

8 Literaturverzeichnis

- Aberle, H., Butz, S., Stappert, J., Weissig, H., Kemler, R., and Hoschuetzky, H. (1994). Assembly of the cadherin-catenin complex in vitro with recombinant proteins. *J Cell Sci 107 (Pt 12)*, 3655-3663.
- Amasheh, S., Meiri, N., Gitter, A. H., Schoneberg, T., Mankertz, J., Schulzke, J. D., and Fromm, M. (2002). Claudin-2 expression induces cation-selective channels in tight junctions of epithelial cells. *J Cell Sci 115*, 4969-4976.
- Babyatsky, M. W., deBeaumont, M., Thim, L., and Podolsky, D. K. (1996). Oral trefoil peptides protect against ethanol- and indomethacin-induced gastric injury in rats. *Gastroenterology 110*, 489-497.
- Balda, M. S., and Anderson, J. M. (1993). Two classes of tight junctions are revealed by ZO-1 isoforms. *Am J Physiol 264*, C918-924.
- Balda, M. S., Whitney, J. A., Flores, C., Gonzalez, S., Cereijido, M., and Matter, K. (1996). Functional dissociation of paracellular permeability and transepithelial electrical resistance and disruption of the apical-basolateral intramembrane diffusion barrier by expression of a mutant tight junction membrane protein. *J Cell Biol 134*, 1031-1049.
- Bamforth, S. D., Kniesel, U., Wolburg, H., Engelhardt, B., and Risau, W. (1999). A dominant mutant of occludin disrupts tight junction structure and function. *J Cell Sci 112 (Pt 12)*, 1879-1888.
- Batlle, E., Sancho, E., Franci, C., Dominguez, D., Monfar, M., Baulida, J., and Garcia De Herreros, A. (2000). The transcription factor snail is a repressor of E-cadherin gene expression in epithelial tumour cells. *Nat Cell Biol 2*, 84-89.
- Birchmeier, W., and Behrens, J. (1994). Cadherin expression in carcinomas: role in the formation of cell junctions and the prevention of invasiveness. *Biochim Biophys Acta 1198*, 11-26.
- Bonkhoff, H., Stein, U., Welter, C., and Remberger, K. (1995). Differential expression of the pS2 protein in the human prostate and prostate cancer: association with premalignant changes and neuroendocrine differentiation. *Hum Pathol 26*, 824-828.
- Brabertz, T., Jung, A., Reu, S., Porzner, M., Hlubek, F., Kunz-Schughart, L. A., Knuechel, R., and Kirchner, T. (2001). Variable beta-catenin expression in colorectal cancers indicates tumor progression driven by the tumor environment. *Proc Natl Acad Sci U S A 98*, 10356-10361.

- Brady-Kalnay, S. M., Rimm, D. L., and Tonks, N. K. (1995). Receptor protein tyrosine phosphatase PTPmu associates with cadherins and catenins in vivo. *J Cell Biol* 130, 977-986.
- Brady-Kalnay, S. M., and Tonks, N. K. (1995). Protein tyrosine phosphatases as adhesion receptors. *Curr Opin Cell Biol* 7, 650-657.
- Brieher, W. M., Yap, A. S., and Gumbiner, B. M. (1996). Lateral dimerization is required for the homophilic binding activity of C-cadherin. *J Cell Biol* 135, 487-496.
- Butz, S., and Kemler, R. (1994). Distinct cadherin-catenin complexes in Ca(2+)-dependent cell-cell adhesion. *FEBS Lett* 355, 195-200.
- Campbell-Thompson, M. L. (1997). Estrogen receptor alpha and beta expression in upper gastrointestinal tract with regulation of trefoil factor family 2 mRNA levels in ovariectomized rats. *Biochem Biophys Res Commun* 240, 478-483.
- Cano, A., Perez-Moreno, M. A., Rodrigo, I., Locascio, A., Blanco, M. J., del Barrio, M. G., Portillo, F., and Nieto, M. A. (2000). The transcription factor snail controls epithelial-mesenchymal transitions by repressing E-cadherin expression. *Nat Cell Biol* 2, 76-83.
- Carr, M. D. (1992). ¹H NMR-based determination of the secondary structure of porcine pancreatic spasmolytic polypeptide: one of a new family of "trefoil" motif containing cell growth factors. *Biochemistry* 31, 1998-2004.
- Chadwick, M. P., May, F. E., and Westley, B. R. (1995). Production and comparison of mature single-domain 'trefoil' peptides pNR-2/pS2 Cys58 and pNR-2/pS2 Ser58. *Biochem J* 308 (Pt 3), 1001-1007.
- Chadwick, M. P., Westley, B. R., and May, F. E. (1997). Homodimerization and hetero-oligomerization of the single-domain trefoil protein pNR-2/pS2 through cysteine 58. *Biochem J* 327 (Pt 1), 117-123.
- Chinery, R., and Cox, H. M. (1995). Modulation of epidermal growth factor effects on epithelial ion transport by intestinal trefoil factor. *Br J Pharmacol* 115, 77-80.
- Collier, J. D., Bennett, M. K., Bassendine, M. F., and Lendrum, R. (1995). Immunolocalization of pS2, a putative growth factor, in pancreatic carcinoma. *J Gastroenterol Hepatol* 10, 396-400.
- Coman, D. R. (1944). Decreased mutual adhesivness, a property of cells from squamous cell carcinomas. *Cancer Res* 4, 625-629.
- Comijn, J., Berx, G., Vermassen, P., Verschueren, K., van Grunsven, L., Bruyneel, E., Mareel, M., Huylebroeck, D., and van Roy, F. (2001). The two-handed E box binding zinc finger protein SIP1 downregulates E-cadherin and induces invasion. *Mol Cell* 7, 1267-1278.

- Conacci-Sorrell, M., Zhurinsky, J., and Ben-Ze'ev, A. (2002). The cadherin-catenin adhesion system in signaling and cancer. *J Clin Invest* *109*, 987-991.
- Cox, R. T., Kirkpatrick, C., and Peifer, M. (1996). Armadillo is required for adherens junction assembly, cell polarity, and morphogenesis during *Drosophila* embryogenesis. *J Cell Biol* *134*, 133-148.
- De, A., Brown, D. G., Gorman, M. A., Carr, M., Sanderson, M. R., and Freemont, P. S. (1994). Crystal structure of a disulfide-linked "trefoil" motif found in a large family of putative growth factors. *Proc Natl Acad Sci U S A* *91*, 1084-1088.
- Detrick, R. J., Dickey, D., and Kintner, C. R. (1990). The effects of N-cadherin misexpression on morphogenesis in *Xenopus* embryos. *Neuron* *4*, 493-506.
- Dignass, A., Lynch-Devaney, K., Kindon, H., Thim, L., and Podolsky, D. K. (1994). Trefoil peptides promote epithelial migration through a transforming growth factor beta-independent pathway. *J Clin Invest* *94*, 376-383.
- Dignass, A. U., and Sturm, A. (2001). Peptide growth factors in the intestine. *Eur J Gastroenterol Hepatol* *13*, 763-770.
- Efstathiou, J. A., Noda, M., Rowan, A., Dixon, C., Chinery, R., Jawhari, A., Hattori, T., Wright, N. A., Bodmer, W. F., and Pignatelli, M. (1998). Intestinal trefoil factor controls the expression of the adenomatous polyposis coli-catenin and the E-cadherin-catenin complexes in human colon carcinoma cells. *Proc Natl Acad Sci U S A* *95*, 3122-3127.
- Emami, S., Le Floch, N., Bruyneel, E., Thim, L., May, F., Westley, B., Rio, M., Mareel, M., and Gespach, C. (2001). Induction of scattering and cellular invasion by trefoil peptides in src- and RhoA-transformed kidney and colonic epithelial cells. *Faseb J* *15*, 351-361.
- Evans, W. H., and Martin, P. E. (2002). Gap junctions: structure and function (Review). *Mol Membr Biol* *19*, 121-136.
- Fagotto, F., and Gumbiner, B. M. (1996). Cell contact-dependent signaling. *Dev Biol* *180*, 445-454.
- Fanning, A. S., Jameson, B. J., Jesaitis, L. A., and Anderson, J. M. (1998). The tight junction protein ZO-1 establishes a link between the transmembrane protein occludin and the actin cytoskeleton. *J Biol Chem* *273*, 29745-29753.
- Farrell, J. J., Taupin, D., Koh, T. J., Chen, D., Zhao, C. M., Podolsky, D. K., and Wang, T. C. (2002). TFF2/SP-deficient mice show decreased gastric proliferation, increased acid secretion, and increased susceptibility to NSAID injury. *J Clin Invest* *109*, 193-204.

- Frandsen, E. K., Jorgensen, K. H., and Thim, L. (1986). Receptor binding of pancreatic spasmolytic polypeptide (PSP) in rat intestinal mucosal cell membranes inhibits the adenylate cyclase activity. *Regul Pept 16*, 291-297.
- Franke, W. W., Goldschmidt, M. D., Zimbelmann, R., Mueller, H. M., Schiller, D. L., and Cowin, P. (1989). Molecular cloning and amino acid sequence of human plakoglobin, the common junctional plaque protein. *Proc Natl Acad Sci U S A 86*, 4027-4031.
- Frommer, M., McDonald, L. E., Millar, D. S., Collis, C. M., Watt, F., Grigg, G. W., Molloy, P. L., and Paul, C. L. (1992). A genomic sequencing protocol that yields a positive display of 5-methylcytosine residues in individual DNA strands. *Proc Natl Acad Sci U S A 89*, 1827-1831.
- Fuchs, M., Muller, T., Lerch, M. M., and Ullrich, A. (1996). Association of human protein-tyrosine phosphatase kappa with members of the armadillo family. *J Biol Chem 271*, 16712-16719.
- Fujita, N., Jaye, D. L., Kajita, M., Geigerman, C., Moreno, C. S., and Wade, P. A. (2003). MTA3, a Mi-2/NuRD complex subunit, regulates an invasive growth pathway in breast cancer. *Cell 113*, 207-219.
- Fujita, Y., Krause, G., Scheffner, M., Zechner, D., Leddy, H. E., Behrens, J., Sommer, T., and Birchmeier, W. (2002). Hakai, a c-Cbl-like protein, ubiquitinates and induces endocytosis of the E-cadherin complex. *Nat Cell Biol 4*, 222-231.
- Furuse, M., Fujita, K., Hiiragi, T., Fujimoto, K., and Tsukita, S. (1998a). Claudin-1 and -2: novel integral membrane proteins localizing at tight junctions with no sequence similarity to occludin. *J Cell Biol 141*, 1539-1550.
- Furuse, M., Furuse, K., Sasaki, H., and Tsukita, S. (2001). Conversion of zonulae occludentes from tight to leaky strand type by introducing claudin-2 into Madin-Darby canine kidney I cells. *J Cell Biol 153*, 263-272.
- Furuse, M., Hirase, T., Itoh, M., Nagafuchi, A., Yonemura, S., and Tsukita, S. (1993). Occludin: a novel integral membrane protein localizing at tight junctions. *J Cell Biol 123*, 1777-1788.
- Furuse, M., Sasaki, H., Fujimoto, K., and Tsukita, S. (1998b). A single gene product, claudin-1 or -2, reconstitutes tight junction strands and recruits occludin in fibroblasts. *J Cell Biol 143*, 391-401.
- Furuse, M., Sasaki, H., and Tsukita, S. (1999). Manner of interaction of heterogeneous claudin species within and between tight junction strands. *J Cell Biol 147*, 891-903.
- Gajhede, M., Petersen, T. N., Henriksen, A., Petersen, J. F., Dauter, Z., Wilson, K. S., and Thim, L. (1993). Pancreatic spasmolytic polypeptide: first three-dimensional structure of a member of the mammalian trefoil family of peptides. *Structure 1*, 253-262.

- Gmachl, M., Berger, H., Thalhammer, J., and Kreil, G. (1990). Dermal glands of *Xenopus laevis* contain a polypeptide with a highly repetitive amino acid sequence. *FEBS Lett* 260, 145-148.
- Gonzalez-Mariscal, L., Betanzos, A., Nava, P., and Jaramillo, B. E. (2003). Tight junction proteins. *Prog Biophys Mol Biol* 81, 1-44.
- Gott, P., Beck, S., Machado, J. C., Carneiro, F., Schmitt, H., and Blin, N. (1996). Human trefoil peptides: genomic structure in 21q22.3 and coordinated expression. *Eur J Hum Genet* 4, 308-315.
- Gottardi, C. J., Wong, E., and Gumbiner, B. M. (2001). E-cadherin suppresses cellular transformation by inhibiting beta-catenin signaling in an adhesion-independent manner. *J Cell Biol* 153, 1049-1060.
- Grady, W. M., Willis, J., Guilford, P. J., Dunbier, A. K., Toro, T. T., Lynch, H., Wiesner, G., Ferguson, K., Eng, C., Park, J. G., et al. (2000). Methylation of the CDH1 promoter as the second genetic hit in hereditary diffuse gastric cancer. *Nat Genet* 26, 16-17.
- Graff, J. R., Gabrielson, E., Fujii, H., Baylin, S. B., and Herman, J. G. (2000). Methylation patterns of the E-cadherin 5' CpG island are unstable and reflect the dynamic, heterogeneous loss of E-cadherin expression during metastatic progression. *J Biol Chem* 275, 2727-2732.
- Graness, A., Chwieralski, C. E., Reinhold, D., Thim, L., and Hoffmann, W. (2002). Protein kinase C and ERK activation are required for TFF-peptide-stimulated bronchial epithelial cell migration and tumor necrosis factor-alpha-induced interleukin-6 (IL-6) and IL-8 secretion. *J Biol Chem* 277, 18440-18446.
- Gumbiner, B., Lowenkopf, T., and Apatira, D. (1991). Identification of a 160-kDa polypeptide that binds to the tight junction protein ZO-1. *Proc Natl Acad Sci U S A* 88, 3460-3464.
- Gumbiner, B. M. (1996). Cell adhesion: the molecular basis of tissue architecture and morphogenesis. *Cell* 84, 345-357.
- Hajra, K. M., Chen, D. Y., and Fearon, E. R. (2002). The SLUG zinc-finger protein represses E-cadherin in breast cancer. *Cancer Res* 62, 1613-1618.
- Hanahan, D. (1983). Studies on transformation of *Escherichia coli* with plasmids. *J Mol Biol* 166, 557-580.
- Hanby, A. M., Jankowski, J. A., Elia, G., Poulsom, R., and Wright, N. A. (1994). Expression of the trefoil peptides pS2 and human spasmolytic polypeptide (hSP) in Barrett's metaplasia and the native oesophageal epithelium: delineation of epithelial phenotype. *J Pathol* 173, 213-219.
- Hanby, A. M., Poulsom, R., Elia, G., Singh, S., Longcroft, J. M., and Wright, N. A. (1993a). The expression of the trefoil peptides pS2 and human spasmolytic polypeptide (hSP) in 'gastric metaplasia' of the

- proximal duodenum: implications for the nature of 'gastric metaplasia'. *J Pathol* 169, 355-360.
- Hanby, A. M., Poulsom, R., Singh, S., Elia, G., Jeffery, R. E., and Wright, N. A. (1993b). Spasmolytic polypeptide is a major antral peptide: distribution of the trefoil peptides human spasmolytic polypeptide and pS2 in the stomach. *Gastroenterology* 105, 1110-1116.
- Hanby, A. M., Poulsom, R., Singh, S., Jankowski, J., Hopwood, D., Elia, G., Rogers, L., Patel, K., and Wright, N. A. (1993c). Hyperplastic polyps: a cell lineage which both synthesizes and secretes trefoil-peptides and has phenotypic similarity with the ulcer-associated cell lineage. *Am J Pathol* 142, 663-668.
- Haskins, J., Gu, L., Wittchen, E. S., Hibbard, J., and Stevenson, B. R. (1998). ZO-3, a novel member of the MAGUK protein family found at the tight junction, interacts with ZO-1 and occludin. *J Cell Biol* 141, 199-208.
- Hatzfeld, M. (1999). The armadillo family of structural proteins. *Int Rev Cytol* 186, 179-224.
- Hauser, F., and Hoffmann, W. (1991). xP1 and xP4. P-domain peptides expressed in *Xenopus laevis* stomach mucosa. *J Biol Chem* 266, 21306-21309.
- Hauser, F., and Hoffmann, W. (1992). P-domains as shuffled cysteine-rich modules in integumentary mucin C.1 (FIM-C.1) from *Xenopus laevis*. Polydispersity and genetic polymorphism. *J Biol Chem* 267, 24620-24624.
- Hauser, F., Poulsom, R., Chinery, R., Rogers, L. A., Hanby, A. M., Wright, N. A., and Hoffmann, W. (1993). hP1.B, a human P-domain peptide homologous with rat intestinal trefoil factor, is expressed also in the ulcer-associated cell lineage and the uterus. *Proc Natl Acad Sci U S A* 90, 6961-6965.
- Heasman, J., Crawford, A., Goldstone, K., Garner-Hamrick, P., Gumbiner, B., McCrea, P., Kintner, C., Noro, C. Y., and Wylie, C. (1994). Overexpression of cadherins and underexpression of beta-catenin inhibit dorsal mesoderm induction in early *Xenopus* embryos. *Cell* 79, 791-803.
- Henry, J. A., Bennett, M. K., Piggott, N. H., Levett, D. L., May, F. E., and Westley, B. R. (1991). Expression of the pNR-2/pS2 protein in diverse human epithelial tumours. *Br J Cancer* 64, 677-682.
- Herman, J. G., Graff, J. R., Myohanen, S., Nelkin, B. D., and Baylin, S. B. (1996). Methylation-specific PCR: a novel PCR assay for methylation status of CpG islands. *Proc Natl Acad Sci U S A* 93, 9821-9826.
- Hirano, H., Kasahara, M., Nagano, M., Osumi, M., Sase, S., and Takata, K. (1982). Identification and properties of the glucose transporter of human erythrocytes. *Tokai J Exp Clin Med* 7 Suppl, 121-129.

- Hirohashi, S. (1998). Inactivation of the E-cadherin-mediated cell adhesion system in human cancers. *Am J Pathol* 153, 333-339.
- Hoffmann, W., Jagla, W., and Wiede, A. (2001). Molecular medicine of TFF-peptides: from gut to brain. *Histol Histopathol* 16, 319-334.
- Hoschuetzky, H., Aberle, H., and Kemler, R. (1994). Beta-catenin mediates the interaction of the cadherin-catenin complex with epidermal growth factor receptor. *J Cell Biol* 127, 1375-1380.
- Huber, A. H., Stewart, D. B., Laurents, D. V., Nelson, W. J., and Weis, W. I. (2001). The cadherin cytoplasmic domain is unstructured in the absence of beta-catenin. A possible mechanism for regulating cadherin turnover. *J Biol Chem* 276, 12301-12309.
- Huber, D., Balda, M. S., and Matter, K. (2000). Occludin modulates transepithelial migration of neutrophils. *J Biol Chem* 275, 5773-5778.
- Huber, O. (2003). Structure and function of desmosomal proteins and their role in development and disease. *Cell Mol Life Sci* 60, 1872-1890.
- Huber, O., Bierkamp, C., and Kemler, R. (1996). Cadherins and catenins in development. *Curr Opin Cell Biol* 8, 685-691.
- Huber, O., Kemler, R., and Langosch, D. (1999). Mutations affecting transmembrane segment interactions impair adhesiveness of E-cadherin. *J Cell Sci* 112 (Pt 23), 4415-4423.
- Huber, O., Krohn, M., and Kemler, R. (1997). A specific domain in alpha-catenin mediates binding to beta-catenin or plakoglobin. *J Cell Sci* 110 (Pt 15), 1759-1765.
- Itoh, M., Furuse, M., Morita, K., Kubota, K., Saitou, M., and Tsukita, S. (1999). Direct binding of three tight junction-associated MAGUKs, ZO-1, ZO-2, and ZO-3, with the COOH termini of claudins. *J Cell Biol* 147, 1351-1363.
- Itoh, M., Nagafuchi, A., Moroi, S., and Tsukita, S. (1997). Involvement of ZO-1 in cadherin-based cell adhesion through its direct binding to alpha catenin and actin filaments. *J Cell Biol* 138, 181-192.
- Jakowlew, S. B., Breathnach, R., Jeltsch, J. M., Masiakowski, P., and Chambon, P. (1984). Sequence of the pS2 mRNA induced by estrogen in the human breast cancer cell line MCF-7. *Nucleic Acids Res* 12, 2861-2878.
- Jamora, C., DasGupta, R., Kocieniewski, P., and Fuchs, E. (2003). Links between signal transduction, transcription and adhesion in epithelial bud development. *Nature* 422, 317-322.
- Jorgensen, K. D., Diamant, B., Jorgensen, K. H., and Thim, L. (1982a). Pancreatic spasmolytic polypeptide (PSP): III. Pharmacology of a new porcine pancreatic polypeptide with spasmolytic and gastric acid secretion inhibitory effects. *Regul Pept* 3, 231-243.

- Jorgensen, K. H., Thim, L., and Jacobsen, H. E. (1982b). Pancreatic spasmolytic polypeptide (PSP): I. Preparation and initial chemical characterization of a new polypeptide from porcine pancreas. *Regul Pept 3*, 207-219.
- Kanai, M., Mullen, C., and Podolsky, D. K. (1998). Intestinal trefoil factor induces inactivation of extracellular signal-regulated protein kinase in intestinal epithelial cells. *Proc Natl Acad Sci U S A 95*, 178-182.
- Kato, N., Tsuchiya, T., Tamura, G., and Motoyama, T. (2002). E-cadherin expression in follicular carcinoma of the thyroid. *Pathol Int 52*, 13-18.
- Kemler, R. (1992). Classical cadherins. *Semin Cell Biol 3*, 149-155.
- Khulusi, S., Hanby, A. M., Marrero, J. M., Patel, P., Mendall, M. A., Badve, S., Poulsom, R., Elia, G., Wright, N. A., and Northfield, T. C. (1995). Expression of trefoil peptides pS2 and human spasmolytic polypeptide in gastric metaplasia at the margin of duodenal ulcers. *Gut 37*, 205-209.
- Kindon, H., Pothoulakis, C., Thim, L., Lynch-Devaney, K., and Podolsky, D. K. (1995). Trefoil peptide protection of intestinal epithelial barrier function: cooperative interaction with mucin glycoprotein. *Gastroenterology 109*, 516-523.
- Kinoshita, K., Taupin, D. R., Itoh, H., and Podolsky, D. K. (2000). Distinct pathways of cell migration and antiapoptotic response to epithelial injury: structure-function analysis of human intestinal trefoil factor. *Mol Cell Biol 20*, 4680-4690.
- Kreusel, K. M., Fromm, M., Schulzke, J. D., and Hegel, U. (1991). Cl-secretion in epithelial monolayers of mucus-forming human colon cells (HT-29/B6). *Am J Physiol 261*, C574-582.
- Kypta, R. M., Su, H., and Reichardt, L. F. (1996). Association between a transmembrane protein tyrosine phosphatase and the cadherin-catenin complex. *J Cell Biol 134*, 1519-1529.
- Labouvie, C., Machado, J. C., Carneiro, F., Sarbia, M., Vieth, M., Porschen, R., Seitz, G., and Blin, N. (1999). Differential expression of mucins and trefoil peptides in native epithelium, Barrett's metaplasia and squamous cell carcinoma of the oesophagus. *J Cancer Res Clin Oncol 125*, 71-76.
- Laemmli, U. K. (1970). Cleavage of structural proteins during the assembly of the head of bacteriophage T4. *Nature 227*, 680-685.
- Lefebvre, O., Chenard, M. P., Masson, R., Linares, J., Dierich, A., LeMeur, M., Wendling, C., Tomasetto, C., Chambon, P., and Rio, M. C. (1996). Gastric mucosa abnormalities and tumorigenesis in mice lacking the pS2 trefoil protein. *Science 274*, 259-262.

- Levi, M., Ruden, U., Birx, D., Loomis, L., Redfield, R., Lovgren, K., Akerblom, L., Sandstrom, E., and Wahren, B. (1993). Effects of adjuvants and multiple antigen peptides on humoral and cellular immune responses to gp160 of HIV-1. *J Acquir Immune Defic Syndr* 6, 855-864.
- Levine, E., Lee, C. H., Kintner, C., and Gumbiner, B. M. (1994). Selective disruption of E-cadherin function in early *Xenopus* embryos by a dominant negative mutant. *Development* 120, 901-909.
- Liu, D., el-Hariry, I., Karayannakis, A. J., Wilding, J., Chinery, R., Kmiet, W., McCrea, P. D., Gullick, W. J., and Pignatelli, M. (1997). Phosphorylation of beta-catenin and epidermal growth factor receptor by intestinal trefoil factor. *Lab Invest* 77, 557-563.
- Longman, R. J., Douthwaite, J., Sylvester, P. A., Poulsom, R., Corfield, A. P., Thomas, M. G., and Wright, N. A. (2000). Coordinated localisation of mucins and trefoil peptides in the ulcer associated cell lineage and the gastrointestinal mucosa. *Gut* 47, 792-800.
- Luqmani, Y., Bennett, C., Paterson, I., Corbishley, C. M., Rio, M. C., Chambon, P., and Ryall, G. (1989). Expression of the pS2 gene in normal, benign and neoplastic human stomach. *Int J Cancer* 44, 806-812.
- Machado, J. C., Nogueira, A. M., Carneiro, F., Reis, C. A., and Sobrinho-Simoes, M. (2000). Gastric carcinoma exhibits distinct types of cell differentiation: an immunohistochemical study of trefoil peptides (TFF1 and TFF2) and mucins (MUC1, MUC2, MUC5AC, and MUC6). *J Pathol* 190, 437-443.
- Marchbank, T., Cox, H. M., Goodlad, R. A., Giraud, A. S., Moss, S. F., Poulsom, R., Wright, N. A., Jankowski, J., and Playford, R. J. (2001). Effect of ectopic expression of rat trefoil factor family 3 (intestinal trefoil factor) in the jejunum of transgenic mice. *J Biol Chem* 276, 24088-24096.
- Marchbank, T., Westley, B. R., May, F. E., Calnan, D. P., and Playford, R. J. (1998). Dimerization of human pS2 (TFF1) plays a key role in its protective/healing effects. *J Pathol* 185, 153-158.
- Mashimo, H., Wu, D. C., Podolsky, D. K., and Fishman, M. C. (1996). Impaired defense of intestinal mucosa in mice lacking intestinal trefoil factor. *Science* 274, 262-265.
- Masiakowski, P., Breathnach, R., Bloch, J., Gannon, F., Krust, A., and Chambon, P. (1982). Cloning of cDNA sequences of hormone-regulated genes from the MCF-7 human breast cancer cell line. *Nucleic Acids Res* 10, 7895-7903.
- Matter, K., and Balda, M. S. (2003). Signalling to and from tight junctions. *Nat Rev Mol Cell Biol* 4, 225-236.

- May, F. E., and Westley, B. R. (1997). Close physical linkage of the genes encoding the pNR-2/pS2 protein and human spasmolytic protein (hSP). *Hum Genet* *99*, 303-307.
- McCarthy, K. M., Skare, I. B., Stankewich, M. C., Furuse, M., Tsukita, S., Rogers, R. A., Lynch, R. D., and Schneeberger, E. E. (1996). Occludin is a functional component of the tight junction. *J Cell Sci* *109* (*Pt 9*), 2287-2298.
- McCutcheon, M., Coman, D. R., and Moore, F. B. (1948). Adhesivness of malignant cells in various human adenocarcinomas. *Cancer* *1*, 460-467.
- McGuire, J. K., Li, Q., and Parks, W. C. (2003). Matrilysin (matrix metalloproteinase-7) mediates E-cadherin ectodomain shedding in injured lung epithelium. *Am J Pathol* *162*, 1831-1843.
- Menkel, A. R., Kroemker, M., Bubeck, P., Ronsiek, M., Nikolai, G., and Jockusch, B. M. (1994). Characterization of an F-actin-binding domain in the cytoskeletal protein vinculin. *J Cell Biol* *126*, 1231-1240.
- Meyer zum Büschchenfelde, D., Hoschützky, H., Tauber, R., and Huber, O. (previosly accepted). Molecular mechanisms involved in TFF3 peptide-mediated modulation of the E-cadherin/catenin adhesion complex. Peptides.
- Miyaki, M., Tanaka, K., Kikuchi-Yanoshita, R., Muraoka, M., Konishi, M., and Takeichi, M. (1995). Increased cell-substratum adhesion, and decreased gelatinase secretion and cell growth, induced by E-cadherin transfection of human colon carcinoma cells. *Oncogene* *11*, 2547-2552.
- Morita, K., Furuse, M., Fujimoto, K., and Tsukita, S. (1999a). Claudin multigene family encoding four-transmembrane domain protein components of tight junction strands. *Proc Natl Acad Sci U S A* *96*, 511-516.
- Morita, K., Sasaki, H., Fujimoto, K., Furuse, M., and Tsukita, S. (1999b). Claudin-11/OSP-based tight junctions of myelin sheaths in brain and Sertoli cells in testis. *J Cell Biol* *145*, 579-588.
- Muller, T., Choidas, A., Reichmann, E., and Ullrich, A. (1999). Phosphorylation and free pool of beta-catenin are regulated by tyrosine kinases and tyrosine phosphatases during epithelial cell migration. *J Biol Chem* *274*, 10173-10183.
- Nagafuchi, A. (2001). Molecular architecture of adherens junctions. *Curr Opin Cell Biol* *13*, 600-603.
- Näthke, I. S., Hinck, L., Swedlow, J. R., Papkoff, J., and Nelson, W. J. (1994). Defining interactions and distributions of cadherin and catenin complexes in polarized epithelial cells. *J Cell Biol* *125*, 1341-1352.
- Navarro, P., Gomez, M., Pizarro, A., Gamallo, C., Quintanilla, M., and Cano, A. (1991). A role for the E-cadherin cell-cell adhesion molecule

- during tumor progression of mouse epidermal carcinogenesis. *J Cell Biol* 115, 517-533.
- Nawrocki-Raby, B., Gilles, C., Polette, M., Bruyneel, E., Laronze, J. Y., Bonnet, N., Foidart, J. M., Mareel, M., and Birembaut, P. (2003). Upregulation of MMPs by soluble E-cadherin in human lung tumor cells. *Int J Cancer* 105, 790-795.
- Nieto, M. A. (2002). The snail superfamily of zinc-finger transcription factors. *Nat Rev Mol Cell Biol* 3, 155-166.
- Nollet, F., Berx, G., and van Roy, F. (1999). The role of the E-cadherin/catenin adhesion complex in the development and progression of cancer. *Mol Cell Biol Res Commun* 2, 77-85.
- Ochiai, A., Akimoto, S., Kanai, Y., Shibata, T., Oyama, T., and Hirohashi, S. (1994). c-erbB-2 gene product associates with catenins in human cancer cells. *Biochem Biophys Res Commun* 205, 73-78.
- Oda, T., Kanai, Y., Oyama, T., Yoshiura, K., Shimoyama, Y., Birchmeier, W., Sugimura, T., and Hirohashi, S. (1994). E-cadherin gene mutations in human gastric carcinoma cell lines. *Proc Natl Acad Sci U S A* 91, 1858-1862.
- Oyama, T., Kanai, Y., Ochiai, A., Akimoto, S., Oda, T., Yanagihara, K., Nagafuchi, A., Tsukita, S., Shibamoto, S., Ito, F., and et al. (1994). A truncated beta-catenin disrupts the interaction between E-cadherin and alpha-catenin: a cause of loss of intercellular adhesiveness in human cancer cell lines. *Cancer Res* 54, 6282-6287.
- Ozawa, M., Baribault, H., and Kemler, R. (1989). The cytoplasmic domain of the cell adhesion molecule uvomorulin associates with three independent proteins structurally related in different species. *Embo J* 8, 1711-1717.
- Ozawa, M., and Kemler, R. (1990). Correct proteolytic cleavage is required for the cell adhesive function of uvomorulin. *J Cell Biol* 111, 1645-1650.
- Ozawa, M., Ringwald, M., and Kemler, R. (1990). Uvomorulin-catenin complex formation is regulated by a specific domain in the cytoplasmic region of the cell adhesion molecule. *Proc Natl Acad Sci U S A* 87, 4246-4250.
- Perez-Moreno, M., Jamora, C., and Fuchs, E. (2003). Sticky business: orchestrating cellular signals at adherens junctions. *Cell* 112, 535-548.
- Perez-Moreno, M. A., Locascio, A., Rodrigo, I., Dhondt, G., Portillo, F., Nieto, M. A., and Cano, A. (2001). A new role for E12/E47 in the repression of E-cadherin expression and epithelial-mesenchymal transitions. *J Biol Chem* 276, 27424-27431.
- Playford, R. J., Marchbank, T., Chinery, R., Evison, R., Pignatelli, M., Boulton, R. A., Thim, L., and Hanby, A. M. (1995). Human spasmolytic

- polypeptide is a cytoprotective agent that stimulates cell migration. *Gastroenterology* 108, 108-116.
- Podolsky, D. K., Lynch-Devaney, K., Stow, J. L., Oates, P., Murgue, B., DeBeaumont, M., Sands, B. E., and Mahida, Y. R. (1993). Identification of human intestinal trefoil factor. Goblet cell-specific expression of a peptide targeted for apical secretion. *J Biol Chem* 268, 6694-6702.
- Poser, I., Dominguez, D., de Herreros, A. G., Varnai, A., Buettner, R., and Bosserhoff, A. K. (2001). Loss of E-cadherin expression in melanoma cells involves up-regulation of the transcriptional repressor Snail. *J Biol Chem* 276, 24661-24666.
- Poulsom, R., Hanby, A. M., Lalani, E. N., Hauser, F., Hoffmann, W., and Stamp, G. W. (1997). Intestinal trefoil factor (TFF 3) and pS2 (TFF 1), but not spasmolytic polypeptide (TFF 2) mRNAs are co-expressed in normal, hyperplastic, and neoplastic human breast epithelium. *J Pathol* 183, 30-38.
- Prest, S. J., May, F. E., and Westley, B. R. (2002). The estrogen-regulated protein, TFF1, stimulates migration of human breast cancer cells. *Faseb J* 16, 592-594.
- Rajasekaran, A. K., Hojo, M., Huima, T., and Rodriguez-Boulan, E. (1996). Catenins and zonula occludens-1 form a complex during early stages in the assembly of tight junctions. *J Cell Biol* 132, 451-463.
- Ribieras, S., Tomasetto, C., and Rio, M. C. (1998). The pS2/TFF1 trefoil factor, from basic research to clinical applications. *Biochim Biophys Acta* 1378, F61-77.
- Rio, M. C., Bellocq, J. P., Daniel, J. Y., Tomasetto, C., Lathe, R., Chenard, M. P., Batzenschlager, A., and Chambon, P. (1988). Breast cancer-associated pS2 protein: synthesis and secretion by normal stomach mucosa. *Science* 241, 705-708.
- Rodrigues, S., Attoub, S., Nguyen, Q. D., Bruyneel, E., Rodrigue, C. M., Westley, B. R., May, F. E., Thim, L., Mareel, M., Emami, S., and Gespach, C. (2003a). Selective abrogation of the proinvasive activity of the trefoil peptides pS2 and spasmolytic polypeptide by disruption of the EGF receptor signaling pathways in kidney and colonic cancer cells. *Oncogene* 22, 4488-4497.
- Rodrigues, S., Nguyen, Q. D., Faivre, S., Bruyneel, E., Thim, L., Westley, B., May, F., Flatau, G., Mareel, M., Gespach, C., and Emami, S. (2001). Activation of cellular invasion by trefoil peptides and src is mediated by cyclooxygenase- and thromboxane A2 receptor-dependent signaling pathways. *Faseb J* 15, 1517-1528.
- Rodrigues, S., Van Aken, E., Van Bocxlaer, S., Attoub, S., Nguyen, Q. D., Bruyneel, E., Westley, B. R., May, F. E., Thim, L., Mareel, M., *et al.* (2003b). Trefoil peptides as proangiogenic factors in vivo and in vitro:

- implication of cyclooxygenase-2 and EGF receptor signaling. *Faseb J* 17, 7-16.
- Rüdiger, M. (1998). Vinculin and alpha-catenin: shared and unique functions in adherens junctions. *Bioessays* 20, 733-740.
- Saitou, M., Furuse, M., Sasaki, H., Schulzke, J. D., Fromm, M., Takano, H., Noda, T., and Tsukita, S. (2000). Complex phenotype of mice lacking occludin, a component of tight junction strands. *Mol Biol Cell* 11, 4131-4142.
- Sands, B. E., and Podolsky, D. K. (1996). The trefoil peptide family. *Annu Rev Physiol* 58, 253-273.
- Sanson, B., White, P., and Vincent, J. P. (1996). Uncoupling cadherin-based adhesion from wingless signalling in *Drosophila*. *Nature* 383, 627-630.
- Savagner, P. (2001). Leaving the neighborhood: molecular mechanisms involved during epithelial-mesenchymal transition. *Bioessays* 23, 912-923.
- Schmidt, A., Utepbergenov, D. I., Krause, G., and Blasig, I. E. (2001). Use of surface plasmon resonance for real-time analysis of the interaction of ZO-1 and occludin. *Biochem Biophys Res Commun* 288, 1194-1199.
- Seib, T., Blin, N., Hilgert, K., Seifert, M., Theisinger, B., Engel, M., Dooley, S., Zang, K. D., and Welter, C. (1997). The three human trefoil genes TFF1, TFF2, and TFF3 are located within a region of 55 kb on chromosome 21q22.3. *Genomics* 40, 200-202.
- Seitz, G., Thelsinger, B., Tomasetto, G., Rio, M. C., Chambon, P., Blin, N., and Welter, G. (1991). Breast cancer-associated protein pS2 expression in tumors of the biliary tract. *Am J Gastroenterol* 86, 1491-1494.
- Singh, A. B., and Harris, R. C. (2003). EGF receptor activation differentially regulates Claudin expression and enhances trans-epithelial resistance in MDCK cells. *J Biol Chem*.
- St Croix, B., Sheehan, C., Rak, J. W., Florenes, V. A., Slingerland, J. M., and Kerbel, R. S. (1998). E-Cadherin-dependent growth suppression is mediated by the cyclin-dependent kinase inhibitor p27(KIP1). *J Cell Biol* 142, 557-571.
- Steinhusen, U., Weiske, J., Badock, V., Tauber, R., Bommert, K., and Huber, O. (2001). Cleavage and shedding of E-cadherin after induction of apoptosis. *J Biol Chem* 276, 4972-4980.
- Stevenson, B. R., Siliciano, J. D., Mooseker, M. S., and Goodenough, D. A. (1986). Identification of ZO-1: a high molecular weight polypeptide associated with the tight junction (zonula occludens) in a variety of epithelia. *J Cell Biol* 103, 755-766.
- Suemori, S., Lynch-Devaney, K., and Podolsky, D. K. (1991). Identification and characterization of rat intestinal trefoil factor: tissue- and

- cell-specific member of the trefoil protein family. *Proc Natl Acad Sci U S A* 88, 11017-11021.
- Takeichi, M. (1991). Cadherin cell adhesion receptors as a morphogenetic regulator. *Science* 251, 1451-1455.
- Tanaka, S., Podolsky, D. K., Engel, E., Guth, P. H., and Kaunitz, J. D. (1997). Human spasmolytic polypeptide decreases proton permeation through gastric mucus in vivo and in vitro. *Am J Physiol* 272, G1473-1480.
- Taupin, D., Ooi, K., Yeomans, N., and Giraud, A. (1996). Conserved expression of intestinal trefoil factor in the human colonic adenoma-carcinoma sequence. *Lab Invest* 75, 25-32.
- Taupin, D., and Podolsky, D. K. (2003). Trefoil factors: initiators of mucosal healing. *Nat Rev Mol Cell Biol* 4, 721-732.
- Theisinger, B., Seitz, G., Dooley, S., and Welter, C. (1996). A second trefoil protein, ITF/hP1.B, is transcribed in human breast cancer. *Breast Cancer Res Treat* 38, 145-151.
- Theisinger, B., Welter, C., Seitz, G., Rio, M. C., Lathe, R., Chambon, P., and Blin, N. (1991). Expression of the breast cancer associated gene pS2 and the pancreatic spasmolytic polypeptide gene (hSP) in diffuse type of stomach carcinoma. *Eur J Cancer* 27, 770-773.
- Thim, L. (1989). A new family of growth factor-like peptides. 'Trefoil' disulphide loop structures as a common feature in breast cancer associated peptide (pS2), pancreatic spasmolytic polypeptide (PSP), and frog skin peptides (spasmolysins). *FEBS Lett* 250, 85-90.
- Thim, L. (1997). Trefoil peptides: from structure to function. *Cell Mol Life Sci* 53, 888-903.
- Thim, L., Woldike, H. F., Nielsen, P. F., Christensen, M., Lynch-Devaney, K., and Podolsky, D. K. (1995). Characterization of human and rat intestinal trefoil factor produced in yeast. *Biochemistry* 34, 4757-4764.
- Tomasetto, C., Masson, R., Linares, J. L., Wendling, C., Lefebvre, O., Chenard, M. P., and Rio, M. C. (2000). pS2/TFF1 interacts directly with the VWFC cysteine-rich domains of mucins. *Gastroenterology* 118, 70-80.
- Towbin, H., Staehelin, T., and Gordon, J. (1979). Electrophoretic transfer of proteins from polyacrylamide gels to nitrocellulose sheets: procedure and some applications. *Proc Natl Acad Sci U S A* 76, 4350-4354.
- Tsukita, S., and Furuse, M. (2000). Pores in the wall: claudins constitute tight junction strands containing aqueous pores. *J Cell Biol* 149, 13-16.
- Tsukita, S., Furuse, M., and Itoh, M. (2001). Multifunctional strands in tight junctions. *Nat Rev Mol Cell Biol* 2, 285-293.

- Wang, X., Kaetzel, M. A., Yoo, S. E., Kim, P. S., and Dedman, J. R. (2002). Ligand-regulated secretion of recombinant annexin V from cultured thyroid epithelial cells. *Am J Physiol Cell Physiol* *282*, C1313-1321.
- Wei, Y., Van Nhieu, J. T., Prigent, S., Srivatanakul, P., Tiollais, P., and Buendia, M. A. (2002). Altered expression of E-cadherin in hepatocellular carcinoma: correlations with genetic alterations, beta-catenin expression, and clinical features. *Hepatology* *36*, 692-701.
- Welter, C., Theisinger, B., Rio, M. C., Seitz, G., Schuder, G., and Blin, N. (1994). Expression pattern of breast-cancer-associated protein pS2/BCEI in colorectal tumors. *Int J Cancer* *56*, 52-55.
- Welter, C., Theisinger, B., Seitz, G., Tomasetto, C., Rio, M. C., Chambon, P., and Blin, N. (1992). Association of the human spasmolytic polypeptide and an estrogen-induced breast cancer protein (pS2) with human pancreatic carcinoma. *Lab Invest* *66*, 187-192.
- Wheeler, J. M., Kim, H. C., Efstatthiou, J. A., Ilyas, M., Mortensen, N. J., and Bodmer, W. F. (2001). Hypermethylation of the promoter region of the E-cadherin gene (CDH1) in sporadic and ulcerative colitis associated colorectal cancer. *Gut* *48*, 367-371.
- Williams, R., Stamp, G. W., Gilbert, C., Pignatelli, M., and Lalani, E. N. (1996). pS2 transfection of murine adenocarcinoma cell line 410.4 enhances dispersed growth pattern in a 3-D collagen gel. *J Cell Sci* *109* (*Pt 1*), 63-71.
- Wittchen, E. S., Haskins, J., and Stevenson, B. R. (1999). Protein interactions at the tight junction. Actin has multiple binding partners, and ZO-1 forms independent complexes with ZO-2 and ZO-3. *J Biol Chem* *274*, 35179-35185.
- Wittchen, E. S., Haskins, J., and Stevenson, B. R. (2000). Exogenous expression of the amino-terminal half of the tight junction protein ZO-3 perturbs junctional complex assembly. *J Cell Biol* *151*, 825-836.
- Wong, W. M., Poulsom, R., and Wright, N. A. (1999). Trefoil peptides. *Gut* *44*, 890-895.
- Wright, N. A. (1993). Trefoil peptides and the gut. *Gut* *34*, 577-579.
- Wright, N. A., Hoffmann, W., Otto, W. R., Rio, M. C., and Thim, L. (1997). Rolling in the clover: trefoil factor family (TFF)-domain peptides, cell migration and cancer. *FEBS Lett* *408*, 121-123.
- Wright, N. A., Poulsom, R., Stamp, G. W., Hall, P. A., Jeffery, R. E., Longcroft, J. M., Rio, M. C., Tomasetto, C., and Chambon, P. (1990). Epidermal growth factor (EGF/URO) induces expression of regulatory peptides in damaged human gastrointestinal tissues. *J Pathol* *162*, 279-284.

Yap, A. S., Brieher, W. M., Prusky, M., and Gumbiner, B. M. (1997). Lateral clustering of the adhesive ectodomain: a fundamental determinant of cadherin function. *Curr Biol* 7, 308-315.