

8. Literatur

- Abu-Jawdeh, G., Comella, N., Tomita, Y., Brown, L. F., Tognazzi, K., Sokol, S. Y., and Kocher, O. (1999). Differential expression of frpHE: a novel human stromal protein of the secreted frizzled gene family, during the endometrial cycle and malignancy. *Lab Invest* **79**, 439-47.
- Akazawa, C., Sasai, Y., Nakanishi, S., and Kageyama, R. (1992). Molecular characterization of a rat negative regulator with a basic helix-loop-helix structure predominantly expressed in the developing nervous system. *J Biol Chem* **267**, 21879-85.
- Aronson, B. D., Fisher, A. L., Blechman, K., Caudy, M., and Gergen, J. P. (1997). Groucho-dependent and -independent repression activities of Runt domain proteins. *Mol Cell Biol* **17**, 5581-7.
- Artavanis-Tsakonas, S., Rand, M. D., and Lake, R. J. (1999). Notch signaling: cell fate control and signal integration in development. *Science* **284**, 770-6.
- Aufderheide, E., Chiquet-Ehrismann, R., and Ekblom, P. (1987). Epithelial-mesenchymal interactions in the developing kidney lead to expression of tenascin in the mesenchyme. *J Cell Biol* **105**, 599-608.
- Aulehla, A., and Johnson, R. L. (1999). Dynamic expression of lunatic fringe suggests a link between notch signaling and an autonomous cellular oscillator driving somite segmentation. *Dev Biol* **207**, 49-61.
- Ausubel, F. M., Brent, R., Kingston, R. E., Moore, D. D., Seidman, J. G., Smith, J. A., and Struhl, K. (1987-1999). Current protocols in molecular biology. Green and Wiley-Interscience, New York.
- Barrantes, I. B., Elia, A. J., Wunsch, K., De Angelis, M. H., Mak, T. W., Rossant, J., Conlon, R. A., Gossler, A., and de la Pompa, J. L. (1999). Interaction between notch signalling and lunatic fringe during somite boundary formation in the mouse. *Curr Biol* **9**, 470-80.
- Bellosta, P., Zhang, Q., Goff, S. P., and Basilico, C. (1997). Signaling through the ARK tyrosine kinase receptor protects from apoptosis in the absence of growth stimulation. *Oncogene* **15**, 2387-97.
- Benezra, R., Davis, R. L., Lassar, A., Tapscott, S., Thayer, M., Lockshon, D., and Weintraub, H. (1990). Id: a negative regulator of helix-loop-helix DNA binding proteins. Control of terminal myogenic differentiation. *Ann N Y Acad Sci* **599**, 1-11.
- Bettenhausen, B., Hrabe de Angelis, M., Simon, D., Guenet, J. L., and Gossler, A. (1995). Transient and restricted expression during mouse embryogenesis of Dll1, a murine gene closely related to Drosophila Delta. *Development* **121**, 2407-18.
- Bhanot, P., Brink, M., Samos, C. H., Hsieh, J. C., Wang, Y., Macke, J. P., Andrew, D., Nathans, J., and Nusse, R. (1996). A new member of the frizzled family from Drosophila functions as a Wingless receptor. *Nature* **382**, 225-30.
- Binari, R. C., Staveley, B. E., Johnson, W. A., Godavarti, R., Sasisekharan, R., and Manoukian, A. S. (1997). Genetic evidence that heparin-like glycosaminoglycans are involved in wingless signaling. *Development* **124**, 2623-32.
- Botas, J., Moscoso del Prado, J., and Garcia-Bellido, A. (1982). Gene-dose titration analysis in the search of trans-regulatory genes in Drosophila. *Embo J* **1**, 307-10.
- Bradford, M. M. (1976). A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. *Anal Biochem* **72**, 248-54.

- Bullock, S. L., Fletcher, J. M., Beddington, R. S., and Wilson, V. A. (1998). Renal agenesis in mice homozygous for a gene trap mutation in the gene encoding heparan sulfate 2-sulfotransferase. *Genes Dev* **12**, 1894-906.
- Call, K. M., Glaser, T., Ito, C. Y., Buckler, A. J., Pelletier, J., Haber, D. A., Rose, E. A., Kral, A., Yeger, H., Lewis, W. H., and et al. (1990). Isolation and characterization of a zinc finger polypeptide gene at the human chromosome 11 Wilms' tumor locus. *Cell* **60**, 509-20.
- Chang, J. T., Esumi, N., Moore, K., Li, Y., Zhang, S., Chew, C., Goodman, B., Rattner, A., Moody, S., Stetten, G., Campochiaro, P. A., and Zack, D. J. (1999). Cloning and characterization of a secreted frizzled-related protein that is expressed by the retinal pigment epithelium. *Hum Mol Genet* **8**, 575-83.
- Chiang, C., Litingtung, Y., Lee, E., Young, K. E., Corden, J. L., Westphal, H., and Beachy, P. A. (1996). Cyclopia and defective axial patterning in mice lacking Sonic hedgehog gene function. *Nature* **383**, 407-13.
- Cho, E. A., Patterson, L. T., Brookhiser, W. T., Mah, S., Kintner, C., and Dressler, G. R. (1998). Differential expression and function of cadherin-6 during renal epithelium development. *Development* **125**, 803-12.
- Chomczynski, P., and Sacchi, N. (1987). Single-step method of RNA isolation by acid guanidinium thiocyanate- phenol-chloroform extraction. *Anal Biochem* **162**, 156-9.
- Conlon, R. A., Reaume, A. G., and Rossant, J. (1995). Notch1 is required for the coordinate segmentation of somites. *Development* **121**, 1533-45.
- Daoust, M. C., Reynolds, D. M., Bichet, D. G., and Somlo, S. (1995). Evidence for a third genetic locus for autosomal dominant polycystic kidney disease. *Genomics* **25**, 733-6.
- Davies, J., Lyon, M., Gallagher, J., and Garrod, D. (1995). Sulphated proteoglycan is required for collecting duct growth and branching but not nephron formation during kidney development. *Development* **121**, 1507-17.
- Davies, J. A., and Bard, J. B. L. (1998). The Development of the Kidney. *Current Topics in Developmental Biology* **39**, 245-301.
- Davis, A. P., Witte, D. P., Hsieh-Li, H. M., Potter, S. S., and Capecchi, M. R. (1995). Absence of radius and ulna in mice lacking hoxa-11 and hoxd-11. *Nature* **375**, 791-5.
- de la Pompa, J. L., Wakeham, A., Correia, K. M., Samper, E., Brown, S., Aguilera, R. J., Nakano, T., Honjo, T., Mak, T. W., Rossant, J., and Conlon, R. A. (1997). Conservation of the Notch signalling pathway in mammalian neurogenesis. *Development* **124**, 1139-48.
- Dehbi, M., and Pelletier, J. (1996). PAX8-mediated activation of the wt1 tumor suppressor gene. *Embo J* **15**, 4297-306.
- Dehbi, M., Ghahremani, M., Lechner, M., Dressler, G., and Pelletier, J. (1996). The paired-box transcription factor, PAX2, positively modulates expression of the Wilms' tumor suppressor gene (WT1). *Oncogene* **13**, 447-53.
- Dressler, G. R., Deutsch, U., Chowdhury, K., Nornes, H. O., and Gruss, P. (1990). Pax2, a new murine paired-box-containing gene and its expression in the developing excretory system. *Development* **109**, 787-95.
- Drews, U. (1995). "Color atlas of embryology." Georg Thieme Verlag, Stuttgart.
- Dudley, A. T., Lyons, K. M., and Robertson, E. J. (1995). A requirement for bone morphogenetic protein-7 during development of the mammalian kidney and eye. *Genes Dev* **9**, 2795-807.

- Dudley, A. T., and Robertson, E. J. (1997). Overlapping expression domains of bone morphogenetic protein family members potentially account for limited tissue defects in BMP7 deficient embryos. *Dev Dyn* **208**, 349-62.
- Durbec, P., Marcos-Gutierrez, C. V., Kilkenny, C., Grigoriou, M., Wartiovaara, K., Suvanto, P., Smith, D., Ponder, B., Costantini, F., Saarma, M., and et al. (1996). GDNF signalling through the Ret receptor tyrosine kinase. *Nature* **381**, 789-93.
- Ekbom, P. (1996). Receptors for laminins during epithelial morphogenesis. *Curr Opin Cell Biol* **8**, 700-6.
- Evans, G. A., and Wahl, G. M. (1987). Cosmid vectors for genomic walking and rapid restriction mapping. *Methods Enzymol* **152**, 604-10.
- Ezer, S., Schlessinger, D., Srivastava, A., and Kere, J. (1997). Anhidrotic ectodermal dysplasia (EDA) protein expressed in MCF-7 cells associates with cell membrane and induces rounding. *Hum Mol Genet* **6**, 1581-7.
- Fahrner, K., Hogan, B. L., and Flavell, R. A. (1987). Transcription of H-2 and Qa genes in embryonic and adult mice. *Embo J* **6**, 1265-71.
- Faust, M., Ebensperger, C., Schulz, A. S., Schleithoff, L., Hameister, H., Bartram, C. R., and Janssen, J. W. (1992). The murine ufo receptor: molecular cloning, chromosomal localization and in situ expression analysis. *Oncogene* **7**, 1287-93.
- Feinberg, A. P., and Vogelstein, B. (1983). A technique for radiolabeling DNA restriction endonuclease fragments to high specific activity. *Anal Biochem* **132**, 6-13.
- Finch, P. W., Cunha, G. R., Rubin, J. S., Wong, J., and Ron, D. (1995). Pattern of keratinocyte growth factor and keratinocyte growth factor receptor expression during mouse fetal development suggests a role in mediating morphogenetic mesenchymal-epithelial interactions. *Dev Dyn* **203**, 223-40.
- Finch, P. W., He, X., Kelley, M. J., Uren, A., Schaudies, R. P., Popescu, N. C., Rudikoff, S., Aaronson, S. A., Varmus, H. E., and Rubin, J. S. (1997). Purification and molecular cloning of a secreted, Frizzled-related antagonist of Wnt action. *Proc Natl Acad Sci U S A* **94**, 6770-5.
- Fisher, A. L., and Caudy, M. (1998). Groucho proteins: transcriptional corepressors for specific subsets of DNA-binding transcription factors in vertebrates and invertebrates. *Genes Dev* **12**, 1931-40.
- Fisher, A., and Caudy, M. (1998). The function of hairy-related bHLH repressor proteins in cell fate decisions. *Bioessays* **20**, 298-306.
- Gessler, M., Poustka, A., Cavenee, W., Neve, R. L., Orkin, S. H., and Bruns, G. A. (1990). Homozygous deletion in Wilms tumours of a zinc-finger gene identified by chromosome jumping. *Nature* **343**, 774-8.
- Gridley, T. (1997). Notch signaling in vertebrate development and disease. *Mol Cell Neurosci* **9**, 103-8.
- Grobstein, C. (1956). Transfilter induction of tubules in mouse metanephric mesenchyme. *Exp Cell Res* **10**, 424-40.
- Guimaraes, M. J., Lee, F., Zlotnik, A., and McClanahan, T. (1995). Differential display by PCR: novel findings and applications. *Nucleic Acids Res* **23**, 1832-3.
- Gyapay, G., Schmitt, K., Fizames, C., Jones, H., Vega-Czarny, N., Spillett, D., Muselet, D., Prud'Homme, J. F., Dib, C., Auffray, C., Morissette, J., Weissenbach, J., and Goodfellow, P. N. (1996). A radiation hybrid map of the human genome. *Hum Mol Genet* **5**, 339-46.

- Hacker, U., Lin, X., and Perrimon, N. (1997). The Drosophila sugarless gene modulates Wingless signaling and encodes an enzyme involved in polysaccharide biosynthesis. *Development* **124**, 3565-73.
- Haerry, T. E., Heslip, T. R., Marsh, J. L., and O'Connor, M. B. (1997). Defects in glucuronate biosynthesis disrupt Wingless signaling in Drosophila. *Development* **124**, 3055-64.
- Hassouna, N., Michot, B., and Bachellerie, J. P. (1984). The complete nucleotide sequence of mouse 28S rRNA gene. Implications for the process of size increase of the large subunit rRNA in higher eukaryotes. *Nucleic Acids Res* **12**, 3563-83.
- Hatini, V., Huh, S. O., Herzlinger, D., Soares, V. C., and Lai, E. (1996). Essential role of stromal mesenchyme in kidney morphogenesis revealed by targeted disruption of Winged Helix transcription factor BF-2. *Genes Dev* **10**, 1467-78.
- Hellmich, H. L., Kos, L., Cho, E. S., Mahon, K. A., and Zimmer, A. (1996). Embryonic expression of glial cell-line derived neurotrophic factor (GDNF) suggests multiple developmental roles in neural differentiation and epithelial-mesenchymal interactions. *Mech Dev* **54**, 95-105.
- Helms, C., Graham, M. Y., Dutchik, J. E., and Olson, M. V. (1985). A new method for purifying lambda DNA from phage lysates. *Dna* **4**, 39-49.
- Henrique, D., Adam, J., Myat, A., Chitnis, A., Lewis, J., and Ish-Horowicz, D. (1995). Expression of a Delta homologue in prospective neurons in the chick. *Nature* **375**, 787-90.
- Herzlinger, D., Qiao, J., Cohen, D., Ramakrishna, N., and Brown, A. M. (1994). Induction of kidney epithelial morphogenesis by cells expressing Wnt-1. *Dev Biol* **166**, 815-8.
- Hildebrandt, F., Cybulla, M., Strahm, B., Nothwang, H. G., Singh-Sawhney, I., Berz, K., Nicklin, M., Reiner, O., and Brandis, M. (1996). Physical mapping of the gene for juvenile nephronophthisis (NPH1) by construction of a complete YAC contig of 7 Mb on chromosome 2q13. *Cytogenet Cell Genet* **73**, 235-9.
- Hoang, B., Moos, M., Jr., Vukicevic, S., and Luyten, F. P. (1996). Primary structure and tissue distribution of FRZB, a novel protein related to Drosophila frizzled, suggest a role in skeletal morphogenesis. *J Biol Chem* **271**, 26131-7.
- Hrabe de Angelis, M., McIntyre, J., 2nd, and Gossler, A. (1997). Maintenance of somite borders in mice requires the Delta homologue DII1. *Nature* **386**, 717-21.
- Huber, O., Bierkamp, C., and Kemler, R. (1996). Cadherins and catenins in development. *Curr Opin Cell Biol* **8**, 685-91.
- Ish-Horowicz, D., Howard, K. R., Pinchin, S. M., and Ingham, P. W. (1985). Molecular and genetic analysis of the hairy locus in Drosophila. *Cold Spring Harb Symp Quant Biol* **50**, 135-44.
- Ishibashi, M., Ang, S. L., Shiota, K., Nakanishi, S., Kageyama, R., and Guillemot, F. (1995). Targeted disruption of mammalian hairy and Enhancer of split homolog-1 (HES-1) leads to up-regulation of neural helix-loop-helix factors, premature neurogenesis, and severe neural tube defects. *Genes Dev* **9**, 3136-48.
- Jansson, S., Olkkonen, V., Martin-Parras, L., Chavrier, P., Stapleton, M., Zerial, M., and Lehtonen, E. (1997). Mouse metanephric kidney as a model system for identifying developmentally regulated genes. *J Cell Physiol* **173**, 147-51.
- Kageyama, R., and Nakanishi, S. (1997). Helix-loop-helix factors in growth and differentiation of the vertebrate nervous system. *Curr Opin Genet Dev* **7**, 659-65.
- Kaufmann, M. H., and Bard, J. B. L. (1999). "The anatomical basis of mouse development." Academic Press, London.

- Kispert, A., Vainio, S., Shen, L., Rowitch, D. H., and McMahon, A. P. (1996). Proteoglycans are required for maintenance of Wnt-11 expression in the ureter tips. *Development* **122**, 3627-37.
- Kispert, A., Vainio, S., and McMahon, A. P. (1998). Wnt-4 is a mesenchymal signal for epithelial transformation of metanephric mesenchyme in the developing kidney. *Development* **125**, 4225-34.
- Klamt, B., Koziell, A., Poulat, F., Wieacker, P., Scambler, P., Berta, P., and Gessler, M. (1998). Frasier syndrome is caused by defective alternative splicing of WT1 leading to an altered ratio of WT1 +/-KTS splice isoforms. *Hum Mol Genet* **7**, 709-14.
- Klein, P. S., and Melton, D. A. (1996). A molecular mechanism for the effect of lithium on development. *Proc Natl Acad Sci U S A* **93**, 8455-9.
- Koseki, C., Herzlinger, D., and al-Awqati, Q. (1992). Apoptosis in metanephric development. *J Cell Biol* **119**, 1327-33.
- Koskimies, O., and Saxen, L. (1966). Studies on kidney tubulogenesis. IV. Lactic dehydrogenase isozymes in the development of mouse metanephrogenic mesenchyme in vitro. *Ann Med Exp Biol Fenn* **44**, 151-4.
- Kreidberg, J. A., Sariola, H., Loring, J. M., Maeda, M., Pelletier, J., Housman, D., and Jaenisch, R. (1993). WT-1 is required for early kidney development. *Cell* **74**, 679-91.
- Kretzler, M., Fan, G., Rose, D., Arend, L. J., Briggs, J. P., and Holzman, L. B. (1996). Novel mouse embryonic renal marker gene products differentially expressed during kidney development. *Am J Physiol* **271**, F770-7.
- Leimeister, C., Bach, A., and Gessler, M. (1998). Developmental expression patterns of mouse sFRP genes encoding members of the secreted frizzled related protein family. *Mech Dev* **75**, 29-42.
- Lescher, B., Haenig, B., and Kispert, A. (1998). sFRP-2 is a target of the Wnt-4 signaling pathway in the developing metanephric kidney. *Dev Dyn* **213**, 440-51.
- Leveen, P., Pekny, M., Gebre-Medhin, S., Swolin, B., Larsson, E., and Betsholtz, C. (1994). Mice deficient for PDGF B show renal, cardiovascular, and hematological abnormalities. *Genes Dev* **8**, 1875-87.
- Leyns, L., Bouwmeester, T., Kim, S. H., Piccolo, S., and De Robertis, E. M. (1997). Frzb-1 is a secreted antagonist of Wnt signaling expressed in the Spemann organizer. *Cell* **88**, 747-56.
- Liang, P., and Pardee, A. B. (1992). Differential display of eukaryotic messenger RNA by means of the polymerase chain reaction. *Science* **257**, 967-71.
- Lin, K., Wang, S., Julius, M. A., Kitajewski, J., Moos, M., Jr., and Luyten, F. P. (1997). The cysteine-rich frizzled domain of Frzb-1 is required and sufficient for modulation of Wnt signaling. *Proc Natl Acad Sci U S A* **94**, 11196-200.
- Lindsell, C. E., Boulter, J., diSibio, G., Gossler, A., and Weinmaster, G. (1996). Expression patterns of Jagged, Delta1, Notch1, Notch2, and Notch3 genes identify ligand-receptor pairs that may function in neural development. *Mol Cell Neurosci* **8**, 14-27.
- Linskens, M. H., Feng, J., Andrews, W. H., Enlow, B. E., Saati, S. M., Tonkin, L. A., Funk, W. D., and Villeponteau, B. (1995). Cataloging altered gene expression in young and senescent cells using enhanced differential display. *Nucleic Acids Res* **23**, 3244-51.
- Luo, G., Hofmann, C., Bronckers, A. L., Sohocki, M., Bradley, A., and Karsenty, G. (1995). BMP-7 is an inducer of nephrogenesis, and is also required for eye development and skeletal patterning. *Genes Dev* **9**, 2808-20.

- Lyons, K. M., Hogan, B. L., and Robertson, E. J. (1995). Colocalization of BMP 7 and BMP 2 RNAs suggests that these factors cooperatively mediate tissue interactions during murine development. *Mech Dev* **50**, 71-83.
- Mallo, M., Steingrimsson, E., Copeland, N. G., Jenkins, N. A., and Gridley, T. (1994). Genomic organization, alternative polyadenylation, and chromosomal localization of Grg, a mouse gene related to the groucho transcript of the Drosophila Enhancer of split complex. *Genomics* **21**, 194-201.
- Manson, J., West, J. D., Thomson, V., McBride, P., Kaufman, M. H., and Hope, J. (1992). The prion protein gene: a role in mouse embryogenesis? *Development* **115**, 117-22.
- Mansouri, A., Chowdhury, K., and Gruss, P. (1998). Follicular cells of the thyroid gland require Pax8 gene function. *Nat Genet* **19**, 87-90.
- Mansouri, A., Goudreau, G., and Gruss, P. (1999). Pax genes and their role in organogenesis. *Cancer Res* **59**, 1707s-1709s; discussion 1709s-1710s.
- Mayr, T., Deutsch, U., Kuhl, M., Drexler, H. C., Lottspeich, F., Deutzmann, R., Wedlich, D., and Risau, W. (1997). Fritz: a secreted frizzled-related protein that inhibits Wnt activity. *Mech Dev* **63**, 109-25.
- McGrew, M. J., and Pourquie, O. (1998). Somitogenesis: segmenting a vertebrate. *Curr Opin Genet Dev* **8**, 487-93.
- McGrew, M. J., Dale, J. K., Fraboulet, S., and Pourquie, O. (1998). The lunatic fringe gene is a target of the molecular clock linked to somite segmentation in avian embryos. *Curr Biol* **8**, 979-82.
- Melkonyan, H. S., Chang, W. C., Shapiro, J. P., Mahadevappa, M., Fitzpatrick, P. A., Kiefer, M. C., Tomei, L. D., and Umansky, S. R. (1997). SARPs: a family of secreted apoptosis-related proteins. *Proc Natl Acad Sci U S A* **94**, 13636-41.
- Mendelsohn, C., Batourina, E., Fung, S., Gilbert, T., and Dodd, J. (1999). Stromal cells mediate retinoid-dependent functions essential for renal development. *Development* **126**, 1139-48.
- Mitsiadis, T. A., Henrique, D., Thesleff, I., and Lendahl, U. (1997). Mouse Serrate-1 (Jagged-1): expression in the developing tooth is regulated by epithelial-mesenchymal interactions and fibroblast growth factor-4. *Development* **124**, 1473-83.
- Miyamoto, N., Yoshida, M., Kuratani, S., Matsuo, I., and Aizawa, S. (1997). Defects of urogenital development in mice lacking Emx2. *Development* **124**, 1653-64.
- Mochizuki, T., Lemmink, H. H., Mariyama, M., Antignac, C., Gubler, M. C., Pirson, Y., Verellen-Dumoulin, C., Chan, B., Schroder, C. H., Smeets, H. J., and et al. (1994). Identification of mutations in the alpha 3(IV) and alpha 4(IV) collagen genes in autosomal recessive Alport syndrome. *Nat Genet* **8**, 77-81.
- Moore, M. W., Klein, R. D., Farinas, I., Sauer, H., Armanini, M., Phillips, H., Reichardt, L. F., Ryan, A. M., Carver-Moore, K., and Rosenthal, A. (1996). Renal and neuronal abnormalities in mice lacking GDNF. *Nature* **382**, 76-9.
- Muller, U., Wang, D., Denda, S., Meneses, J. J., Pedersen, R. A., and Reichardt, L. F. (1997). Integrin alpha8beta1 is critically important for epithelial-mesenchymal interactions during kidney morphogenesis. *Cell* **88**, 603-13.
- Nishimura, M., Isaka, F., Ishibashi, M., Tomita, K., Tsuda, H., Nakanishi, S., and Kageyama, R. (1998). Structure, chromosomal locus, and promoter of mouse Hes2 gene, a homologue of Drosophila hairy and Enhancer of split. *Genomics* **49**, 69-75.

- Nusslein-Volhard, C., and Wieschaus, E. (1980). Mutations affecting segment number and polarity in *Drosophila*. *Nature* **287**, 795-801.
- Ohsako, S., Hyer, J., Panganiban, G., Oliver, I., and Caudy, M. (1994). Hairy function as a DNA-binding helix-loop-helix repressor of *Drosophila* sensory organ formation. *Genes Dev* **8**, 2743-55.
- Pachnis, V., Mankoo, B., and Costantini, F. (1993). Expression of the c-ret proto-oncogene during mouse embryogenesis. *Development* **119**, 1005-17.
- Palazzolo, M. J., Hamilton, B. A., Ding, D. L., Martin, C. H., Mead, D. A., Mierendorf, R. C., Raghavan, K. V., Meyerowitz, E. M., and Lipshitz, H. D. (1990). Phage lambda cDNA cloning vectors for subtractive hybridization, fusion- protein synthesis and Cre-loxP automatic plasmid subcloning. *Gene* **88**, 25-36.
- Palmeirim, I., Henrique, D., Ish-Horowicz, D., and Pourquie, O. (1997). Avian hairy gene expression identifies a molecular clock linked to vertebrate segmentation and somitogenesis. *Cell* **91**, 639-48.
- Palsson, R., Sharma, C. P., Kim, K., McLaughlin, M., Brown, D., and Arnaout, M. A. (1996). Characterization and cell distribution of polycystin, the product of autosomal dominant polycystic kidney disease gene 1. *Mol Med* **2**, 702-11.
- Paroush, Z., Finley, R. L., Jr., Kidd, T., Wainwright, S. M., Ingham, P. W., Brent, R., and Ish-Horowicz, D. (1994). Groucho is required for *Drosophila* neurogenesis, segmentation, and sex determination and interacts directly with hairy-related bHLH proteins. *Cell* **79**, 805-15.
- Parr, B. A., Shea, M. J., Vassileva, G., and McMahon, A. P. (1993). Mouse Wnt genes exhibit discrete domains of expression in the early embryonic CNS and limb buds. *Development* **119**, 247-61.
- Pelletier, J., Bruening, W., Kashtan, C. E., Mauer, S. M., Manivel, J. C., Striegel, J. E., Houghton, D. C., Junien, C., Habib, R., Fouser, L., and et al. (1991). Germline mutations in the Wilms' tumor suppressor gene are associated with abnormal urogenital development in Denys-Drash syndrome. *Cell* **67**, 437-47.
- Perantoni, A. O., Dove, L. F., and Karavanova, I. (1995). Basic fibroblast growth factor can mediate the early inductive events in renal development. *Proc Natl Acad Sci U S A* **92**, 4696-700.
- Pfeffer, P. L., De Robertis, E. M., and Izpisua-Belmonte, J. C. (1997). Crescent, a novel chick gene encoding a Frizzled-like cysteine-rich domain, is expressed in anterior regions during early embryogenesis. *Int J Dev Biol* **41**, 449-58.
- Pichel, J. G., Shen, L., Sheng, H. Z., Granholm, A. C., Drago, J., Grinberg, A., Lee, E. J., Huang, S. P., Saarma, M., Hoffer, B. J., Sariola, H., and Westphal, H. (1996). Defects in enteric innervation and kidney development in mice lacking GDNF. *Nature* **382**, 73-6.
- Rattner, A., Hsieh, J. C., Smallwood, P. M., Gilbert, D. J., Copeland, N. G., Jenkins, N. A., and Nathans, J. (1997). A family of secreted proteins contains homology to the cysteine-rich ligand-binding domain of frizzled receptors. *Proc Natl Acad Sci U S A* **94**, 2859-63.
- Rose, T. M., Schultz, E. R., Henikoff, J. G., Pietrovski, S., McCallum, C. M., and Henikoff, S. (1998). Consensus-degenerate hybrid oligonucleotide primers for amplification of distantly related sequences. *Nucleic Acids Res* **26**, 1628-35.
- Rosenblum, N. D., and Yager, T. D. (1997). Changing patterns of gene expression in developing mouse kidney, as probed by differential mRNA display combined with cDNA library screening. *Kidney Int* **51**, 920-5.

- Rubenstein, J. L., Martinez, S., Shimamura, K., and Puelles, L. (1994). The embryonic vertebrate forebrain: the prosomeric model. *Science* **266**, 578-80.
- Rushlow, C. A., Hogan, A., Pinchin, S. M., Howe, K. M., Lardelli, M., and Ish-Horowicz, D. (1989). The Drosophila hairy protein acts in both segmentation and bristle patterning and shows homology to N-myc. *Embo J* **8**, 3095-103.
- Salic, A. N., Kroll, K. L., Evans, L. M., and Kirschner, M. W. (1997). Sizzled: a secreted Xwnt8 antagonist expressed in the ventral marginal zone of Xenopus embryos. *Development* **124**, 4739-48.
- Sambrook, J., Fritsch, E. F., and Maniatis, T. (1989). "Molecular cloning: a laboratory manual." Cold Spring Harbor Laboratory Press, New York.
- Sanchez, M. P., Silos-Santiago, I., Frisen, J., He, B., Lira, S. A., and Barbacid, M. (1996). Renal agenesis and the absence of enteric neurons in mice lacking GDNF. *Nature* **382**, 70-3.
- Sasai, Y., Kageyama, R., Tagawa, Y., Shigemoto, R., and Nakanishi, S. (1992). Two mammalian helix-loop-helix factors structurally related to Drosophila hairy and Enhancer of split. *Genes Dev* **6**, 2620-34.
- Saxén, L. (1987). "Organogenesis of the kidney." Cambridge University Press, Cambridge.
- Scavo, L. M., Ertsey, R., and Gao, B. Q. (1998). Human surfactant proteins A1 and A2 are differentially regulated during development and by soluble factors. *Am J Physiol* **275**, L653-69.
- Schmidt, C., Bladt, F., Goedecke, S., Brinkmann, V., Zschiesche, W., Sharpe, M., Gherardi, E., and Birchmeier, C. (1995). Scatter factor/hepatocyte growth factor is essential for liver development. *Nature* **373**, 699-702.
- Schuchardt, A., D'Agati, V., Larsson-Blomberg, L., Costantini, F., and Pachnis, V. (1994). Defects in the kidney and enteric nervous system of mice lacking the tyrosine kinase receptor Ret. *Nature* **367**, 380-3.
- Schuchardt, A., D'Agati, V., Pachnis, V., and Costantini, F. (1996). Renal agenesis and hypodysplasia in ret-k- mutant mice result from defects in ureteric bud development. *Development* **122**, 1919-29.
- Shawlot, W., and Behringer, R. R. (1995). Requirement for Lim1 in head-organizer function. *Nature* **374**, 425-30.
- Shirozu, M., Tada, H., Tashiro, K., Nakamura, T., Lopez, N. D., Nazarea, M., Hamada, T., Sato, T., Nakano, T., and Honjo, T. (1996). Characterization of novel secreted and membrane proteins isolated by the signal sequence trap method. *Genomics* **37**, 273-80.
- Soriano, P. (1994). Abnormal kidney development and hematological disorders in PDGF beta-receptor mutant mice. *Genes Dev* **8**, 1888-96.
- Sorokin, L., Sonnenberg, A., Aumailley, M., Timpl, R., and Ekblom, P. (1990). Recognition of the laminin E8 cell-binding site by an integrin possessing the alpha 6 subunit is essential for epithelial polarization in developing kidney tubules. *J Cell Biol* **111**, 1265-73.
- Southern, E. M. (1975). Detection of specific sequences among DNA fragments separated by gel electrophoresis. *J Mol Biol* **98**, 503-17.
- Stark, K., Vainio, S., Vassileva, G., and McMahon, A. P. (1994). Epithelial transformation of metanephric mesenchyme in the developing kidney regulated by Wnt-4. *Nature* **372**, 679-83.
- Treanor, J. J., Goodman, L., de Sauvage, F., Stone, D. M., Poulsen, K. T., Beck, C. D., Gray, C., Armanini, M. P., Pollock, R. A., Hefti, F., Phillips, H. S., Goddard, A., Moore, M. W., Buj-

- Bello, A., Davies, A. M., Asai, N., Takahashi, M., Vandlen, R., Henderson, C. E., and Rosenthal, A. (1996). Characterization of a multicomponent receptor for GDNF. *Nature* **382**, 80-3.
- Uehara, Y., Minowa, O., Mori, C., Shiota, K., Kuno, J., Noda, T., and Kitamura, N. (1995). Placental defect and embryonic lethality in mice lacking hepatocyte growth factor/scatter factor. *Nature* **373**, 702-5.
- Vize, P. D., Seufert, D. W., Carroll, T. J., and Wallingford, J. B. (1997). Model systems for the study of kidney development: use of the pronephros in the analysis of organ induction and patterning. *Dev Biol* **188**, 189-204.
- Wada, J., Kumar, A., Ota, K., Wallner, E. I., Batlle, D. C., and Kanwar, Y. S. (1997). Representational difference analysis of cDNA of genes expressed in embryonic kidney. *Kidney Int* **51**, 1629-38.
- Wan, J. S., Sharp, S. J., Poirier, G. M., Wagaman, P. C., Chambers, J., Pyati, J., Hom, Y. L., Galindo, J. E., Huvar, A., Peterson, P. A., Jackson, M. R., and Erlander, M. G. (1996). Cloning differentially expressed mRNAs. *Nat Biotechnol* **14**, 1685-91.
- Wang, Y., Macke, J. P., Abella, B. S., Andreasson, K., Worley, P., Gilbert, D. J., Copeland, N. G., Jenkins, N. A., and Nathans, J. (1996). A large family of putative transmembrane receptors homologous to the product of the Drosophila tissue polarity gene frizzled. *J Biol Chem* **271**, 4468-76.
- Wang, S., Krinks, M., Lin, K., Luyten, F. P., and Moos, M., Jr. (1997a). Frzb, a secreted protein expressed in the Spemann organizer, binds and inhibits Wnt-8. *Cell* **88**, 757-66.
- Wang, S., Krinks, M., and Moos, M., Jr. (1997b). Frzb-1, an antagonist of Wnt-1 and Wnt-8, does not block signaling by Wnts -3A, -5A, or -11. *Biochem Biophys Res Commun* **236**, 502-4.
- Wang, Y. K., Samos, C. H., Peoples, R., Perez-Jurado, L. A., Nusse, R., and Francke, U. (1997c). A novel human homologue of the Drosophila frizzled wnt receptor gene binds wingless protein and is in the Williams syndrome deletion at 7q11.23. *Hum Mol Genet* **6**, 465-72.
- Wang, Y. K., Sporle, R., Paperna, T., Schughart, K., and Francke, U. (1999). Characterization and expression pattern of the frizzled gene Fzd9, the mouse homolog of FZD9 which is deleted in Williams-Beuren syndrome. *Genomics* **57**, 235-48.
- Weinmaster, G., Roberts, V. J., and Lemke, G. (1991). A homolog of Drosophila Notch expressed during mammalian development. *Development* **113**, 199-205.
- Weinmaster, G., Roberts, V. J., and Lemke, G. (1992). Notch2: a second mammalian Notch gene. *Development* **116**, 931-41.
- Williams, R., Lendahl, U., and Lardelli, M. (1995). Complementary and combinatorial patterns of Notch gene family expression during early mouse development. *Mech Dev* **53**, 357-68.
- Woolf, A. S., Kolatsi-Joannou, M., Hardman, P., Andermarcher, E., Moorby, C., Fine, L. G., Jat, P. S., Noble, M. D., and Gherardi, E. (1995). Roles of hepatocyte growth factor/scatter factor and the met receptor in the early development of the metanephros. *J Cell Biol* **128**, 171-84.
- Xue, Y., Gao, X., Lindsell, C. E., Norton, C. R., Chang, B., Hicks, C., Gendron-Maguire, M., Rand, E. B., Weinmaster, G., and Gridley, T. (1999). Embryonic lethality and vascular defects in mice lacking the notch ligand jagged1. *Hum Mol Genet* **8**, 723-30.
- Yang-Snyder, J., Miller, J. R., Brown, J. D., Lai, C. J., and Moon, R. T. (1996). A frizzled homolog functions in a vertebrate Wnt signaling pathway. *Curr Biol* **6**, 1302-6.

- Zhou, J., Barker, D. F., Hostikka, S. L., Gregory, M. C., Atkin, C. L., and Tryggvason, K. (1991). Single base mutation in alpha 5(IV) collagen chain gene converting a conserved cysteine to serine in Alport syndrome. *Genomics* **9**, 10-8.