kennedy, M.E. Lippman, and C.R. King. Overexpression of erbB-2 protein in breast cancer: Association with increased mortality rates among low risk patient groups. J. Clin. Oncology 8, 103-112 (1990).

181. L. Naldini, D. Cirillo, T.M. Moody, P. Comoglio, J. Schlessinger, and R. Kris. Solubilization of the receptor for the neuropeptide gastrin-releasing peptide (Bombesin) with functional ligand binding properties. Biochemistry 29, 5153-5160 (1990).

182. B.W. Ennis, E.M. Valverius, S.E. Bates, M.E. Lippman, F. Vellot, R. Kris, J. Schlessinger, H. Masui, A. Goldenberg, J. Mendelsohn, and R. B. Dickson. Anti-EGF receptor antibodies inhibit the autocrine stimulated growth of MDA-468 human breast cancer cells. Mol. Endocrinol. 3, 1830-1838 (1990).

183. R. Hazan, B. Margolis, M. Dombalagian, A. Ullrich, A. Zilberstein, and J. Schlessinger. Identification of autophosphorylation sites of HER2/neu. Cell Growth and Diff. 1, 3-7 (1990).

184. A.M. Honegger, A. Schmidt, A. Ullrich and J. Schlessinger. Evidence for EGF-induced intermolecular autophosphorylation of EGF-receptor in living cells. Mol. Cell. Biol. 10, 4035-4044 (1990).

185. W.H. Burgess, C.A. Dionne, J. Kaplow, R. Mudd, R. Friesel, A. Zilberstein, J. Schlessinger and M. Jaye. Characterization of cDNA cloning of a major substrate for HBGF-1 (acidic-FGF) activated tyrosine kinase: phospholipase C-γ. Mol. Cell. Biol. 10, 4770-4777 (1990).

186. A.M. Honegger, A. Schmidt, A. Ullrich, and J. Schlessinger. Separate endocytic pathways of kinase defective and active EGF-receptor mutants expressed in same cells. J. Cell Biol. 110, 1541-1548 (1990).

187. H.J. Goldberg, M.M. Viegas, B.L. Margolis, J. Schlessinger and K.L. Skorecki. The tyrosine activity of the EGF-receptor is necessary for phospholipase A-2 activation. Biochem. J. 267, 461-465 (1990).

188. 188. C.-Y. J. Hsu, M. Mohammadi, M. Nathan, A.M. Honegger, A. Ullrich, J. Schlessinger and D.R. Hurwitz. Generation of cytoplasmic domain of EGF-receptor with intrinsic protein tyrosine kinase activity. Cell Growth and Diff. 1, 191-200 (1990).

189. R. Lammers, E. Van Obberghen, J. Schlessinger and A. Ullrich. Transphosphorylation as a possible mechanism of insulin and EGF-receptor activation. J. Biol. Chem, 265, 16886-16890 (1990).

190. C.F.M. Verheijden, I. Verlaan, J. Schlessinger and W.H. Moolenaar. EGF-induced phosphoinositide hydrolysis in permeablized 3T3 cells: lack of guanoside triphosphate dependence and inhibition by tyrosine-containing peptides. Mol. Biol. Cell 1, 615-620 (1990).

191. S. Felder, K. Miller, A. Ullrich, J. Schlessinger and C.R. Hopkins. Kinase activity controls the sorting of EGF-receptor within the multivesicular body. Cell 61, 623-634 (1990).

192. S. Massoglia, A. Gray, T.J. Dull, S. Munemitsu, H.J. Kung, J. Schlessinger and A. Ullrich. Epidermal growth factor receptor cytoplasmic domain mutations trigger ligand-independent transformation. Mol. Cell Biol. 10, 3048-3055 (1990).

193. B. Margolis, A. Zilberstein, C. Franks, S. Felder, S. Kremer, A. Ullrich, S.G. Rhee, K. Skrorecki and J. Schlessinger. Effect of phospholipase C-γ overexpression on PDGF-induced second messengers and Mitogenesis. Science 248, 607-610 (1990).

194. C. Dionne, G. Crumley, F. Bellot, J. Kaplow, M. Ruta, G. Searfosi, W. Burgess, M. Jaye and J. Schlessinger. Cloning and expression of two distinct high affinity receptors cross-reacting with acidic and basic fibroblast growth factors. EMBO J. 9, 2685-2692 (1990).

195. A. Ullrich and J. Schlessinger. Signal transduction by receptors with protein tyrosine activity. Cell 61, 203-212 (1990).

196. J. Sap, P. D'Eustachio, D. Givol, and J. Schlessinger. Cloning and expression of a widely expressed receptor tyrosine phosphatase. Proc. Natl. Acad. of Sci. USA, 87, 6112-6116 (1990).

197. R. Kaplan, B. Morse, K. Huebner, C. Croce, R. Howk, M. Ravera, G. Ricca, M. Jaye, and J. Schlessinger. Cloning of three novel human tyrosine phosphatases reveals the existence of a multigenese family of receptor-linked protein tyrosine phosphatases expressed in brain. Proc. Natl. Acad. Sci. USA, 87, 7000-7004 (1990).

198. B. Margolis, N. Li, A. Koch, M. Mohamaddi, D. Hurwitz, A. Zilberstein, A. Ullrich, T. Pawson and J. Schlessinger. The tyrosine phosphorylated carboxyterminus of the EGF-receptor is a binding site for GAP and PLC-γ. EMBO J., 9, 4375-4380 (1990).
199. H. App, R. Hazan, A. Zilberstein, A. Ullrich, J. Schlessinger and U. Rapp. EGF stimulates association with c-raf and its kinase activity in living cells. Mol. Cell Biol., 11, 913-919 (1991).
200. O. Kashles, Y. Yarden, A. Ullrich and J. Schlessinger. A dominant negative mutation supresses the function of normal EGF-receptors by heterodimerization. Mol. Cell Biol., 11, 1454-1463 (1991).
201. J. den Hertog, J. Schlessinger, S.W. deLaat and W. Kruiger. Neuronal differentiation of transfected murine F19 embryonal carcinoma cells expressing human EGF-receptors. Cell Growth and Diff., 2, 155-164 (1991).
202. Lax, R. Fischer, C. Ng, J. Segre, A. Ullrich, D. Givol and J. Schlessinger. Non-contiguous regions in the extracellular domain of EGF-receptor define ligand binding specificity. Mol. Biol. Cell 2, 337-345 (1991).
203. H. Yan, J. Schlessinger and M.V. Chao. Chimeric NGF-EGF receptors define domains responsible for neuronal differentiation. Science 252, 561-563 (1991).
204. K. Seedorf, S. Felder, B. Millauer, J. Schlessinger and A. Ullrich. Analysis of PDGF-receptor domain function using a novel chimeric receptor approach. J. Biol. Chem. 266, 12424-12431 (1991).
205. H.K. Kim, J.W. Kim, A. Zilberstein, B. Margolis, C.K. Kim, J. Schlessinger and S.G. Rhee. PDGF stimulation of inositol phospholipid hydrolysis requires PLC-γ phosphorylation on residues 783 and 1254. Cell 65, 435-441 (1991).
206. I. Lax, A. Mitra, C. Ravera, D.R. Hurwitz, M. Rubinstein, A. Ullrich, R. M. Stroud and J. Schlessinger. EGF induces oligomerization of soluble extracellular ligand binding domain of EGF receptor. A low resolution projecture structure of the ligand binding domain. J. Biol. Chem. 266, 13828-13833 (1991).
207. R.M. Kris, V. South, A. Saltzman, S. Felder, G.A. Ricca, M. Jaye, K. Huebner, J. Kagan, ,C.M Croce, and J. Schlessinger. Cloning, expression and chromosomal localization of the human substance-K receptor and analysis of its role in mitogenesis. Cell Growth and Diff. 2, 266 (1991).
208. J. Adnane, P. Gaudray, C. Dionne, G. Grumley, M. Jaye, J. Schlessinger, P. Jeanteur, D. Birnbaum and C. Theillet Bek and flg, receptors two members of the FGF family, are amplified in subsets human breast cancer. Oncogene 6, 659-663 (1991).
209. D.R. Hurwitz, S.L. Emanuel, M.H. Nathan, N. Sarver, A. Ullrich, S. Felder, I. Lax and J. Schlessinger. EGF induces increased ligand binding affinity and dimerization of soluble EGF-receptor extracellular domain. J. Biol. Chem. 266, 22035-22043 (1991).
210. E.Y. Skolnik, B. Margolis, M. Mohammadi, E. Lowenstein, R. Fischer, A. Drepps, A. Ullrich and J. Schlessinger. Cloning of PI3 kinase associated P85 utilizing a novel method for expression cloning of target proteins for receptor tyrosine kinases. Cell 65, 83-90 (1991).
211. C.A. Dionne, M. Jaye and J. Schlessinger. Structural diversity and binding of FGF-receptors. The fibroblast growth factor family. Ann. N.Y. Acad. of Science ed. A. Baird and M. Klagsbrum 638, 161-166 (1991).
212. D. Birnbaum, O. DeLapeyreire, J. Adnane, C. Dionne, G. Crumley, M. Jaye, J. Schlessinger, L. Xerri, C. Escot, P. Gaudray and C. Theillet. Structural diversity and binding of FGF-receptors. The fibroblast growth factor family. Ann. N.Y. Acad. of Science ed. A. Baird and M. Klagsbrum 638, 409-411 (1991).
213. W. Li and J. Schlessinger. Platelet-Derived Growth Factor (PDGF)-induced disulfide-linked dimerization of PDGF receptors in living cells. Mol. Cell Biol. 11, 3756-3761 (1991).
214. G. Daum, N.F. Zander, B. Morse, D. Hurwitz, J. Schlessinger and E.H. Fischer. Characterization of a human recombinant receptor linked protein tyrosine phosphorylation. J. Biol. Chem. 266, 12211-12215 (1991).
215. S. LaForgia, B. Morse, J. Levy, G. Barnea, L.A. Cannizzaro, F. Li, P.C. Nowell, L. Boghosien-Sell, J. Glick, A. Westin, C. Harris, H. Drabkin, P. Patterson, C.M. Croce, J. Schlessinger and K. Huebner. Receptor protein-tyrosine phosphatase γ is a candidate tumor suppressor gene at human chromosome region 3p21. Proc. Natl Acad. Sci., USA, 88, 5036-5040, (1991).
216. A. Avivi, I. Lax, A. Ullrich, J. Schlessinger, D. Givol and B. Morse. Comparison of EGF-receptor sequences as a guide to study the ligand binding site. Oncogene, 6, 673-676 (1991).
217. T. Yoneda, M.M. Alsina, K. Watatani, F. Bellot, J. Schlessinger and G.R. Mundy. Dependence of a human squamous carcinoma and associated paraneoplastic syndromes on ambient EGF concentration in nude mice. Cancer Res. 51, 2438-2443 (1991).
218. F. Bellot, G. Crumly J.M. Kaplow, J. Schlessinger, M. Jaye and C.A. Dionne. Ligand-induced transphosphorylation between different FGF-receptors. EMBO J. 10, 2849-2854 (1991).
219. N. Rederman, B. Holzmann, T. von Rüden, E.F. Wagner, J. Schlessinger and A. Ullrich. Anti-oncogenic activity of signalling-defective EGF-receptors mutants. Mol. Cell Biol. 12, 491-498 (1991).
220. R. Herbst, R. Lammers, J. Schlessinger and A. Ullrich. Substrate phosphorylation specificity of the human c-kit receptor tyrosine kinase. J. Biol. Chem. 266, 19908-19916 (1991).

221. R. Schumacher, L. Mesthof, J. Schlessinger, D. Brandenbung and A. Ullrich. Insulin and IGF-1 binding sites are located in distinct region of their cognate receptors. J. Biol. Chem. 266, 19288-19295 (1991).

222. W. Li, N. Hack, B. Margolis, A. Ullrich, K. Skorecki and J. Schlessinger. Carboxy-terminal truncations of EGF-receptor affect diverse EGF-induced cellular responses. Mol. Biol. Cell 2, 641-649 (1991).

223. M. Mohammadi, A.M. Honegger, F. Bellot, W. Li, D. Rotin, R. Fischer, F. Bellot, C.A. Dionne, M. Jaye, M. Rubinstein and J. Schlessinger. A tyrosine phosphorylated carboxy-terminal peptide of FGF-recptor (flg) is a binding site for the SH2 domain of phospholipase C-γ. Mol. Cell Biol., 11, 5068-5078 (1991).

224. B. Schechter, R. Arnon, M. Wilcheck, J. Schlessinger, E. Hurwitz, E. Aboud-Pirak and M. Sela. Indirect immunotargeting of CIS-PIT to human epidermoid carcinoma KB using the avidin-biotin system. Int. J. Cancer 48, 167-172 (1991).

225. N. Hack, B. Margolis, A. Ullrich, K. Skorecki and J. Schlessinger. Distinct structural specificities for functional coupling of the epidermal factor receptor to calcium-signalling versus phospholipase A2 responses. Biochem. J. 275, 563-567 (1991).

226. S. Tartare, R. Balloti, R. Lammers, C. Fillowx, A. Chauval, J. Schlessinger, A. Ullrich and E. Van Obberghen. Activation of Insulin-EGF-chimera regulates EGF-receptor binding affinity. J. Cell Biol. 116, 627-633 (1991).

227. A. Ullrich, A. Gray, S. Munemitsu, J. Schlessinger and S. Massoglia. Epidermal growth factor receptor autophosphorylation is not required for normal mitogenic or transforming signal generation: in "Biological signal transduction, Nato ASI series, vol. H52, Springer-Verlag, Heidelberg (1991).

228. G. Crumley, F. Bellot, J.M. Kaplow, J. Schlessinger, M. Jaye and C. A. Dionne. High-affinity binding and activation of a truncated FGF receptor by both aFGF and bFGF. Oncogene 6, 2255-2262, (1991).

229. J. Oval, R. Hershberg, B. Gansbacher, E. Gilboa, J. Schlessinger and R. Taetle. Expression of functional epidermal growth factor receptors in a human hematopoietic cell line. Cancer Res. 51, 150-156, (1991).

230. C.A. Dionne, M. Jaye and J. Schlessinger. FGF receptors as targets for drug development. in "The clinical pharmacology of biotechnology products." M.M. Reidenberg, ed. Elsevier Science Publishers, pp. 49-56 (1991).

231. C.A. Dionne, W.S. Modi, G. Crumley, H. Seuanez, S.J. O'Brien, J. Schlessinger and M. Jaye. BEK, a receptor for multiple members of the FGF family, maps to human chromosome. l0q 25.3-q26. Cytogen Cell Gene. 60, 34-36 (1992).

232. C.D. Renard, M. McLean-Bolton, S.G. Rhee, B. Margolis, A. Zilberstein, J. Schlessinger and A.P. Thomas. Modified kinetics of PDGF-induced Ca^{+2} increase in NIH-3T3 cells overexpressing phospholipase-Cγ1. Biochem. J. 281, 775-784 (1992).

233. K. Seedorf, B. Millauer, G. Kostra, J. Schlessinger and A. Ullrich. Differential effects of carboxy-terminal sequence deletions of platelet-derived growth factor receptor signaling activities and interactions with cellular substrates. Mol. Cell Biol. 12, 4347-4356 (1992).

234. D. Rotin, B. Margolis, M. Mohammadi, R.J. Daly, G. Daum, N. Li, E.H. Fischer, W.H. Burgess, A. Ullrich and J. Schlessinger. SH2 domain prevent tyrosine dephosphorylation of the EGF-receptor: identification of Tyr992 as the high-affinity binding site for the SH2 domains of phospolipase Cγ. EMBO J. 11, 559-567 (1992).

235. P. Hu, B. Margolis, E. Skolnik, A. Ullrich and J. Schlessinger. Binding of EGF and PDGF-Receptors by PI-3 kinase associated p85 correlates with stimulation of PI-3 kinases. Mol. Cell Biol. 12, 981-990 (1992).

236. S. Felder, J. Lavin, A. Ullrich and J. Schlessinger. Kinetics of binding, endocythosis and EGF-receptor mutants. J. Cell Biol. 117, 203-210 (1992).

237. T. Spivak-Kroizman, D. Rotin, D. Pinchasi, A. Ullrich, J. Schlessinger and I. Lax. Heterodimerization of c-erbB2 with different EGF-receptor mutants elicits stimulatory or inhibitory responses. J. Biol. Chem. 267, 8056-8063 (1992).

238. B. Margolis, P. Hu, S. Katzav, W. Li, J.M. Oliver, A. Ullrich, A. Weiss and J. Schlessinger. Tyrosine phosphorylation of vav proto-oncogene product containing SH2 domain and transcription factor motifs. Nature 356, 71-74 (1992).

239. V.V.N. Gopal Rao, C. Löffler, J. Sap, J. Schlessinger and I. Hansmann. The gene for receptor linked protein tyrosine phosphatase (R-PTPα) is assigned to human chromosome 20p12-pter by in situ hybridization (ISH and FISH). Genomics 13, 906-907 (1992).

240. L.A. Cannizzaro, E. Skolnik, B. Margolis, C.M. Croce, J. Schlessinger and K. Huebner. The human gene encoding PI3-kinase associated P85α is at chromosome region 5g12-13. Cancer Res. 51, 3818-3820 (1992).

241. R. Herbst, M.S. Shearman, A. Obermeir, J. Schlessinger and A. Ullrich. Differential Effects of W mutations on $p145^{c\text{-}kit}$ tyrosine kinase activity and substrate interaction. J. Biol. Chem. 267, 13210-13216 (1992).

242. M. Jaye, J. Schlessinger and C.A. Dionne. Fibroblast growth factor receptor tyrosine kinases: molecular analysis and signal transduction. Biochem. Biophys. Acta. 1135, 185-199 (1992).

243. J.M. Baker, M.G. Myers Jr., S.E. Shoelson, D.J. Chin, X.J. Sun, M. Miralpeix, P. Hu, B. Margolis, E. Skolnik, J. Schlessinger and M.F. White. Phosphatidylinositol 3-kinase is activated by association with IRS-1 during insulin stimulation. EMBO J. 11, 3469-3479 (1992).

244. M.G. Myers Jr., J.M. Backer, X.J. Sun, S.E. Shoelson, P. Hu, J. Schlessinger, M. Yoakim, B. Schaffhausen and M.F. White. IRS-1 activates the phosphatidylinositol 3'-kinase by associating with *src* homology 2 domains of p85. Proc. Natl. Acad. Sci. USA., 89, 10350-10354 (1992).

245. D. Rotin, A.M. Honegger, B. Margolis, A. Ullrich and J. Schlessinger. Presence of SH2 domain of phospholipase Cγ enhances substrate phosphorylation by increasing the affinity toward the EGF-receptor. J. Biol. Chem. 267, 9678-9683 (1992).

246. E.J. Lowenstein, R.J. Daly, A.G. Batzer, W. Li, B. Margolis, R. Lammers, A. Ullrich, E.Y. Skolnik, D. Bar-Sagi and J. Schlessinger. The SH2 and SH3 domain containing protein GRB2 links receptor tyrosine kinases to *ras* signaling. Cell 70, 431-442 (1992).

247. B. Jallal, J. Schlessinger and A. Ullrich. Tyrosine phosphatase inhibition permits analysis of signal transduction complexes in $p185^{HER2/neu}$-overexpressing human tumor cells. J. Biol. Chem. 267, 4357-4363 (1992).

248. H.A. Drabkin, M.J. Mendez, P.H. Rabbitts, T. Varkony, J. Bergh, J. Schlessinger, P. Erickson and R.M. Gemmill. Characterization of the submicroscopic deletion in the small-cell lung carcinoma (SCLC) cell line U2020. Genes, Chromosomes & Cancer 5, 67-74 (1992).

249. M. Mohammadi, C.A. Dionne, W. Li, N. Li, T. Spivak, A.M. Honegger, M. Jaye, and J. Schlessinger. Point mutation in FGF-receptor eliminates phosphatidylinositol hydrolysis without affecting mitogenesis. Nature 358, 681-684 (1992).

250. W. Li, G.G. Deanin, B. Margolis, J. Schlessinger and J.M. Oliver. FceR1-Mediated tyrosine phosphorylation of multiple proteins, including phospholipase Cγ1 and the receptor $\beta\gamma_2$ complex, in RBL-2H3 rat basophilic leukemia cells. Mol. Cell. Biol. 12, 3176-3182 (1992).

251. W. Li, P. Hu, E.Y. Skolnik, A. Ullrich and J. Schlessinger. The SH2 and SH3 domains-containing nck protein is oncogenic and a common target for phosphorylation by different surface receptors. Mol. Cell. Biol. 12, 5824-5833 (1992) .

252. J. Schlessinger and A. Ullrich. Growth factor signaling by receptor tyrosine kinases. Neuron 9, 383-391 (1992).

253. B. Margolis, O. Silvennoinen, F. Comoglio, C. Roonprapunt, E. Skolnik, A. Ullrich and J. Schlessinger. High-efficiency expression/cloning of epidermal growth factor-receptor-binding proteins with Src homology 2 domains. Proc. Natl. Acad. Sci. USA 89, 8894-8898 (1992).

254. M. Rozakis-Adcock, J. McGlade, G. Mbamalu, G. Pelicci, R. Daly, W. Li, A. Batzer, S. Thomas, J. Brugge, P.G. Pelicci, J. Schlessinger, and T. Pawson. Association of the Shc and Grb2/Sem5 SH2-containing proteins is implicated in activation of the ras pathway by tyrosine kinases. Nature 360, 689-692 (1992).

255. J. Schlessinger, M. Mohammadi, B. Margolis, and A. Ullrich. Role of SH2 containing proteins in cellular signaling by receptor tyrosine kinases. Cold Spring Harbor, Symposium on Quantitative Biology. The Cell Surface 57, 67-74 (1992).

256. C.E. Futter, S. Felder, J. Schlessinger, A. Ullrich and C.R. Hopkins. Annexin I is phosphorylated in the multivesicular body during the processing of the epidermal growth factor receptor. J. Cell Biol. 120, 77-83 (1993).

257. D. Kohda, M. Odaka, I. Lax, H. Kawasaki, K. Suzuki, A. Ullrich, J. Schlessinger and F. Inagaki. A 40-kDa epidermal growth factor/transforming growth factor α-binding domain produced by limited proteolysis of the extracellular domain of the epidermal growth factor receptor. J. Biol. Chem. 268, 1976-1981 (1993).

258. S.E. Shoelson, M. Sivaraja, K.P. Williams, P. Hu, J. Schlessinger and M.A. Weiss. Specific phosphopeptide binding regulates a conformational change in the PI-3-kinase SH2 domain associated with enzyme activation. EMBO J. 12, 795-802 (1993).

259. S. Felder, M. Zhou, P. Hu, J. Ureña, A. Ullrich, M. Chaudhury, M. White, S.E. Shoelson and J. Schlessinger. SH2 domains exhibit high-affinity binding to tyrosine phosphorylated peptides yet also exhibit rapid dissociation and exchange. Mol. Cell. Biol. 13, 1449-1455 (1993).

260. G. Barnea, O. Silvennoienen, B. Shaanan, A.M. Honegger, P.D. Canoll, P. D'Eustachio, B.Morse, J.B. Levy, S. LaForgia, K. Huebner, J.M. Musacchio, J. Sap and J. Schlessinger. Identification of a Carbonic anhydrase-like domain in the extracellular region of RPTPγ defines a new subfamily of receptor tyrosine phosphatases. Mol. Cell. Biol. 13, 1497-1506 (1993).

261. A. Obermeier, H. Halfter, K.-H. Wiesmüller, G. Jung, J. Schlessinger and A. Ullrich. Tyrosine 785 is a major determinant of Trk - substrate interaction. EMBO J. 12, 933-941 (1993).
262. J. P. Olivier, T. Raabe, M. Henkemeyer, B. Dickson, G. Mbamalu, B. Margolis, J. Schlessinger, E. Hafen and T. Pawson. A Drosphila SH2-SH3 adaptor protein implicated in coupling the Sevenless tyrosine kinase to an activator of Ras guanine nucleotide exchange, Sos. Cell 73, 179-191 (1993).
263. P. Hu, B. Margolis and J. Schlessinger. Vav: a potential link between tyrosine kinases and ras-like GTPases in hematopoietic cell signaling. Bio Essays 15, 179-186 (1993).
264. D. Kohda, H. Hatanaka, M. Odaka, V. Mandiyan, A. Ullrich J. Schlessinger and F. Inagaki. Solution structure of the SH3 domain of phospholipase Cγ. Cell 72, 953-960 (1993).
265. Y.P. Jiang, H. Wang, P.D'Eustachio, J.M. Musacchio, J. Schlessinger and J. Sap. Cloning and characterization of R-PTP-κ, a new member of the receptor protein tyrosine phosphatase family with a proteolytically cleaved cellular adhesion molecule-like extracellular region. Mol. Cell. Biol. 13, 2942-2951 (1993).
266. N. Li, A. Batzer, R. Daly, V. Yajnik, E. Skolnik, P. Chardin, D. Bar-Sagi, B. Margolis and J. Schlessinger. Guanine-nucleotide-releasing factor $hSOS_1$, binds to GRB2 and links receptor tyrosine kinases to *ras* signaling. Nature 363, 85-88 (1993).
267. N.W. Gale, S. Kaplan, E. Lowenstein, J. Schlessinger and D. Bar-Sagi. GRB2 mediates the EGF-dependent activation of guanine nucleotide exchange of $p21^{ras}$. Nature 363, 88-92 (1993).
268. E. Piccione, R.D. Case, S.M. Domcheck, P. Hu, M. Chaudhuri, J.M. Macker, J. Schlessinger and S.E. Shoelson. PI 3-kinase p85 SH2 domain specificity defined by direct phosphopeptide/SH2 domain binding. Biochemistry 32, 3197-3202 (1993).
269. D.M. Desai, J. Sap, J. Schlessinger and A. Weiss. Ligand-mediated negative regulation of a chimeric transmembrane receptor tyrosine phosphatase. Cell 73, 541-554 (1993).
270. J.B. Levy, P.D. Canoll, O. Silvennoinen, G. Barnea, B. Morse, A.M. Honneger, J.-T. Haung, L.A. Cannizzaro, S.-H. Park, T. Druck, K. Huebner, J. Sap, M. Ehrlich, J.M. Musacchio and J. Schlessinger. The cloning of a receptor-type protein tyrosine phosphatase expressed in the central nervous system. J. Biol Chem. 268, 10573-10581 (1993).
271. E.Y. Skolnik, C.-H. Lee, A. Batzer, L.M. Vicentini, M. Zhou, R. Daly, M.J. Myers, Jr., J.M. Backer, A. Ullrich, M.F. White and J. Schlessinger. The SH2/SH3 domain containing protein GRB2 interacts with tyrosine phosphorylated IRS1 and Shc: Implications for insulin control of *ras* signaling. EMBO J. 12, 1929-1936 (1993).
272. P. Chardin, J. Camonis, N.W. Gale, L. Van Aels, J. Schlessinger, M.H. Wigler and D. Bar-Sagi. Human Sos1: A guanine nucleotide exchange factor for *ras* that binds to GRB2. Science 260, 1338-1343 (1993).
273. S. LaForgia, J. Lasota, F. Latif, L. Boghosian-Sell, K. Kastury, M. Ohta, T. Druck, L. Atchison, L.A. Cannizzaro, G. Barnea, J. Schlessenger, W. Modi, I. Kuzmin, K. Tory, B. Zbar, C.M. Croce, M. Lerman and K. Huebner. Detailed genetic and physical map of the 3p chromosome region surrounding the familial renal cell carcinoma chrosome translocation, $t(3;8)(p14.2;q24.1)^1$. Cancer Research 53, 3118-3124 (1993).
274. I. Vietor, P. Schwenger, W. Li, J. Schlessinger and J. Vilcek. Tumor Necrosis factor-induced activation and increased tyrosine phosphorylation of mitogen activated protein (MAP) kinase in human fibroblasts. J. Biol. Chem. 25, 18994-18999 (1993).
275. M. Zhou, S.Felder, M. Rubinstein, D.R. Hurwitz, A. Ullrich, I. Lax, and J. Schlessinger. Real time measurements of kinetics of EGF binding to soluble EGF receptor monomers and dimers support the dimerization model for receptor activation. Biochemistry 32, 8193-8198(1993).
276. D. Bar Sagi, D. Rotin, A. Batzer, V. Mandiyan and J. Schlessinger. SH3 domains direct cellular localization of signaling molecules. Cell 74, 83-91 (1993).
277. E.Y. Skolnik, A. Batzer, N. Li, C.H. Lee, E. Lowenstein, B. Margolis, and J. Schlessinger. Function of protein GRB2, in linking the insulin receptor to *ras* signaling pathways. Science 260, 1953-1955 (1993).
278. J. Schlessinger. How receptor tyrosine kinases activate ras. Trends Biochem. Sci. 18, 273-275 (1993).
279. T. Pawson, and J. Schlessinger. SH2 and SH3 domains. Current Biology 3, 434-442 (1993).
280. L.L. Chen, B. Gansbacher, E. Gilboa, R. Taetle, J. Oval, M.S. Hibbs, C-K Huang, M.L. Clawson, S. Bilgrami, J. Schlessinger and J. Mendelsohn. Retroviral gene transfer of epidermal growth factor receptor into HL60 cells results in a partial block of retinoic acid-induced granulocytic differentiation. Cell Growth and Differ. 4, 769-776 (1993).
281. M. Mohammadi, A. Honneger, A. Sorokin, A. Ullrich, J. Schlessinger and D.R. Hurwitz. Aggregation-induced activation of the epidermal growth factor receptor protein tyrosine kinase. Biochem. 32, 8742-8748 (1993).

282. O. Silvennoinen, C. Schindler, J. Schlessinger and D.E. Levy. Ras-independent growth factor signaling by transcription factor tyrosine phosphorylation. Science 261, 1736-1739 (1993).

283. M.S. Shearman, R. Herbst, J. Schlessinger and A. Ullrich. Phosphatidylinositol 3'-kinase associates with $p145^{c\text{-}kit}$ as part of a cell type-characteristic multimeric signalling complex. EMBO J. 12, 3817-3826 (1993).

284. A.M. Pendergast, L.A. Quilliam, L.D. Cripe, C.H. Bassing, Z. Dai, N. Li, A. Batzer, K.M. Rabun, C.J. Der, J. Schlessinger and M.L. Gishizky. BCR-ABL-induced oncogenesis is mediated by direct interaction with the SH2 domain of the GRB2 adaptor protein. Cell 75, 175-185 (1993).

285. H. Yan, A. Grossman, H. Wang, P. D'Eustachio, K. Mossie, J.M. Musacchio, O. Silvennoinen and J. Schlessinger. A novel receptor tyrosine phosphatase sigma that is highly expressed in the nervous system. J. Bio Chem 288, 24880-24886 (1993).

286. R. Nishimura, W. Li, A. Kashishian, A. Mondino, M. Zhou, J. Cooper and J. Schlessinger. Two signaling molecules share a phosphotyrosine-containing binding site in the PDGF receptor. Mol. Cell Biol. 13, 6889-6896 (1993).

287. P.D. Canoll, G. Barnea, J.B. Levy, J. Sap, M. Ehrlich, O. Silvennoinen, J. Schlessinger and J.M. Musacchio. The expression of a novel receptor-type tyrosine phosphatase suggests a role in morphogenesis and plasticity of the nervous system. Dev. Brain Res. 75, 293-298 (1993).

288. H.-J. Bühring, R. Herbst, G. Kostka, B. Bossenmaier, I. Bartke, H. Kropshofer, H. Kalbacher, F.W. Busch, C.A. Müller, J. Schlessinger and A. Ullrich. Modulation of $p145^{c\text{-}kit}$ function in cells of patients with acute myeloblastic leukemia. Cancer Research 53, 4424-4431 (1993).

289. A. Obermeier, R. Lammers, K.H. Wiesmüller, G. Jung. J. Schlessinger and A. Ullrich. Identification of Trk binding sites for Shc and phosphotidylinositol 3'-kinase and formation of a multimeric signaling complex. J. Biol. Chem. 268, 22963-22966 (1993).

290. P. Hu, A. Mondino, E.Y. Skolnik and J. Schlessinger. Cloning of a novel, ubiquitously expressed human phosphatidylinositol 3-kinase and identification of its binding site on p85. Mol. Cell Biol. 13, 7677-7688 (1993).

291. R. Lammers, B. Bossenmaier, D.E. Cool, N.K. Tonks, J. Schlessinger, E.H. Fischer and A. Ullrich. Differential activities of protein tyrosine phosphatases in intact cells. J. Biol. Chem. 268, 22456-22462 (1993).

292. O. Silvennoinen, J. Schlessinger and D.E. Levy. Interferon-induced nuclear signaling by JAK protein tyrosine kinases. Nature 366, 583-585 (1993).

293. M.J. Stern, L.E.M. Marengere, R.J. Daly, E.J. Lowenstein, M. Kokel, A. Batzer, P. Olivier, T. Pawson and J. Schlessinger. The human GRB2 and *Drosophila Drk* genes can functionally replace the *C. elegans* cell signaling gene *sem-5*. Mol. Biol. Cell 4, 1175-1188 (1993).

294. C.H. Lee, W. Li, R. Nishimura, M. Zhou, A.G. Batzer, M.G. Myers, Jr., M.F. White, J. Schlessinger and E.Y. Skolnik. Nck associates with the SH2 domains-docking protein IRS-1 in insulin stimulated cells. Proc. Natl. Acad. Sci., USA 90, 11713-11717 (1993).

295. R. Schumacher, M.A. Soos, J. Schlessinger, D. Brandenburg, K. Siddle and A. Ullrich. Signalling-competent receptor chimeras allow mapping of major insulin receptor binding domain determinants. J. Biol.Chem. 268, 1087-1094 (1993).

296. J. Sap, Y.-P. Jiang, D. Friedlander, M. Grumet and J. Schlessinger. Receptor tyrosine phosphatase R-PTP-κ mediates homophilic binding. Mol. Cell Biol. 14, 1-9 (1994).

297. W. Li, R. Nishimura, A. Kashishian, A. Batzer, W.J.H. Kim, J.A. Cooper and J. Schlessinger. A new function for a phosphotyrosine phosphatase: linking GRB2/Sos to a receptor tyrosine kinase. Mol. Cell Biol. 14, 509-517 (1994).

298. G. Barnea, M. Grumet, J. Sap, R.U. Margolis and J. Schlessinger. Close similarity between a receptor linked tyrosine phosphatase and a rat brain proteoglycan. Cell 76, 205 (1994).

299. J. Schlessinger. SH2/SH3 Signaling proteins. Curr. Opin. Gen. Dev. Biol. 4, 25-30 (1994).

300. P. Hu and J. Schlessinger. Direct Association of p110β phosphatidylinositol 3-kinase with p85 is mediated by an N-terminal fragment on p110β. Mol. Cell. Biol. 14, 2577-2583 (1994).

301. A. Sorokin, M.A. Lemmon, A. Ullrich and J. Schlessinger. Stabilization of an active dimeric form of the EGF receptor by introduction of an inter-receptor disulfide bond. J. Biol. Chem. 269, 9752-9759 (1994).

302. G. Daum, S. Regenass, J. Sap, J. Schlessinger and E.H. Fischer. Multiple forms of the human tyrosine phosphatase RPTPa: Isozymes and differences in glycosylation. J. Biol. Chem. 269, 10524-10528 (1994).

303. A. Obermeier, Bradshaw, R.A., Seedorf, K., A. Choidas, J. Schlessinger and A. Ullrich. Neuronal differentiation signals are controlled by nerve growth factor receptor/Trk binding sites for SHC and PLCγ. EMBO J. 13, 1585-1590 (1994).

304. G. Barnea, M. Grumet, P. Milev, O. Silvennoinen, J.B. Levy, J. Sap, R.U. Margolis and J. Schlessinger. Receptor tyrosine phosphatase β is expressed in the form of proteoglycan and binds to the extracellular matrix protein tenascin. J. Biol. Chem. 269, 14349-14352 (1994).
305. C.-H., Lee, D. Kominos, S. Jacques, B. Margolis, J. Schlessinger, S.E. Shoelson, and J. Kuriyan. Crystal structures of peptide complexes of the N-terminal SH2 domain of the *Syp* tyrosine phosphatase. Structure 2, 423-438 (1994).
306. T. Spivak-Kroizman, M. Mohammadi, P. Hu, M. Jaye, J. Schlessinger and I. Lax. Point mutation in the fibroblast growth factor receptor eliminates phosphatidylinositol hydrolysis without affecting neuronal differentiation of PC12 cells. J. Biol. Chem. 269, 14419-14423 (1994).
307. M.G. Myers, Jr., L.-M. Wang, X. J. Sun, Y. Zhang, L.P. Yenush, J. Schlessinger, J.H. Pierce and M.F. White. Role of IRS-1-GRB2 complexes in insulin signaling. Mol. Cell Biol. 14, 3577-3587 (1994).
308. K. Seedorf, G. Kostka, R. Lammers, P. Bashkin, R. Daly, W.H. Burgess, A.M. van der Bliek, J. Schlessinger and A. Ullrich. Dynamin binds to SH3 domains of phospholipase Cγ and GRB-2. J. Biol. Chem. 269, 16009-16014 (1994).
309. M. Sieh, A. Batzer, J. Schlessinger and A. Weiss. Grb2 and phospholipase C-γ1 associate with a 36- to 38-kilodalton phosphotyrosine protein after T-cell receptor stimulation. Mol. Cell. Biol. 14, 4435-4442 (1994).
310. A. Sorokin, M. Mohammadi, J. Huang and J. Schlessinger. Internalization of fibroblast growth factor receptor is inhibited by a point mutation at tyrosine 766. J. Biol. Chem 269, 17056-17061 (1994).
311. P.S. McPherson, A.J. Czernik, T.J. Chilcote, F. Onofri, F. Benfenati, P. Greengard, J. Schlessinger and P. De Camilli. Interaction of Grb2 via its SH3 domains with synaptic proteins including synapsin I. Proc. Natl. Acad. Sci. USA 91, 6486-6490 (1994).
312. I. Dikic, J. Schlessinger and I. Lax. PC12 cells overexpressing the insulin receptor undergo insulin dependent neuronal differentiation. Current Biology 4, 702-708 (1994).
313. S.E. Salmon, K.S. Lam, S. Felder, H. Yeoman, J. Schlessinger, A. Ullrich, V. Krchnák and M. Lebl. One bead, one chemical compound: Use of the selectide process for anticancer drug discovery. Acta Oncologica 33, 127-131 (1994).
314. A.G. Batzer, D. Rotin, J.M. Ureña, E.Y. Skolnik and J. Schlessinger. Hierarchy of binding sites for Grb2 and Shc on the epidermal growth factor receptor. Mol. Cell Biol. 14, 5192-5201 (1994).
315. O. Hobert, B. Jallal, J. Schlessinger and A. Ullrich. Novel signaling pathway suggested by SH3 domain-mediated $p95^{vav}$/hnRNP-K interaction. J. Biol. Chem. 269, 20225-20228 (1994).
316. A. Ullrich, I. Sures, M. D'Egidio, B. Jallal, T.J. Powell, R. Herbst, A. Dreps, M. Azam, M. Rubinstein, C. Natoli, L. Shawver, J. Schlessinger and S. Iacobelli. The secreted tumor-associated antigen 90K is a potent immune stimulator. J. Biol. Chem. 269, 18401-18407 (1994).
317. J.K. Huebner, K. Kastury, T. Druck, A. F. Salcini, L. Lanfrancone, G. Pelicci, E. Lowenstein, W. Li, S.H. Park, L. Cannizzaro, P.G. Pelicci and J. Schlessinger. Chromosome locations of genes encoding human signal transduction adapter proteins, Nck, Shc and Grb2. Genomics 22, 281-287 (1994).
318. D.M. Desai, J. Sap, O. Silvennoinen, J. Schlessinger and A. Weiss. The catalytic activity of the CD45 membrane- proximal phosphatase domain is required for TCR signaling and regulation. EMBO J. 13, 4002-4010 (1994).
319. A.-K. Arvidsson, E. Rupp, E. Nånberg, J. Downward, L. Rönnstrand, S. Wenström, J. Schlessinger, C.H. Heldin and L. Claesson-Welsh. Tyr-716 in the platelet-derived growth factor b-receptor kinase insert is involved in GRB2 binding and Ras activation. Mol. Cell. Biol. 14, 6715-6726 (1994).
320. A. Aronheim, D. Engelberg, N. Li, J. Schlessinger and M. Karin. Membrane targeting of the nucleotide exchange factor Sos is sufficient for activating the Ras signaling pathway. Cell 78, 949-961 (1994).
321. K. Ferguson, M.A. Lemmon, J. Schlessinger and P.B. Sigler. Crystal structure at 2.2Å regulation of the pleckstrin homology domain from human Dynamin. Cell 79, 199-209 (1994) .
322. D. Kohda, H. Terasawa, S. Ichikawa, K. Ogura, H. Hatanaka, V. Mandiyan, A. Ullrich, J. Schlessinger and F. Inagaki. Solution structure and ligand-binding site of the C-terminal SH3 domain of Grb2. Structure 2, 1029-1040 (1994).
323. M.A. Lemmon and J. Schlessinger. Regulation of signal transduction and signal diversity by receptor oligomerization. Trends Biochem. Sci. 19, 459-463 (1994).
324. M.A. Lemmon, J.E. Ladbury, V. Mandiyan, M. Zhou and J. Schlessinger. Independent binding of peptide ligands to the SH2 and SH3 domains of Grb2. J. Biol. Chem. 269, 31653-31658 (1994).
325. N. Li, J. Schlessinger and B. Margolis. Autophosphorylation mutants of the EGF-receptor signal through auxiliary mechanisms involving SH2 domain proteins. Oncogene 9, 3457-3465 (1994).

326. T. Spivak-Kroizmann, M.A. Lemmon, I. Dikic, J.E. Ladbury, D. Pinchasi, J. Huang, M. Jaye, G. Crumley, J. Schlessinger and I. Lax. Heparin-induced oligomerization of FGF molecules is responsible for FGF receptor dimerization, activation and cell proliferation. Cell 79, 1015-1024 (1994).

327. H. Terasawa, D. Kohda, H. Hatanaka, S. Tsuchiya, K. Ogura, K. Nagata, S. Ishii, V. Mandiyan, A. Ullrich, J. Schlessinger and F. Inagaki. Structure of N-terminal SH3 domain of GRB2 complexed with a peptide from the guanine nucleotide releasing factor Sos. Nature Struct. Biol. 1, 891-897 (1994).

328. J. Schlessinger and D. Bar-Sagi. Activation of Ras and other signaling pathways by receptor tyrosine kinases. Cold Spring Harbor Symposium on Quantitative Biology. Molecular Genetics of Cancer 59, 173-179 (1994).

329. D. Fushman, S. Cahill, M. Lemmon, J. Schlessinger and D. Cowburn. Solution structure of Pleckstrin homology domain of dynamin by heteronuclear NMR spectroscopy. Proc. Natl. Acad. Science USA 92, 816-820 (1995).

330. Z. Songyang, K.L. Carraway III, M.J. Eck, S.C. Harrison, R.A. Feldman, M. Mohammadi, J. Schlessinger, S.R. Hubbard, D.P. Smith, C. Eng, M.J. Lorenzo, B.A.J. Ponder, B.J. Mayer and L.C. Cantley. Catalytic specificity of protein-tyrosine kinases is critical for selective signaling. Nature 373, 536-539 (1995).

331. J. den Hertog, J. Sap, C.E.G.M. Pals, J. Schlessinger and W. Kruijer. Stimulation of receptor protein-tyrosine phosphatase α activity and phosphorylation by phorbol ester. Cell Growth and Differ. 6, 303-307 (1995).

332. J. Huang, M. Mohammadi, G. Rodrigues and J. Schlessinger. Reduced activation of Raf-1 and MAP kinase by fibroblast growth factor receptor mutant deficient in stimulation of phosphatidilinositol hydrolysis. J. Biol. Chem. 270, 5065-5072 (1995).

333. J.E. Ladbury, M.A. Lemmon, M. Zhou, J. Green, M. C. Botfield and J. Schlessinger. Measurement of the binding of tyrosyl phosphopeptides to SH2 domains: A reappraisal. Proc. Natl. Acad. Sci. USA 92, 3199-3203 (1995).

334. J. Schlessinger. Cellular signaling by receptor tyrosine kinases. The Harvey Society Lectures 89, 105-123 (1995).

335. R. Fernandez, D. Tabarini, N. Azpiazu, M. Frasch and J. Schlessinger. The Drosophila insulin receptor homologue: a gene essential for embryonic development encodes two receptor isoforms with different signaling potential. EMBO J. 14, 3373-3384 (1995).

336. H. Wang, H. Yan, P.D. Canoll, O. Silvennoinen, J. Schlessinger and J.M. Musacchio Expression of receptor tyrosine phosphatase-σ (RPTP-σ) in the nervous system of the developing and adult rat. J. Neuroscience Research 41, 297-310 (1995).

337. I. Dikic, A.G. Batzer, P. Blaikie, A. Obermeier, A. Ullrich, J. Schlessinger and B. Margolis. SHC binding to NGF receptor is mediated by the PI domain. J. Biol. Chem. 270, 15125-15129 (1995).

338. A.G. Batzer, P. Blaikie, K. Nelson, J. Schlessinger and B. Margolis. The Phosphotyrosine interaction domain of Shc binds an LXNPXY motif on the epidermal growth factor receptor. Mol. Cell Biol. 15, 4403-4409 (1995).

339. E. Peles, M. Nativ, P.L. Campbell, T. Sakurai, R. Martinez, S. Lev, D.O. Clary, J. Schilling, G. Barnea, G.D. Plowman, M. Grumet and J. Schlessinger. The carbonic anhydrase domain of receptor tyrosine phosphatase β is a functional ligand for the axonal cell recognition molecule contactin. Cell 82, 251-260 (1995).

340. F. Mainiero, A. Pepe, K.K. Wary, L. Spinardi, M. Mohammadi, J. Schlessinger, and F.G. Giancotti. Signal transduction by the $\alpha_6\beta_4$ integrin: distinct β_4 subunit sites mediate recruitment of Shc/Grb2 and association with the cytoskeleton of hemidesmosomes. EMBO J. 14, 4470-4481 (1995).

341. R. Herbst, M.S. Shearman, B. Jallal, J. Schlessinger and A. Ullrich. Formation of signal transfer complexes between stem cell and platelet-derived growth factor receptors and SH2 domain proteins *in vitro*. Biochemistry 34, 5971-5979 (1995).

342. M.L. Galisteo, I. Dikic, A.G. Batzer, W.Y. Langdon and J. Schlessinger. Tyrosine phosphorylation of the c-cbl proto-oncogene protein product and association with EGF receptor upon EGF stimulation. J. Biol. Chem. 270, 20242-20245 (1995).

343. S. Lev., H. Moreno, G.D. Plowman, R. Martines, E. Peles, P. Canoll, J.M. Musacchio, B. Rudy and J. Schlessinger. Protein tyrosine kinase PYK2 involved in Ca+2 induced regulation of ion channel and MAP kinase functions. Nature 376, 737-745 (1995).

344. K.M. Ferguson, M.A. Lemmon, P.B. Sigler and J. Schlessinger. Scratching the surface with the PH domain. Nature, Structural Biology 2, 715-718 (1995).

345. A. Obermeier, R.A. Bradshaw, K. Seedorf, A. Choidas, J. Schlessinger and A. Ullrich. Definition of signals for neuronal differentiation: In Receptor activation by antigens, cytokines, hormones, and growth factors, Eds. D. Naor, P. De Meyts, M. Feldman and J. Schlessinger. Annals of the NY Acad. Science 776, 1-17 (1995).

346. J. Schlessinger, I. Lax, and M. Lemmon. Regulation of growth factor activation by proteoglycans: What is the role of the low affinity receptors? Cell 83, 357-360 (1995).

347. M.A. Lemmon, K.M. Ferguson, R. O'Brien, P.S. Sigler and J. Schlessinger. Specific and high-affinity binding of inositol phosphates to an isolated pleckstrin homology domain. Proc. Natl. Acad. Sci. USA 92, 10472-10476 (1995).

348. K.M. Ferguson, M.A. Lemmon, J. Schlessinger and P.B. Sigler. Structure of the high affinity complex of inositol trisphosphate with a phospholipase C pleckstrin homology domain. Cell 83, 1037-1046 (1995).

349. B. Margolis, E.Y. Skolnik and J. Schlessinger. The use of tyrosine-phosphorylated proteins to screen bacterial expression libraries for SH2 domain. Methods in Enzymology 255, 360-369 (1995).

350. D.W. Leaman, S. Pisharody, T.W. Flickinger, M.A. Commane, J. Schlessinger, I.M. Kerr, D.E. Levy and G.R. Stark. Roles of JAKs in activation of STATs and stimulation of c-*fos* gene expression by epidermal growth factor. Mol. Cell. Biol. 16:369-375 (1996).

351. W.S. Katz, G.M. Lesa, D. Yannoukakos, T.R. Clandinin, J. Schlessinger and P.W. Sternberg. A point mutation in the extracellular domain activates LET-23, the *Caenorhabditis elegans* epidermal growth factor receptor homolog. Mol. Cell. Biol. 16, 529-537 (1996).

352. M. Mohammadi, I. Dikic, A. Sorokin, W.H. Burgess, M. Jaye and J. Schlessinger. Identification of six novel autophosphorylation sites on fibroblast growth factor receptor-1 and elucidation of their importance in receptor activation and signal transduction. Mol. Cell. Biol. 16, 977-989 (1996).

353. V. Mandiyan, R. O'Brien, M. Zhou, B. Margolis, M.A. Lemmon, J.M. Sturtevant and J. Schlessinger. Thermodynamic studies of Shc phosphotyrosine-interaction-domain recognition of the NPXpY-Motif. J. Biol. Chem. 271, 4770-4775 (1996).

354. L. Yenush, R. Fernandez, M.G. Myers Jr., T.C. Grammer, X.J. Sun, J. Blenis, J.H. Pierce, J. Schlessinger and M.F. White. The Drosophila homologue of the insulin receptor activates IRS-1-like signals but does not mediate mitogenesis in 32D cells. Mol. Cell Biol. 16, 2509-2517 (1996).

355. R.T. Nolte, M.J. Eck, J. Schlessinger, S.E. Shoelson and S.C. Harrison. Crystal structure of the PI3-kinase P85 amino-terminal SH2 domain and its phosphopeptide complexes. Nature Structural Biol. 3, 364-374 (1996).

356. P.D. Canoll, S. Petanceska, J. Schlessinger and J.M. Musacchio. Three forms of RPTP-β are differentially expressed during gliogenesis in the developing rat brain and during glial cell differentiation in culture. J. Neuroscience Res. 44, 199-215 (1996).

357. M.A. Lemmon, K.M. Ferguson and J. Schlessinger. PH Domains: Diverse sequences with a common fold recruit signaling molecules to the cell surface. Cell 85, 621-624 (1996).

358. J. Zheng, S.M. Cahill, M.A. Lemmon, D. Fushman, J. Schlessinger and D. Cowburn. Identification of the binding site for acidic phospholipids on the PH domain of dynamin: Implications for stimulation of GTPase activity. J. Mol. Biol. 255, 14-21 (1996).

359. G. Tokiwa, I. Dikic, S. Lev and J. Schlessinger. Activation of PYK2 by stress signals and coupling with JNK signaling pathway. Science 273, 792-794 (1996).

360. M. Mohammadi, J. Schlessinger and S.R. Hubbard. Structure of the FGF receptor tyrosine kinase domain reveals a novel autoinhibitory mechanism for receptor tyrosine kinases. Cell 86, 577-587 (1996).

361. M.L. Galisteo, J. Chernoff, Y.C., Su, E.Y. Skolnik and J. Schlessinger. The adaptor protein Nck links receptor tyrosine kinases with the serine-threonine kinase Pak1. J. Biol. Chem. 271, 20997-21000 (1996).

362. I. Dikic, G. Tokiwa, S. Lev, S.A. Courtneidge and J. Schlessinger. A role for PYK2 and Src in linking G-protein-coupled receptor with MAP kinase activation. Nature 383, 547-550 (1996).

363. M. Sahni, X.M. Zhou, L. Bakiri, J. Schlessinger, R. Baron and J.B. Levy. Identification of a novel 135-kDa Grb2-binding protein in osteoclasts. J. Biol. Chem. 271, 33141-33147 (1996).

364. M.A. Lemmon, Z. Bu, J.E. Ladbury, M. Zhou, D. Pinchasi, I. Lax, D.M. Engelman and J. Schlessinger. Two EGF molecules contribute additively to stabilization of the EGFR dimer. EMBO J. 16, 281-294 (1997).

365. T. Sakurai, M. Lustig, M. Nativ, J.J. Hemperly, J. Schlessinger, E. Peles and M. Grumet. Induction of neurite outgrowth through contactin and Nr-CAM by extracellular regions of glial receptor tyrosine phosphatase β. J. Cell Biol. 136, 907-918 (1997).

366. M.A. Lemmon, D. Pinchasi, M. Zhou, I. Lax and J. Schlessinger. Kit receptor dimerization is driven by bivalent binding of stem cell factor. J. Biol. Chem. 272, 6311-6317 (1997).

367. E. Peles, M. Nativ, M. Lustig, M. Grumet, J. Schilling, R. Martinez, G.D. Plowman and J. Schlessinger. Identification of a novel contactin associated transmembrane receptor with multiple domains implicated in protein-protein interactions. EMBO J. 16, 978-988 (1997).

368. E. Peles, K. Joho, G.D. Plowman and J. Schlessinger. Close similarity between Drosophila Neurexin IV and mammalian Casper protein suggests a conserved mechanism for cellular interactions. Cell 88, 745-746 (1997).
369. R. Llinás, H. Moreno, M. Sugimori, M. Mohammadi and J. Schlessinger. Differential pre and postsynaptic modulation of chemical transmission in the squid giant synapse by tyrosine phosphorylation. Proc. Natl. Acad. Sci. USA 94, 1990-1994 (1997).
370. C.R. Artalejo, M.A. Lemmon, J. Schlessinger and H.C. Palfrey. Specific role for the PH domain of dynamin-1 in the regulation of rapid endocytosis in adrenal chromaffin cells. EMBO J. 16, 1565-1574 (1997).
371. J. Schlessinger. Phospholipase-Cγ activation and phosphoinositide hydrolysis are essential for embryonal development. Proc. Natl. Acad. Sci. USA 94, 2798-2799 (1997).
372. D. Qian, S. Lev N. S..C. van Oers, I. Dikic, J. Schlessinger and A. Weiss. Evidence for functional specificities of Lck and Fyn during TCR signaling. J. Exp. Med. 185, 1253-1259 (1997).
373. M. Mohammadi, J. McMahon, L. Sun, C. Tang, P. Hirth, B.K. Yeh, S.R. Hubbard and J. Schlessinger. Structures of tyrosine kinase domain of fibroblast growth factor receptor in complex with inhibitors. Science 276, 955-960 (1997).
374. M.A. Lemmon, M. Falasca, K.M. Ferguson and J. Schlessinger. Regulatory recruitment of signalling molecules to the cell membrane by pleckstrin-homology domains. Trends in Cell Biol. 7, 237-242 (1997).
375. H. Kouhara, Y. Hadari, T. Spivak-Kroizman, J. Schilling, D. Bar-Sagi, I. Lax and J. Schlessinger. A lipid-anchored Grb2-binding protein that links FGF-receptor activation to the Ras/MAP kinase signaling pathway. Cell 89, 693-702 (1997).
376. G.A. Rodrigues, M. Park and J. Schlessinger. Activation of Jnk pathway is essential for transformation by the Met oncogene. EMBO J. 16, 2634-2645 (1997).
377. M. Odaka, D. Kohda, I. Lax, J. Schlessinger and F. Inagaki. Ligand-binding enhances the affinity of dimerization of the extracellular domain of the epidermal growth factor receptor. J. Biochem. 122, 116-121 (1997).
378. S.K. Logan, M. Falasca, P. Hu and J. Schlessinger. Phosphatidylinositol 3-kinase mediates epidermal growth factor-induced activation of the c-Jun N terminal kinase signaling pathway. Mol. Cell. Biol. 17, 5784-5790 (1997).
379. Z. Zhang C.-H. Lee V. Mandiyan, J.-P. Borg B. Margolis, J. Schlessinger and J. Kuriyan. Sequence-specific recognition of the internalization motif of the alzheimer's amyloid precursor protein by the X11 PTB domain. EMBO J. 16, 6141-6150 (1997).
380. C.B. Davis, I. Dikic, D. Unutmaz, C.M. Hill, J. Schlessinger and D.R. Littman. Signal transduction due to HIV-1 envelope interactions with chemokine receptors CXCR4 or CCR5. J. Exp. Med. 186, 1793-1798 (1997).
381. J. Schlessinger. Direct binding and activation of receptor tyrosine kinases by collagen. Cell 91, 869-872 (1997).
382. F. Falasca, S.K. Logan, V.P. Lehto, G. Baccante, M.A. Lemmon and J. Schlessinger. Activation of phospholipase Cγ by PI-3 kinase induced PH domain mediated membrane targeting. EMBO J. 17, 414-422 (1998).
383. K. Ogura, S. Tsuchiya, H. Terasawa, S. Yuzawa, H. Hatanaka, V. Mandiyan, J. Schlessinger and F. Inagaki. Conformation of Shc-derived phosphotyrosine containing peptide complexed with Grb2 SH2 domain. J. Biomolecular NMR 10, 273-278 (1998).
384. S.J. Holland, E. Peles, T. Pawson and J. Schlessinger. Cell-contact-dependent signaling in axon growth and guidance: Eph receptor tyrosine kinases and receptor protein tyrosine phosphatase beta. Curr. Opin. Neurobiol. 8, 117-127 (1998).
385. E. Peles, J. Schlessinger and M. Grumet. Multi-ligand interactions with receptor-like protein tyrosine phosphatase β: implications for intercellular signaling. TIBS 23, 121-124 (1998).
386. Y. Abe, M. Odaka, F. Inagaki, I. Lax, J. Schlessinger and D. Kohda. Disulfide bond structure of human epidermal growth factor receptor. J. Biol. Chem. 273, 11150-11157 (1998).
387. T. Miyazaki, A. Takaoka, L. Nogueira, I. Dikic, H. Fujii, S. Tsujino, Y. Mitani, M. Maeda, J. Schlessinger and T. Taniguchi. Pyk2 is a downstream mediator of the IL-2 receptor-coupled Jak signaling pathway. Genes and Development 12, 770-775 (1998).
388. S.R. Hubbard, M. Mohammadi and J. Schlessinger. Autoregulatory mechanisms in protein-tyrosine kinases. J. Biol. Chem. 273, 11987-11990 (1998).
389. A.S. Sorokin, B. Reed, N. Nnkemere and J. Schlessinger. Crk protein binds to PDGF receptor and insulin receptor substrate-1 with different modulating effects on PDGF- and insulin-dependent signaling pathways. Oncogene 16, 2425-2434 (1998).

390. I. Dikic, I. Dikic and J. Schlessinger. Identification of a new Pyk2 isoform implicated in chemokine and antigen receptor signaling. J. Biol. Chem. 273, 14301-14308 (1998).

391. Y.R. Hadari, H. Kouhara, I. Lax and J. Schlessinger. Binding of Shp2 tyrosine phosphatase to FRS2 is essential for fibroblast growth factor-induced PC12 cells differentiation. Mol. Cell. Biol. 18, 3966-3973 (1998).

392. A.D. DiGabrielle, I. Lax, D.I. Chen, C.M. Svahn, M. Jaye, J. Schlessinger and W.A. Hendrickson. Structure of a heparin-linked biologically active dimer of fibroblast growth factor. Nature 393, 717-820 (1998).

393. A. Weiss and J. Schlessinger. Switching signals on or off by receptor dimerization. Cell 94, 277-280 (1998).

394. Y. Wang, M. Falasca, J. Schlessinger, S. Malstrom, P. Tsichlis, J. Settleman, B. Lim and R. Prywes. Activation of the c-fos serum response element by phosphatidyl inositol 3-kinase and rho pathways in HeLa cells. Cell Growth & Diff. 9, 513-522 (1998).

395. M. Mohammadi, S. Froum, J.M. Hamby, M.C. Shroeder, R.L. Panek, G.H. Lu, A.V. Eliseenkova, D. Green, J. Schlessinger and S.R. Hubbard. Crystal sturcture of an angiogenesis inhibitor bound to the FGF receptor tyrosine kinase domain. EMBO J. 17, 5896-5904 (1998).

396. S. Lev, J. Hernandez, R. Martinez, A. Chen, G. Plowman and J. Schlessinger. Identification of a novel family of targets of PYK2 related to Drosophila Retinal Degeneration B (rdgB) protein. Mol. Cell. Biol. 19, 2278-2288 (1999).

397. J. Andreev, J.-P. Simon, D.D. Sabatini, J. Kam, G. Plowman, P.A. Randazzo and J. Schlessinger. Identification of a new Pyk2 Target Protein with Arf-GAP activity. Mol. Cell. Biol. 19, 2338-2350 (1999).

398. A. Takaoka, N. Tanaka, Y. Mitani, T. Miyazaki, H. Fujii, M. Sato, P. Kovarik, T. Decker, J. Schlessinger and T. Taniguchi. Protein tyrosine kinase Pyk2 mediates the Jak-dependent activation of MAPK and Stat1 in the IFN-γ, but not IFN-α, signalling. EMBO J. 18, 2480-2488 (1999).

399. K. Ogura, K. Nagata, H. Hatanaka, H. Habuchi, K. Kimata, S.-i Tate, M.W. Ravera, M. Jaye, J. Schlessinger and F. Inagaki. Solution structure of human acidic fibroblast growth factor and interaction with heparin-derived hexasaccharide. J. Biomol. NMR 13, 11-24 (1999).

400. K. Ogura, S. Tsuchiya, H. Terasawa, S. Yuzawa, H. Hatanaka, V. Mandiyan, J. Schlessinger and F. Inagaki. Solution structure of the SH2 domain of Grb2 complexed with the Shc derived phosphotyrosine containing peptide. J. Mol. Biol. 289, 439-445 (1999).

401. S. Tsuchiya, K. Ogura, H. Hatanaka, K. Nagata, H. Terasawa, V. Mandiyan, J. Schlessinger S. Aimoto, H. Ohta and F. Inagaki. Solution structure of the SH2 domain of Grb2/Ash complexed with the EGF receptor-derived phosphotyrosine-containing peptide. J. Mol. Biol. 125, 1151-1159 (1999).

402. M.A. Broome, M.L. Galisteo, J. Schlessinger and S.A. Courtneidge. The proto-oncogene c-Cbl is a negative regulator of DNA synthesis initiated by both receptor and cytoplasmic tyrosine kinases. Oncogene 18, 2908-2912 (1999).

403. Z. Shen, A. Batzer, J.A. Koehler, P. Polakis, J. Schlessinger, N.B. Lydon, and M.F. Moran. Evidence for SH3 domain directed binding and phosphorylation of Sam68 by Src. Oncogene 18, 4647-4653 (1999).

404. A.N. Plotnikov, J. Schlessinger, S.R. Hubbard and M. Mohammadi. Structural basis for FGF receptor dimerization and activation. Cell 98, 641-650 (1999).

405. V. Mandiyan, J. Andreev, J. Schlessinger and S.R. Hubbard. Crystal structure of the ARF-GAP domain and ankyrin repeats of PYK2-associated protein β. EMBO J. 18, 6890-6898 (1999).

406. T. Domagala, N. Konstantopoulos, F. Smyth, R. Jorissen, L. Fabri, D. Geleick, I. Lax, J. Schlessinger, W. Sawyer, G. Howlett, A. Burgess and E.C. Nice. Stoichiometry, kinetics and binding equilibria of the interaction between epidermal growth factor (EGF) and the extracellular domain of the EGF receptor. Growth Factors 18, 11-29 (2000).

407. S.H. Ong, G. R. Guy, Y. Hadari, S. Laks, N. Gotoh, J. Schlessinger and I. Lax. FRS2 proteins recruit intracellular signaling pathways by binding to diverse targets on FGF and NGF receptors. Mol. Cell. Biol. 20, 979-989 (2000).

408. G.A. Rodrigues, M. Falasca, Z. Zhang, S.H. Ong and J. Schlessinger. A novel positive feedback loop mediated by the docking protein Gab1 and PI-3 kinase in EGF receptor signaling. Mol. Cell. Biol. 20, 1448-1459 (2000).

409. J. Schlessinger. New roles for Src kinases in the control of cell survival and angiogenesis. Cell 100, 293-296 (2000).

410. J. Schlessinger. Novel fluorescent approaches for studying cell signaling in single cells. Nature Biotechnology 18, 262-263 (2000).

411. A.N. Plotnikov, S.R. Hubbard, J. Schlessinger and M. Mohammadi. Crystal structures of two FGF-FGFR complexes reveal the determinants of ligand-receptor specificity. Cell 101, 413-424 (2000).

412. Z. Zhang, R. Zhang, A. Joachimiak, J. Schlessinger, and X.-P. Kong. Crystal structure of human stem cell factor: Implication for stem cell factor receptor dimerization and activation. Proc. Natl. Acad. Sci. USA 97, 7732-7737 (2000).
413. G. Thomas, F. de Pablo, J. Schlessinger and J. Moscat. Control of signaling by protein phosphorylation. EMBO Reports 1, 11-15 (2000).
414. M. Sibilla, A. Fleischmann, A. Behrens, L. Stingl, J. Carroll, F. Watt, J. Schlessinger and E.F. Wagner. The EGF receptor provides an essential survival signal for SOS-dependent skin tumor development. Cell 102, 211-220 (2000).
415. R. Guimard, M. Okigaki, J. Schlessinger and J.V. Ravetch. Absence of marginal zone B cells in Pyk2 deficient mice defines their role in the humoral response. Nature Immun. 1, 31-36 (2000).
416. J. Schlessinger, A.N. Plotnikov, O.A. Ibrahimi, A.V. Eliseenkova, A. Yayon, B.K. Yeh, R.J. Linhardt and M. Mohammadi. Crystal structure of a ternary FGF:FGFR:heparin complex reveals a dual role for heparin in FGFR binding and dimerization. Mol. Cell 6, 743-750 (2000).
417. S. Harroch, M. Palmeri, J. Rosenbluth, A. Custer, M. Okigaki, P. Shrager, M. Blum, J.D. Buxbaum and J. Schlessinger. Normal development of neurons and glia in mice deficient in receptor protein tyrosine phosphatase β. Mol. Cell. Biol. 20, 7706-7715 (2000).
418. J. Schlessinger. Cell signaling by receptor tyrosine kinases. Cell 103, 211-225 (2000).
419. S. Yuzawa, M. Yokochi, H. Hatanaka, K. Ogura, M. Kataoka, K. Miura, V. Mandiyan, J. Schlessinger and F. Inagaki. Solution structure of Grb2 reveals extensive flexibility of the adaptor protein necessary for target recognition and function. J. Mol. Biol. 306, 527-557 (2001).
420. R. M. Melillo, M. Santoro, S.-H. Ong, Y.R. Hadari, M. Billaud, A. Fusco, J. Schlessinger, and I. Lax. The docking protein FRS2 links Ret and its oncogenic forms with the Ras/MAPK cascade. Mol. Cell. Biol. 21, 4177-4187 (2001).
421. S.-H. Ong, Y.R. Hadari, N. Gotoh, G. Guy, J. Schlessinger, and I. Lax. Stimulation of PI-3 kinase by FGF receptors is mediated by coordinated recruitment of multiple docking proteins. Proc. Natl. Acad. Sci. USA 98, 6074-6079 (2001).
422. J. Andreev, M.L. Galisteo, O. Kranenburg, S.K. Logan, E.S. Chiu, M. Okigaki, L.A. Cary, W.H. Moolenaar and J. Schlessinger. Src and Pyk2 mediate G-protein-coupled receptor activation of epidermal growth factor receptor (EGFR) but are not required for coupling to the mitogen-activated protein (MAP) kinase signaling cascade. J. Biol. Chem. 276, 20130-20135 (2001).
423. M. Nishida, K. Nagata, Y. Hachimori, M. Horiuchi, K. Ogura, V. Mandiyan, J. Schlessinger and F. Inagaki. Novel recognition mode between Vav and Grb2 SH3 domains. EMBO J. 20, 2995-3007 (2001).
424. Y.R. Hadari, N. Gotoh, H Kouhara, I. Lax and J. Schlessinger. Critical role for the docking protein FRS2α in FGF-receptor mediated signal transduction pathways. Proc. Natl. Acad. Sci. USA , 8578-8583 (2001) .
425. J. Schlessinger. A solid base for assaying protein kinase activity. Nature Biotechnology 20, 232-33 (2002).
426. A. Wong, B. Lamotte, A. Lee, J. Schlessinger and I. Lax. FRS2α attenuates FGF-receptor signaling by Grb2-mediated recruitment of the ubiquitin ligase, Cbl. Proc. Natl. Acad. Sci. USA 99, 6684-6689 (2002).
427. J. Schlessinger. All signaling is local? Molecular Cell 10, 218-219 (2002).
428. J. Schlessinger. Ligand induced receptor mediated dimerization and activation of EGF-receptors. Cell 110, 669-672 (2002).
429. S. Harroch, G. Furtado, W. Brueck, J. Rosenbluth, J. Lafaille, M. Chao, J.D. Buxbaum, and J. Schlessinger. S. A critical role for the protein tyrosine phosphatase RPRPβ in functional recovery from demyelinating lesions. Nature Genetics 32, 411-414 (2002).
430. I. Lax, A. Wong, B. Lamothe, A. Lee, A. Frost, J. Hawes and J. Schlessinger. The docking protein FRS2α controls a MAP kinase mediated negative feedback mechanism for signaling by FGF-receptors. Molecular Cell 10, 709-719. (2002).
431. S.J. Fleishman, J. Schlessinger and N. Ben-Tal. A putative molecular activation switch in the transmembrane domain of the ErbB2 receptor tyrosine kinase. Proc. Natl. Acad. Sci. USA 99, 15937-15940 (2002).
432. J. Schlessinger. Signal Transduction: Autoinhibition Control. Science 300, 750-752 (2003).
433. J. Schlessinger and M.A. Lemmon. SH2 and PTB domains in tyrosine kinase signaling. Science STKE 2003 (191) Re12 (2003).
434. M. Okigaki, C. Davies, M. Falasca, S. Harroch, D.P. Felsenfeld, M.P. Sheetz and J. Schlessinger. Pyk2 regulates multiple signaling events crucial for macrophage morphology and migration. Proc. Natl. Acad. Science, USA 100, 10740-10745 (2003).

435. D. Mattoon, P. Klein, M. Lemmon, I. Lax, J. Schlessinger. Limited control of receptor function is mediated by the tethered configuration of the extracellular domain of EGF-receptor. Proc. Natl. Acad. Sci. USA 101, 923-928 (2004).

436. P. Klein, D. Mattoon, M. Lemmon, J. Schlessinger. A structure based model for ligand binding and dimerization of EGF-receptors. Proc. Natl. Acad. Sci. USA 101, 928-934 (2004).

437. S.K Olsen, O.A. Ibrahimi, A. Raucci, F. Zhang, A.V. Elinseenkova, A. Yayon, C. Basilico, R.J. Linhardt, J. Schlessinger, and M. Mohommadi. Insights into the molecular basis for FGF receptor autoinhibition and ligand binding promiscuity. Proc. Natl. Acad. Sci. USA 101, 935-940 (2004).

438. S. Thiberge, A. Nechushtan, D. Sprinzak, O. Gileadi, V. Behar, O. Zik, Y. Chowers, S. Michaeli, J. Schlessinger, and E. Moses. Scanning electron microscopy of cells and tissues under fully hydrated conditions. Proc. Natl. Acad. Sci. USA 101, 3346-3351 (2004).

439. N. Gotoh, S. Laks, M. Nakahsima, I. Lax, and J. Schlessinger. FRS2 family docking proteins with overlapping roles in activation of MAP kinase have distinct patterns of spatial-temporal patterns of expression of their transcripts. FEBS Letters 564, 14-18 (2004).

440. B. Lamothe, M. Yamada, U. Schaeper, W. Birchmeier, I. Lax and J. Schlessinger. The docking protein Gab1 is an essential component of an indirect mechanism for FGF stimulation of the PI 3-kinase/Akt anti-apoptotic pathway. Mol. Cell Biol. 24, 5657-5666 (2004).

441. K.Y. Zhang, G. L. Card, Y. Suzuki, D.R. Artis, D. Fong, S. Gillette, D. Hsieh, J. Neiman, B.L. West, M.V. Milburn, S-H. Kim, J. Schlessinger, and G. Bollag. A novel 'glutamine switch' mechanism for nucleotide selectivity of phosphodiesterases. Mol. Cell 15, 279-286 (2004).

442. T. Wakatsuki, J. Schlessinger, E.L. Elson. The biochemical response of the heart to hypertension and exercise. Trends in Biochem. Sci. 29, 609-617 (2004).

443. D. Mattoon, B. Lamothe, I. Lax, and J. Schlessinger. The docking protein Gab1 is the primary mediator of EGF-stimulated activation of the PI-3K/Akt cell survival pathway. BMC Biology 2, 24 (2004).

444. J. Schlessinger. Common and distinct elements in signaling via EGF and FGF receptors. Science 306, 1506-1507 (2004).

445. N. Gotoh, M. Ito, S. Yamamoto, I. Yoshino, N. Song, Y. Wang, I. Lax, J. Schlessinger, M. Shibuya, and R.A. Lang. Tyrosine phosphorylation sites on FRS2α responsible for Shp2 recruitment are critical for induction of lens and retina. Proc. Natl. Acad. Sci. USA 101, 17144-17149 (2004).

446. G.L. Card, B.P. England, Y. Suzuki, D. Fong, B. Powell, B. Lee, C. Luu, M. Tabrizizad, S. Gillette, P.N. Ibrahim, D.R. Artis, G. Bollag, M.V. Milburn, S-H. Kim, J. Schlessinger, K.Y. J. Zhang. Structural basis for the activity of drugs that inhibit phosphodiesterases. Structure 12, 2233-2247 (2004).

447. G.L. Card, L Blasdell, B.P. England, C. Zhang, Y. Suzuki, S. Gillette, D. Fong, P.N. Ibrahim, D.R. Artis, G. Bollag, M.V. Milburn, S-H. Kim, J. Schlessinger, K.Y.J. Zhang. A family of phosphodiesterase inhibitors discovered by co-crystallography and scaffold-based drug design. Nature Biotech. 23, 201-207 (2005).

448. N. Gotoh, K. Manova, S. Tanaka, M. Murohashi, Y. Hadari, A. Lee, Y. Hamada, T. Hiroe, M. Ito, T. Kiruhara, H. Nakazato, M. Shibuya, I. Lax, E. Lacy and J. Schlessinger. The docking protein FRS2α is an essential component of multiple FGF responses during early mouse development. Mol. Cell Biol. 25, 4105-4116 (2005).

449. V.P. Eswarakumar, I. Lax, and J. Schlessinger. Cellular signaling by fibroblast growth factor receptors. Cytokines & Growth Factor Reviews 16, 139-149 (2005).

450. J.P. Dawson, M.B. Berger, C-C. Lin, J. Schlessinger, M.A. Lemmon, K.M. Ferguson. EGF receptor dimerization and activation require ligand-induced conformational changes in the dimer interface. Mol. Cell Biol. 25, 7734-7742 (2005).

451. S. Yamamoto, I. Yoshino, T. Shimazaki, M. Murohashi, R. F. Hevner, I. Lax, H. Okano, M. Shibuya, J. Schlessinger, and N. Gotoh. Essential role of Shp2-binding sites on the docking protein FRS2α for mammalian corticogenesis and for FGF2-dependent proliferation of cultured neural progenitor cells. Proc. Natl. Acad. Sci. USA 102, 15983-15988 (2005).

452. H. Yokote, K. Fujita, X. Jing, T. Sawada, S. Liang, L. Yao, X. Yan, Y. Zhang, J. Schlessinger, and K. Sakaguchi. Trans-activation of EphA4 and FGF-receptors mediated by direct interactions between their cytoplasmic domains. Proc. Natl. Acad. Sci. USA 102, 18866-18871 (2005).

453. C. Furdui, E.D. Lew, J. Schlessinger, and K.S. Anderson. Autophosphorylation of FGFR1 kinase is mediated by a sequential and precisely ordered reaction. Mol. Cell 21, 711-717 (2006).

454. E. Rohmann, H. Brunner, H. Kayserili, O. Uyguner, G. Nurnberg, E.D. Lew, A. Dobbie, V.P. Eswarakumar, A. Uzumcu, M. Emerouglu, J. Leroy, Y. Li, C. Becker, K. Lehnerdt, C.W.R.J. Cremers, M. Yuksel-Apak, P. Nurnberg, C. Kubisch, J. Schlessinger, H. von Bockhoven, B. Wollnick. Mutations in different components of FGF-signaling in LADD syndrome. Nature Genetics 38, 414-417 (2006).

455. F. Özcan, P. Klein, M. Lemmon, I. Lax, J. Schlessinger. On the nature of the high-affinity EGF-receptor binding sites on living cells. Proc. Natl. Acad. Sci. USA 103, 5735-5740 (2006).

456. S. Lamprianou, N. Vacaresse, Y. Suzuki, H. Meziane, J.D. Buxbaum, J. Schlessinger and S. Harroch. Receptor tyrosine phosphatase-γ (RPTPγ) is a marker for pyramidal cells and sensory neurons in the nervous system and is not necessary for normal development. Mol Cell Biol. 26, 5106-5119 (2006).

457. M.L. Galisteo, Y. Yang, J. Ureña, and J. Schlessinger. Activation of the non-receptor protein tyrosine kinase Ack by multiple extracellular stimuli. Proc. Natl. Acad. Sci. USA 103, 9796-9801 (2006).

458. J. Schlessinger and M.A. Lemmon. Nuclear signaling by receptor tyrosine kinases: The first robin of spring. Cell 127, 45-48 (2006).

459. V.P. Eswarakumar, F. Özcan, E.D. Lew, J.H. Bae, F. Tomé, C.J. Booth, D.J. Adams, I. Lax and J. Schlessinger. Attenuation of signaling pathways stimulated by pathologically activated FGF-receptor 2 mutants prevents craniosynostosis. Proc. Natl. Acad. Sci. USA 103, 18603-18608 (2006).

460. V.P. Eswarakumar and J. Schlessinger. Skeletal overgrowth is mediated by deficiency in a specific isoform of fibroblast growth factor receptor-3. Proc. Natl. Acad. Sci. USA 104, 3937-3942 (2007).

461. S. Yuzawa, Y. Opatowsky, Z. Zhang, V. Mandiyan, I. Lax, and J. Schlessinger. Structural basis for activation of the receptor tyrosine kinase Kit by stem cell factor. Cell 130, 323-334 (2007).

462. H. Gil-Henn, O. Destaing, N.A. Sims, K. Aoki, N. Alles, L. Neff, A. Sanjay, A. Bruzzaniti, R. Baron and J. Schlessinger. Defective Pyk2 mediated podosome organization in osteoclasts leads to increased bond density in Pyk2-null mice. J. Cell Biol. 178, 1053-1064 (2007).

463. I. Shams, E. Rohmann, V.P. Eswarakumar, E. D. Lew, S. Yuzawa, B. Wollnik, J. Schlessinger, and I. Lax. LADD syndrome is caused by reduced activity of the FGF10-FGF receptor 2 signaling pathway. Mol. Cell Biol. 27, 6903-6912 (2007).

464. E.D. Lew, Jae-Hyun Bae, E. Rohmann, B. Wollnik and J. Schlessinger. Structural basis for reduced FGFR2 activity in LADD Syndrome: Implications for FGFR autoinhibition and activation. Proc. Natl. Acad. Sci. USA 140, 19802-19807 (2007).

465. L. Wang, I. Tassiulas, K.H. Park-Min, A.C. Reid, H. Gil-Henn, J. Schlessinger, R. Baron, JJ. Zhang and L.B. Ivashkiv. 'Tuning' of type-I, interferon-induced Jak-STAT1 signaling by calcium-dependent kinases in macrophages. Nature Immunology 9, 186-193 (2008).

466. J. Tsai, W. Wang, J.T. Lee, W. Wang, J. Zhang, H. Cho, S. Mamo, R. Bremer, S. Gillette, J. Kong, N.K. Haas, K. Sproesser, L. Li, K.S.M. Smalley, D. Fong, Y. Zhu, A. Marimuthu, H. Nguyen, B. Lam, J. Liu, I. Cheung, J. Rice, Y. Suzuki, C. Luu, C. Settachatgul, R. Shellooe, J. Cantwell, S. Kim, J. Schlessinger, K.Y.J. Zhang, B. West, B. Powell, G. Habets, C. Zhang, P.N. Ibrahim, P. Hirth, D. Artis, M. Herlyn, G. Bollag. Discovery of a Novel Selective Inhibitor of Oncogenic B-Raf Kinase with Potent Anti-Melanoma Activity. Proc. Natl. Acad. Sci. USA 105, 3041-3046 (2008).

467. Y. Yang, S. Yuzawa and J. Schlessinger. Contacts between membrane proximal regions of PDGF-receptor ectodomain are required for receptor activation but not for receptor dimerization. Proc. Natl. Acad. Sci USA 105, 7681-7686 (2008).

468. E.D. Lew, C.M. Furdui, K.S. Anderson and J. Schlessinger. The precise sequence of FGF-receptor1 autophosphorylation is kinetically driven and is disrupted by oncogenic mutations. Science Signaling 2, 1-10 (2009).

469. Y. Hadari and J.Schlessinger. FGFR3 targeted mAb therapy for bladder cancer and multiple myeloma. J. Clin. Invest. 119, 1077-1079 (2009).

470. J. Lulo, S. Yuzawa and J. Schlessinger. Crystal Structures of free and ligand-bound focal adhesion targeting domain of Pyk2. Biochem. and Biophys. Res. Commun. 383, 347-352 (2009).

471. J.H. Bae, E.D. Lew, S. Yuzawa, F. Tome, I. Lax, and J. Schlessinger. The selectivity of receptor tyrosine kinase signaling is controlled by a secondary SH2 domain binding site. Cell 138, 514-524 (2009).

472. D.Margulies, Y. Opatowsky, S. Fletcher, I. Saraogi, K. Tsou, S. Saha, I. Lax, J. Schlessinger and A. D. Hamilton. Surface Binding Inhibitors of SCF-KIT Protein-Protein Interactions. ChemBiochem. 10, 1955-1958 (2009).

473. M.A. Lemmon and J. Schlessinger. Mechanism of activation and cell signaling by receptor tyrosine kinases. Cell (2010) In Press

474. J.H. Bae, T.J. Boggon, F. Tomé, V. Mandiyan, I. Lax, and J. Schlessinger. An asymmetric receptor contact is required for tyrosine autophosphorylation of fibroblast growth factor receptor in living cells. Proc. Natl. Acad. Sci. USA (2010) Submitted.

475. Y. Yang, P. Xie, Y. Opatowsky, and J. Schlessinger. Direct contacts between extracellular membrane proximal domains are required for VEGF-receptor activation and cell signaling. Proc. Natl. Acad. Sci. USA (2010) In press.

476. K.P. Ravindranathan, V. Mandiyan, A.R. Ekkari, J.H. Bae, J. Schlessinger and W.L. Jorgensen. Discovery of a novel FGFR1 kinase inhibitor by structure-based virtual screening. J. Med. Chem. (2010) Submitted.
477. I. Chung, D. Tomre, J. Schlessinger and I. Mellman. Spatial control of EGF-receptor activation by reversible dimerization. (2010) Submitted.
478. X. Tian, L. Diggs, J. Schlessinger, R. Alpern and P. Preisig. Pyk2 is required in vivo for acid stimulation of NHE3 and NaDC-1 activities. (2010) Submitted.
479. Y. Opatowsky, I. Lax, F. Tomé, F. Bleichert, V. Unger, and J. Schlessinger. Structure, domain organization and different conformational states of stem cell factor induced intact KIT dimers. (2010) Submitted.
480. J. Schellens, I. Lax, Y. Opatowsky, D. de Jong, S. Burgers, and J. Schlessinger. Imatinib sensitive ligand independent signaling through novel oncogenic S476I KIT mutation in metastatic thymus carcinoma. (2010) Submitted.
481. M. Yamada, Y. Yang, J. Schlessinger and I. Lax. FRS2α acts as a local scaffold that specifically assembles membrane-linked MAP kinase substrates in FGF signaling. (2010) Submitted.