

5 References

- Abou-Samra, A. B., Juppner, H., Kong, X. F., Schipani, E., Iida-Klein, A., Karga, H., Urena, P., Gardella, T. F., Potts, J., Jr., Kronenberg, H. M. et al.** (1994). Structure, function, and expression of the receptor for parathyroid hormone and parathyroid hormone-related peptide. *Adv Nephrol Necker Hosp* **23**, 247-264.
- Amizuka, N., Warshawsky, H., Henderson, J. E., Goltzman, D. and Karaplis, A. C.** (1994). Parathyroid hormone-related peptide-depleted mice show abnormal epiphyseal cartilage development and altered endochondral bone formation. *J Cell Biol* **126**, 1611-1623.
- Arman, E., Haffner-Krausz, R., Chen, Y., Heath, J. K. and Lonai, P.** (1998). Targeted disruption of fibroblast growth factor (FGF) receptor 2 suggests a role for FGF signaling in pregastrulation mammalian development. *Proc Natl Acad Sci U S A* **95**, 5082-7.
- Bellus, G. A., McIntosh, I., Smith, E. A., Aylsworth, A. S., Kaitila, I., Horton, W. A., Greenhaw, G. A., Hecht, J. T. and Francomano, C. A.** (1995). A recurrent mutation in the tyrosine kinase domain of fibroblast growth factor receptor 3 causes hypochondroplasia. *Nat Genet* **10**, 357-9.
- Bitgood, M. J. and McMahon, A. P.** (1995). Hedgehog and Bmp genes are coexpressed at many diverse sites of cell-cell interaction in the mouse embryo. *Dev Biol* **172**, 126-138.
- Botchkarev, V. A., Botchkareva, N. V., Roth, W., Nakamura, M., Chen, L. H., Herzog, W., Lindner, G., McMahon, J. A., Peters, C., Lauster, R. et al.** (1999). Noggin is a mesenchymally derived stimulator of hair-follicle induction. *Nat Cell Biol* **1**, 158-64.
- Brunet, L. J., McMahon, J. A., McMahon, A. P. and Harland, R. M.** (1998). Noggin, cartilage morphogenesis, and joint formation in the mammalian skeleton [see comments]. *Science* **280**, 1455-7.
- Chen, L., Adar, R., Yang, X., Monsonego, E. O., Li, C., Hauschka, P. V., Yayon, A. and Deng, C. X.** (1999). Gly369Cys mutation in mouse FGFR3 causes

- achondroplasia by affecting both chondrogenesis and osteogenesis. *J Clin Invest* **104**, 1517-25.
- Chen, L., Li, C., Qiao, W., Xu, X. and Deng, C.** (2001). A Ser(365)-->Cys mutation of fibroblast growth factor receptor 3 in mouse downregulates Ihh/PTHrP signals and causes severe achondroplasia. *Hum Mol Genet* **10**, 457-65.
- Chen, P., Vukicevic, S., Sampath, T. K. and Luyten, F. P.** (1995). Osteogenic protein-1 promotes growth and maturation of chick sternal chondrocytes in serum-free cultures. *J Cell Sci* **108**, 105-14.
- Chung, U. I., Lanske, B., Lee, K., Li, E. and Kronenberg, H.** (1998). The parathyroid hormone/parathyroid hormone-related peptide receptor coordinates endochondral bone development by directly controlling chondrocyte differentiation. *Proc Natl Acad Sci U S A* **95**, 13030-5.
- Chung, U. I., Schipani, E., McMahon, A. P. and Kronenberg, H. M.** (2001). Indian hedgehog couples chondrogenesis to osteogenesis in endochondral bone development. *J Clin Invest* **107**, 295-304.
- Cohen, A., Mulas, R., Seri, M., Gaiero, A., Fichera, G., Marini, M., Baffico, M. and Camera, G.** (2002). Meier-Gorlin syndrome (ear-patella-short stature syndrome) in an Italian patient: Clinical evaluation and analysis of possible candidate genes. *Am J Med Genet* **107**, 48-51.
- Colvin, J. S., Bohne, B. A., Harding, G. W., McEwen, D. G. and Ornitz, D. M.** (1996). Skeletal overgrowth and deafness in mice lacking fibroblast growth factor receptor 3. *Nat Genet* **12**, 390-7.
- Cooper, M. K., Porter, J. A., Young, K. E. and Beachy, P. A.** (1998). Teratogen-mediated inhibition of target tissue response to Shh signaling. *Science* **280**, 1603-7.
- Cormack, D. H.** (1987). Ham's histology. Philadelphia: Pennsylvania.
- Daluiski, A., Engstrand, T., Bahamonde, M. E., Gamer, L. W., Agius, E., Stevenson, S. L., Cox, K., Rosen, V. and Lyons, K. M.** (2001). Bone morphogenetic protein-3 is a negative regulator of bone density. *Nat Genet* **27**, 84-8.
- De Luca, F., Barnes, K. M., Uyeda, J. A., De-Levi, S., Abad, V., Palese, T., Mericq, V. and Baron, J.** (2001). Regulation of growth plate chondrogenesis by bone morphogenetic protein-2. *Endocrinology* **142**, 430-6.

- Delezoide, A. L., Benoist-Lasselin, C., Legeai-Mallet, L., Le Merrer, M., Munnich, A., Vekemans, M. and Bonaventure, J.** (1998). Spatio-temporal expression of FGFR 1, 2 and 3 genes during human embryo-fetal ossification. *Mech Dev* **77**, 19-30.
- Deng, C., Wynshaw-Boris, A., Zhou, F., Kuo, A. and Leder, P.** (1996). Fibroblast Growth Factor Receptor 3 is a negative regulator of bone growth. *Cell* **84**, 911-921.
- Deng, C. X., Wynshaw-Boris, A., Shen, M. M., Daugherty, C., Ornitz, D. M. and Leder, P.** (1994). Murine FGFR-1 is required for early postimplantation growth and axial organization. *Genes Dev* **8**, 3045-57.
- Desbois, C., Hogue, D. A. and Karsenty, G.** (1994). The mouse osteocalcin gene cluster contains three genes with two separate spatial and temporal patterns of expression. *J Biol Chem* **269**, 1183-90.
- 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**, 2795-2807.
- Dunn, N. R., Winnier, G. E., Hargett, L. K., Schrick, J. J., Fogo, A. B. and Hogan, B. L. M.** (1997). Haploinsufficient phenotypes in bmp4 heterozygous null mice and modification by mutations in gli3 and alx4 [In Process Citation]. *Dev Biol* **188**, 235-47.
- Enomoto-Iwamoto, M., Iwamoto, M., Mukudai, Y., Kawakami, Y., Nohno, T., Higuchi, Y., Takemoto, S., Ohuchi, H., Noji, S. and Kurisu, K.** (1998). Bone morphogenetic protein signaling is required for maintenance of differentiated phenotype, control of proliferation, and hypertrophy in chondrocytes. *J Cell Biol* **140**, 409-18.
- Erlebacher, A., Filvaroff, E. H., Gitelman, S. E. and Derynck, R.** (1995). Toward a molecular understanding of skeletal development. *Cell* **80**, 371-8.
- Gallea, S., Lallemand, F., Atfi, A., Rawadi, G., Ramez, V., Spinella-Jaegle, S., Kawai, S., Faucheu, C., Huet, L., Baron, R. et al.** (2001). Activation of mitogen-activated protein kinase cascades is involved in regulation of bone morphogenetic protein-2-induced osteoblast differentiation in pluripotent C2C12 cells. *Bone* **28**, 491-8.

GenBank. <http://www.ncbi.nlm.nih.gov/Genbank/index.html>

- Gerstenfeld, L. C. and Shapiro, F. D.** (1996). Expression of bone-specific genes by hypertrophic chondrocytes: implication of the complex functions of the hypertrophic chondrocyte during endochondral bone development. *J Cell Biochem* **62**, 1-9.
- Gilbert, S. F.** (1994). Developmental Biology. Sunderland: Sinauer Associates, Inc.
- Gong, Y., Krakow, D., Marcelino, J., Wilkin, D., Chitayat, D., Babul-Hirji, R., Hudgins, L., Cremers, C. W., Cremers, F. P., Brunner, H. G. et al.** (1999). Heterozygous mutations in the gene encoding noggin affect human joint morphogenesis. *Nat Genet* **21**, 302-4.
- Goswami, M., Uzgare, A. R. and Sater, A. K.** (2001). Regulation of MAP kinase by the BMP-4/TAK1 pathway in Xenopus ectoderm. *Dev Biol* **236**, 259-70.
- Gritli-Linde, A., Lewis, P., McMahon, A. P. and Linde, A.** (2001). The whereabouts of a morphogen: direct evidence for short- and graded long-range activity of hedgehog signaling peptides. *Dev Biol* **236**, 364-86.
- Haaijman, A., Burger, E. H., Goei, S. W., Nelles, L., ten Dijke, P., Huylebroeck, D. and Bronckers, A. L.** (2000). Correlation between ALK-6 (BMPR-IB) distribution and responsiveness to osteogenic protein-1 (BMP-7) in embryonic mouse bone rudiments. *Growth Factors* **17**, 177-92.
- Haaijman, A., Karperien, M., Lanske, B., Hendriks, J., Lowik, C. W., Bronckers, A. L. and Burger, E. H.** (1999). Inhibition of terminal chondrocyte differentiation by bone morphogenetic protein 7 (OP-1) in vitro depends on the periarticular region but is independent of parathyroid hormone-related peptide. *Bone* **25**, 397-404.
- Hinchcliffe, J. R. and Johnson, D. R.** (1980). The development of the Vertebrate limb. New York: Oxford University Press.
- Hogan, B. L. M.** (1996). Bone morphogenetic proteins: multifunctional regulators of vertebrate development. *Genes Dev.* **10**, 1580-1594.
- Holley, S., Neul, J., Attisano, L., Wrana, J., Sasai, Y., O'Connor, M., De Robertis, E. and Ferguson, E.** (1996). The Xenopus dorsalizing factor noggin ventralizes Drosophila embryos by preventing DPP from activating its receptor. *Cell* **86**, 607-617.
- Incardona, J. P., Gaffield, W., Kapur, R. P. and Roelink, H.** (1998). The teratogenic Veratrum alkaloid cyclopamine inhibits sonic hedgehog signal transduction. *Development* **125**, 3553-62.

- Iseki, S., Wilkie, A. O., Heath, J. K., Ishimaru, T., Eto, K. and Morriss-Kay, G. M.** (1997). Fgfr2 and osteopontin domains in the developing skull vault are mutually exclusive and can be altered by locally applied FGF2. *Development* **124**, 3375-84.
- Iwata, T., Li, C. L., Deng, C. X. and Francomano, C. A.** (2001). Highly activated Fgfr3 with the K644M mutation causes prolonged survival in severe dwarf mice. *Hum Mol Genet* **10**, 1255-64.
- Jacenko, O., LuValle, P. A. and Olsen, B. R.** (1993). Spondylometaphyseal dysplasia in mice carrying a dominant negative mutation in a matrix protein specific for cartilage-to-bone transition. *Nature* **365**, 56-61.
- Jena, N., Martin-Seisdedos, C., McCue, P. and Croce, C. M.** (1997). BMP7 null mutation in mice: developmental defects in skeleton, kidney, and eye. *Exp Cell Res* **230**, 28-37.
- Kan Sh, S. H., Elanko, N., Johnson, D., Cornejo-Roldan, L., Cook, J., Reich, E. W., Tomkins, S., Verloes, A., Twigg, S. R., Rannan-Eliya, S. et al.** (2002). Genomic screening of fibroblast growth-factor receptor 2 reveals a wide spectrum of mutations in patients with syndromic craniosynostosis. *Am J Hum Genet* **70**, 472-86.
- Karaplis, A. C., Luz, A., Glowacki, J., Bronson, R. T., Tybulewicz, V. L., Kronenberg, H. M. and Mulligan, R. C.** (1994). Lethal skeletal dysplasia from targeted disruption of the parathyroid hormone-related peptide gene. *Genes Dev* **8**, 277-89.
- Karaplis, A. C., Yasuda, T., Hendy, G. N., Goltzman, D. and Banville, D.** (1990). Gene-encoding parathyroid hormone-like peptide: nucleotide sequence of the rat gene and comparison with the human homologue. *Mol Endocrinol* **4**, 441-6.
- Karp, S. J., Schipani, E., St-Jacques, B., Hunzelman, J., Kronenberg, H. and McMahon, A. P.** (2000). Indian hedgehog coordinates endochondral bone growth and morphogenesis via parathyroid hormone related-protein-dependent and -independent pathways. *Development* **127**, 543-8.
- Kaufmann, M. H.** (1992). The atlas of mouse development. San Diego: Academic press.
- Kawabata, M., Imamura, T. and Miyazono, K.** (1998). Signal transduction by bone morphogenetic proteins. *Cytokine Growth Factor Rev* **9**, 49-61.
- Kim, I. S., Otto, F., Zabel, B. and Mundlos, S.** (1999). Regulation of chondrocyte differentiation by Cbfa1. *Mech Dev* **80**, 159-70.

- King, J. A., Marker, P. C., Seung, K. J. and Kingsley, D. M.** (1994). BMP5 and the molecular, skeletal, and soft-tissue alterations in short ear mice. *Dev. Biol.* **166**, 112-22.
- Kingsley, D. M.** (1994a). The TGF-beta superfamily: new members, new receptors, and new genetic tests of function in different organisms. *Genes Dev* **8**, 133-46.
- Kingsley, D. M.** (1994b). What do BMPs do in mammals? Clues from the mouse short-ear mutation. *Trends Genet* **10**, 16-21.
- Kingsley, D. M., Bland, A. E., Grubber, J. M., Marker, P. C., Russell, L. B., Copeland, N. G. and Jenkins, N. A.** (1992). The mouse short ear skeletal morphogenesis locus is associated with defects in a bone morphogenetic member of the TGF beta superfamily. *Cell* **71**, 399-410.
- Kohno, K., Martin, G. R. and Yamada, Y.** (1984). Isolation and characterization of a cDNA clone for the amino-terminal portion of the pro-alpha 1(II) chain of cartilage collagen. *J Biol Chem* **259**, 13668-73.
- Kretzschmar, M., Doody, J. and Massague, J.** (1997). Opposing BMP and EGF signalling pathways converge on the TGF-beta family mediator Smad1. *Nature* **389**, 618-22.
- Lamb, T. M., Knecht, A. K., Smith, W. C., Stachel, S. E., Economides, A. N., Stahl, N., Yancopoulous, G. D. and Harland, R. M.** (1993). Neural induction by the secreted polypeptide noggin. *Science* **262**, 713-8.
- Lanske, B., Karaplis, A. C., Lee, K., Luz, A., Vortkamp, A., Pirro, A., Karperien, M., Defize, L. H. K., Ho, C., Mulligan, R. C. et al.** (1996). PTH/PTHrP receptor in early development and Indian hedgehog-regulated bone growth [see comments]. *Science* **273**, 663-6.
- Lee, K., Deeds, J. D. and Segre, G. V.** (1995). Expression of parathyroid hormone-related peptide and its receptor messenger ribonucleic acids during fetal development of rats. *Endocrinology* **136**, 453-463.
- Li, C., Chen, L., Iwata, T., Kitagawa, M., Fu, X. Y. and Deng, C. X.** (1999). A Lys644Glu substitution in fibroblast growth factor receptor 3 (FGFR3) causes dwarfism in mice by activation of STATs and ink4 cell cycle inhibitors. *Hum Mol Genet* **8**, 35-44.
- Liu, Z., Xu, J. and Ornitz, D. M.** (2002). Increased chondrocyte proliferation and differentiation in growth plate chondrocytes in mice lacking Fgf18 identifies FGF18 as a physiological ligand for FGFR3. *Nature Genetics* submitted.

- Long, F., Zhang, X. M., Karp, S., Yang, Y. and McMahon, A. P.** (2001). Genetic manipulation of hedgehog signaling in the endochondral skeleton reveals a direct role in the regulation of chondrocyte proliferation. *Development* **128**, 5099-5108.
- 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**, 2808-2820.
- Macias, D., Ganan, Y., Sampath, T. K., Piedra, M. E., Ros, M. A. and Hurle, J. M.** (1997). Role of BMP-2 and OP-1 (BMP-7) in programmed cell death and skeletogenesis during chick limb development. *Development* **124**, 1109-17.
- Marcelino, J., Sciortino, C. M., Romero, M. F., Ulatowski, L. M., Ballock, R. T., Economides, A. N., Eimon, P. M., Harland, R. M. and Warman, M. L.** (2001). Human disease-causing NOG missense mutations: effects on noggin secretion, dimer formation, and bone morphogenetic protein binding. *Proc Natl Acad Sci U S A* **98**, 11353-8.
- Marigo, V., Davey, R. A., Zuo, Y., Cunningham, J. M. and Tabin, C. J.** (1996). Biochemical evidence that patched is the Hedgehog receptor [see comments]. *Nature* **384**, 176-9.
- Marshall, C. J.** (1995). Specificity of receptor tyrosine kinase signaling: transient versus sustained extracellular signal-regulated kinase activation. *Cell* **80**, 179-85.
- Massague, J.** (1998). TGF-beta signal transduction. *Annu Rev Biochem* **67**, 753-91.
- Massague, J.** (2000). How cells read TGF-beta signals. *Nat Rev Mol Cell Biol* **1**, 169-78.
- Merino, R., Ganan, Y., Macias, D., Economides, A. N., Sampath, K. T. and Hurle, J. M.** (1998). Morphogenesis of digits in the avian limb is controlled by FGFs, TGFbetas, and noggin through BMP signaling. *Dev Biol* **200**, 35-45.
- Monsoro-Burq, A. H., Duprez, D., Watanabe, Y., Bontoux, M., Vincent, C., Brickell, P. and Le Douarin, N.** (1996). The role of bone morphogenetic proteins in vertebral development. *Development* **122**, 3607-16.
- Moon, A. M. and Capecchi, M. R.** (2000). Fgf8 is required for outgrowth and patterning of the limbs. *Nat Genet* **26**, 455-9.
- Mulliken, J. B., Steinberger, D., Kunze, S. and Muller, U.** (1999). Molecular diagnosis of bilateral coronal synostosis. *Plast Reconstr Surg* **104**, 1603-15.

- Murtaugh, L. C., Chyung, J. H. and Lassar, A. B.** (1999). Sonic hedgehog promotes somitic chondrogenesis by altering the cellular response to BMP signaling. *Genes Dev* **13**, 225-37.
- Nakase, T., Takaoka, K., Hirakawa, K., Hirota, S., Takemura, T., Onoue, H., Takebayashi, K., Kitamura, Y. and Nomura, S.** (1994). Alterations in the expression of osteonectin, osteopontin and osteocalcin mRNAs during the development of skeletal tissues in vivo. *Bone Miner* **26**, 109-22.
- Naski, M. C., Colvin, J. S., Coffin, J. D. and Ornitz, D. M.** (1998). Repression of hedgehog signaling and BMP4 expression in growth plate cartilage by fibroblast growth factor receptor 3. *Development* **125**, 4977-4988.
- Naski, M. C., Wang, Q., Xu, J. and Ornitz, D. M.** (1996). Graded activation of fibroblast growth factor receptor 3 by mutations causing achondroplasia and thanatophoric dysplasia. *Nat Genet* **13**, 233-7.
- Neubuser, A., Peters, H., Balling, R. and Martin, G. R.** (1997). Antagonistic interactions between FGF and BMP signaling pathways: a mechanism for positioning the sites of tooth formation. *Cell* **90**, 247-55.
- Olsen, B. R., Reginato, A. M. and Wang, W.** (2000). Bone development. *Annu Rev Cell Dev Biol* **16**, 191-220.
- Ornitz, D. M. and Itoh, N.** (2001). Fibroblast growth factors. *Genome Biol* **2**, REVIEWS3005.
- Passos-Bueno, M. R., Wilcox, W. R., Jabs, E. W., Sertie, A. L., Alonso, L. G. and Kitoh, H.** (1999). Clinical spectrum of fibroblast growth factor receptor mutations. *Hum Mutat* **14**, 115-25.
- Pathi, S., Rutenberg, J. B., Johnson, R. L. and Vortkamp, A.** (1999). Interaction of Ihh and BMP/Noggin signaling during cartilage differentiation. *Dev Biol* **209**, 239-53.
- Rousseau, F., Bonaventure, J., Legeai-Mallet, L., Pelet, A., Rozet, J. M., Maroteaux, P., Le Merrer, M. and Munnich, A.** (1994). Mutations in the gene encoding fibroblast growth factor receptor-3 in achondroplasia. *Nature* **371**, 252-4.
- Schipani, E., Kruse, K. and Juppner, H.** (1995). A constitutively active mutant PTH-PTHrP receptor in Jansen-type metaphyseal chondrodysplasia. *Science* **268**, 98-100.
- Schipani, E., Lanske, B., Hunzeman, J., Luz, A., Kovacs, C. S., Lee, K., Pirro, A., Kronenberg, H. M. and Juppner, H.** (1997). Targeted expression of

constitutively active receptors for parathyroid hormone and parathyroid hormone-related peptide delays endochondral bone formation and rescues mice that lack parathyroid hormone-related peptide. *Proc Natl Acad Sci U S A* **94**, 13689-94.

Segev, O., Chumakov, I., Nevo, Z., Givol, D., Madar-Shapiro, L., Sheinin, Y., Weinreb, M. and Yayon, A. (2000). Restrained chondrocyte proliferation and maturation with abnormal growth plate vascularization and ossification in human FGFR-3(G380R) transgenic mice. *Hum Mol Genet* **9**, 249-58.

Seibel, M. J., Robins, S. P. and Bilezikian, J. P. (1999). Bone and cartilage metabolism. Orlando: Academic press.

Shiang, R., Thompson, L. M., Zhu, Y. Z., Church, D. M., Fielder, T. J., Bocian, M., Winokur, S. T. and Wasmuth, J. J. (1994). Mutations in the transmembrane domain of FGFR3 cause the most common genetic form of dwarfism, achondroplasia. *Cell* **78**, 335-342.

Smith, W. C. (1999). TGF beta inhibitors. New and unexpected requirements in vertebrate development. *Trends Genet* **15**, 3-5.

Smith, W. C. and Harland, R. M. (1992). Expression cloning of noggin, a new dorsalizing factor localized to the Spemann organizer in Xenopus embryos. *Cell* **70**, 829-40.

Smith, W. C., Knecht, A. K., Wu, M. and Harland, R. M. (1993). Secreted noggin protein mimics the Spemann organizer in dorsalizing Xenopus mesoderm. *Nature* **361**, 547-9.

Solloway, M. J., Dudley, A. T., Bikoff, E. K., Lyons, K. M., Hogan, B. L. and Robertson, E. J. (1998). Mice lacking Bmp6 function. *Dev Genet* **22**, 321-39.

St-Jacques, B., Hammerschmidt, M. and McMahon, A. P. (1999). Indian hedgehog signaling regulates proliferation and differentiation of chondrocytes and is essential for bone formation [published erratum appears in Genes Dev 1999 Oct 1;13(19):2617]. *Genes Dev* **13**, 2072-86.

Taipale, J., Chen, J. K., Cooper, M. K., Wang, B., Mann, R. K., Milenkovic, L., Scott, M. P. and Beachy, P. A. (2000). Effects of oncogenic mutations in Smoothened and Patched can be reversed by cyclopamine. *Nature* **406**, 1005-9.

Tavormina, P. L., Shiang, R., Thompson, L. M., Zhu, Y. Z., Wilkin, D. J., Lachman, R. S., Wilcox, W. R., Rimoin, D. L., Cohn, D. H. and Wasmuth, J. J. (1995). Thanatophoric dysplasia (types I and II) caused by distinct mutations in fibroblast growth factor receptor 3. *Nat Genet* **9**, 321-8.

- Thiede, M. A. and Rutledge, S. J.** (1990). Nucleotide sequence of a parathyroid hormone-related peptide expressed by the 10 day chicken embryo. *Nucleic Acids Res* **18**, 3062.
- Tsukazaki, T., Ohtsuru, A., Enomoto, H., Yano, H., Motomura, K., Ito, M., Namba, H., Iwasaki, K. and Yamashita, S.** (1995). Expression of parathyroid hormone-related protein in rat articular cartilage. *Calcif Tissue Int* **57**, 196-200.
- Umbhauer, M., Marshall, C. J., Mason, C. S., Old, R. W. and Smith, J. C.** (1995). Mesoderm induction in Xenopus caused by activation of MAP kinase. *Nature* **376**, 58-62.
- Urist, M. R.** (1965). Bone: formation by autoinduction. *Science* **150**, 893-9.
- Vesque, C., Ellis, S., Lee, A., Szabo, M., Thomas, P., Beddington, R. and Placzek, M.** (2000). Development of chick axial mesoderm: specification of prechordal mesoderm by anterior endoderm-derived TGFbeta family signalling. *Development* **127**, 2795-809.
- von Bubnoff, A. and Cho, K. W.** (2001). Intracellular BMP signaling regulation in vertebrates: pathway or network? *Dev Biol* **239**, 1-14.
- Vortkamp, A., Lee, K., Lanske, B., Segre, G. V., Kronenberg, H. M. and Tabin, C. J.** (1996). Regulation of rate of cartilage differentiation by Indian hedgehog and PTH-related protein [see comments]. *Science* **273**, 613-22.
- Vortkamp, A., Pathi, S., Peretti, G. M., Caruso, E. M., Zaleske, D. J. and Tabin, C. J.** (1998). Recapitulation of signals regulating embryonic bone formation during postnatal growth and in fracture repair. *Mech Dev* **71**, 65-76.
- Wang, Y., Spatz, M. K., Kannan, K., Hayk, H., Avivi, A., Gorivodsky, M., Pines, M., Yayon, A., Lonai, P. and Givol, D.** (1999). A mouse model for achondroplasia produced by targeting fibroblast growth factor receptor 3. *Proc Natl Acad Sci U S A* **96**, 4455-60.
- Weaver, M., Dunn, N. R. and Hogan, B. L.** (2000). Bmp4 and Fgf10 play opposing roles during lung bud morphogenesis. *Development* **127**, 2695-704.
- Webster, M. K. and Donoghue, D. J.** (1996). Constitutive activation of fibroblast growth factor receptor 3 by the transmembrane domain point mutation found in achondroplasia. *Embo J* **15**, 520-7.

- Weinstein, M., Xu, X., Ohyama, K. and Deng, C. X.** (1998). FGFR-3 and FGFR-4 function cooperatively to direct alveogenesis in the murine lung. *Development* **125**, 3615-23.
- Weir, E. C., Philbrick, W. M., Amling, M., Neff, L. A., Baron, R. and Broadus, A. E.** (1996). Targeted overexpression of parathyroid hormone-related peptide in chondrocytes causes chondrodysplasia and delayed endochondral bone formation. *Proc Natl Acad Sci U S A* **93**, 10240-5.
- Wilkie, A. O.** (1997). Craniosynostosis: genes and mechanisms. *Hum Mol Genet* **6**, 1647-56.
- Wilson, S. I., Rydstrom, A., Trimborn, T., Willert, K., Nusse, R., Jessell, T. M. and Edlund, T.** (2001). The status of Wnt signalling regulates neural and epidermal fates in the chick embryo. *Nature* **411**, 325-30.
- Winnier, G., Blessing, M., Labosky, P. A. and Hogan, B. L.** (1995). Bone morphogenetic protein-4 is required for mesoderm formation and patterning in the mouse. *Genes Dev* **9**, 2105-16.
- Wozney, J. M., Rosen, V., Celeste, A. J., Mitsock, L. M., Whitters, M. J., Kriz, R. W., Hewick, R. M. and Wang, E. A.** (1988). Novel regulators of bone formation: molecular clones and activities. *Science* **242**, 1528-34.
- Wu, L. N., Ishikawa, Y., Genge, B. R., Sampath, T. K. and Wuthier, R. E.** (1997). Effect of osteogenic protein-1 on the development and mineralization of primary cultures of avian growth plate chondrocytes: modulation by retinoic acid. *J Cell Biochem* **67**, 498-513.
- Xu, J., Lawshe, A., MacArthur, C. A. and Ornitz, D. M.** (1999). Genomic structure, mapping, activity and expression of fibroblast growth factor 17. *Mech Dev* **83**, 165-78.
- Yamagiwa, H., Tokunaga, K., Hayami, T., Hatano, H., Uchida, M., Endo, N. and Takahashi, H. E.** (1999). Expression of metalloproteinase-13 (Collagenase-3) is induced during fracture healing in mice. *Bone* **25**, 197-203.
- Yamaguchi, T. P., Harpal, K., Henkemeyer, M. and Rossant, J.** (1994). fgfr-1 is required for embryonic growth and mesodermal patterning during mouse gastrulation. *Genes Dev* **8**, 3032-44.

- Yi, S. E., Daluiski, A., Pederson, R., Rosen, V. and Lyons, K. M.** (2000). The type I BMP receptor BMPRIB is required for chondrogenesis in the mouse limb. *Development* **127**, 621-30.
- Zhang, H. and Bradley, A.** (1996). Mice deficient for BMP2 are nonviable and have defects in amnion/chorion and cardiac development. *Development* **122**, 2977-86.
- Zimmerman, L. B., De Jesus-Escobar, J. M. and Harland, R. M.** (1996). The Spemann organizer signal noggin binds and inactivates bone morphogenetic protein 4. *Cell* **86**, 599-606.
- Zou, H., Wieser, R., Massague, J. and Niswander, L.** (1997). Distinct roles of type I bone morphogenetic protein receptors in the formation and differentiation of cartilage. *Genes Dev* **11**, 2191-203.
- Zuniga, A., Haramis, A. P., McMahon, A. P. and Zeller, R.** (1999). Signal relay by BMP antagonism controls the SHH/FGF4 feedback loop in vertebrate limb buds. *Nature* **401**, 598-602.