

8. Literaturverzeichnis

Abbott, C. & Povey, S. (1991) Development of human chromosome-specific PCR primers for characterization of somatic cell hybrids. *Genomics*, **9**, 73-77.

Adam, E.J. & Adam, S.A. (1994) Identification of cytosolic factors required for nuclear location sequence-mediated binding to the nuclear envelope. *J Cell Biol*, **125**, 547-555.

Akey, C.W. (1989) Interactions and structure of the nuclear pore complex revealed by cryo-electron microscopy. *J Cell Biol*, **109**, 955-970.

Akey, C.W. & Goldfarb, D.S. (1989) Protein import through the nuclear pore complex is a multistep process. *J Cell Biol*, **109**, 971-982.

Backer, J.M., Mendola, C.E., Kovesdi, I., Fairhurst, J.L., O'Hara, B., Eddy, R.L., Jr., Shows, T.B., Mathew, S., Murty, V.V. & Chaganti, R.S. (1993) Chromosomal localization and nucleoside diphosphate kinase activity of human metastasis-suppressor genes NM23-1 and NM23-2. *Oncogene*, **8**, 497-502.

Baker, S.J., Fearon, E.R., Nigro, J.M., Hamilton, S.R., Preisinger, A.C., Jessup, J.M., vanTuinen, P., Ledbetter, D.H., Barker, D.F. & Nakamura, Y. (1989) Chromosome 17 deletions and p53 gene mutations in colorectal carcinomas. *Science*, **244**, 217-221.

Barlund, M., Tirkkonen, M., Forozan, F., Tanner, M.M., Kallioniemi, O. & Kallioniemi, A. (1997) Increased copy number at 17q22-q24 by CGH in breast cancer is due to high-level amplification of two separate regions. *Genes Chromosomes Cancer*, **20**, 372-376.

Beroud, C. & Soussi, T. (1996) APC gene: database of germline and somatic mutations in human tumors and cell lines. *Nucleic Acids Res*, **24**, 121-124.

Bieche, I. & Lidereau, R. (1995) Genetic alterations in breast cancer. *Genes Chromosomes Cancer*, **14**, 227-251.

Bischoff, F.R. & Görlich, D. (1997) RanBP1 is crucial for the release of RanGTP from importin beta-related nuclear transport factors. *FEBS Lett*, **419**, 249-254.

Bischoff, F.R., Krebber, H., Smirnova, E., Dong, W. & Ponstingl, H. (1995) Co-activation of RanGTPase and inhibition of GTP dissociation by Ran- GTP binding protein RanBP1. *EMBO J*, **14**, 705-715.

Bischoff, F.R. & Ponstingl, H. (1991 a) Catalysis of guanine nucleotide exchange on Ran by the mitotic regulator RCC1. *Nature*, **354**, 80-82.

Bischoff, F.R. & Ponstingl, H. (1991 b) Mitotic regulator protein RCC1 is complexed with a nuclear ras-related polypeptide. *Proc Natl Acad Sci U S A*, **88**, 10830-10834.

Bodmer, W.F. (1994) Cancer genetics. *Br Med Bull*, **50**, 517-526.

Boland, C.R., Sato, J., Appelman, H.D., Bresalier, R.S. & Feinberg, A.P. (1995) Microallelotyping defines the sequence and tempo of allelic losses at tumour suppressor gene loci during colorectal cancer progression. *Nat Med*, **1**, 902-909.

Bos, J.L., Fearon, E.R., Hamilton, S.R., Verlaan-de Vries, M., van Boom, J.H., van der Eb, A.J. & Vogelstein, B. (1987) Prevalence of ras gene mutations in human colorectal cancers. *Nature*, **327**, 293-297.

Breukel, C., Tops, C., van Leeuwen, C., van der Klift, H., Nakamura, Y., Fodde, R. & Khan, P.M. (1991) CA repeat polymorphism at the D5S82 locus, proximal to adenomatous polyposis coli (APC). *Nucleic Acids Res*, **19**, 5804

Brinkmann, U., Brinkmann, E., Gallo, M. & Pastan, I. (1995) Cloning and characterization of a cellular apoptosis susceptibility gene, the human homologue to the yeast chromosome segregation gene CSE1. *Proc Natl Acad Sci U S A*, **92**, 10427-10431.

- Brinkmann, U., Brinkmann, E., Gallo, M., Scherf, U. & Pastan, I. (1996) Role of CAS, a human homologue to the yeast chromosome segregation gene CSE1, in toxin and tumor necrosis factor mediated apoptosis. *Biochemistry*, **35**, 6891-6899.
- Bronner, C.E., Baker, S.M., Morrison, P.T., Warren, G., Smith, L.G., Lescoe, M.K., Kane, M., Earabino, C., Lipford, J. & Lindblom, A. (1994) Mutation in the DNA mismatch repair gene homologue hMLH1 is associated with hereditary non-polyposis colon cancer. *Nature*, **368**, 258-261.
- Callen, D.F. (1986) A mouse-human hybrid cell panel for mapping human chromosome 16. *Ann Genet*, **29**, 235-239.
- Cawthon, R.M., Weiss, R., Xu, G.F., Viskochil, D., Culver, M., Stevens, J., Robertson, M., Dunn, D., Gesteland, R. & O'Connell, P. (1990) A major segment of the neurofibromatosis type 1 gene: cDNA sequence, genomic structure, and point mutations [published erratum appears in Cell 1990 Aug 10;62(3):following 608]. *Cell*, **62**, 193-201.
- Chandrasekharappa, S.C., Gross, L.A., King, S.E. & Collins, F.S. (1993) The human NME2 gene lies within 18kb of NME1 in chromosome 17. *Genes Chromosomes Cancer*, **6**, 245-248.
- Chang-Claude, J., Becher, H., Hamann, U. & Schroeder-Kurth, T. (1995) [Risk assessment for familial occurrence of breast cancer]. *Zentralbl Gynakol*, **117**, 423-434.
- Chi, N.C., Adam, E.J. & Adam, S.A. (1995) Sequence and characterization of cytoplasmic nuclear protein import factor p97. *J Cell Biol*, **130**, 265-274.
- Chi, N.C., Adam, E.J., Visser, G.D. & Adam, S.A. (1996) RanBP1 stabilizes the interaction of Ran with p97 nuclear protein import. *J Cell Biol*, **135**, 559-569.

Cortes, P., Ye, Z.S. & Baltimore, D. (1994) RAG-1 interacts with the repeated amino acid motif of the human homologue of the yeast protein SRP1. *Proc Natl Acad Sci U S A*, **91**, 7633-7637.

Couch, F.J., Farid, L.M., DeShano, M.L., Tavtigian, S.V., Calzone, K., Campeau, L., Peng, Y., Bogden, B., Chen, Q., Neuhausen, S., Shattuck-Eidens, D., Godwin, A.K., Daly, M., Radford, D.M., Sedlacek, S., Rommens, J., Simard, J., Garber, J., Merajver, S. & Weber, B.L. (1996) BRCA2 germline mutations in male breast cancer cases and breast cancer families. *Nat Genet*, **13**, 123-125.

Couch, F.J. & Weber, B.L. (1996) Mutations and polymorphisms in the familial early-onset breast cancer (BRCA1) gene. Breast Cancer Information Core. *Hum Mutat*, **8**, 8-18.

Coutavas, E., Ren, M., Oppenheim, J.D., D'Eustachio, P. & Rush, M.G. (1993) Characterization of proteins that interact with the cell-cycle regulatory protein Ran/TC4. *Nature*, **366**, 585-587.

Cuomo, C.A., Kirch, S.A., Gyuris, J., Brent, R. & Oettinger, M.A. (1994) Rch1, a protein that specifically interacts with the RAG-1 recombination-activating protein. *Proc Natl Acad Sci U S A*, **91**, 6156-6160.

Devilee, P. & Cornelisse, C.J. (1994) Somatic genetic changes in human breast cancer. *Biochim Biophys Acta*, **1198**, 113-130.

Dingwall, C. & Laskey, R.A. (1991) Nuclear targeting sequences--a consensus? [see comments]. *Trends Biochem Sci*, **16**, 478-481.

Dorman, B.P., Shimizu, N. & Ruddle, F.H. (1978) Genetic analysis of the human cell surface: antigenic marker for the human X chromosome in human-mouse hybrids. *Proc Natl Acad Sci U S A*, **75**, 2363-2367.

- Ellis, N.A., Roe, A.M., Kozloski, J., Proytcheva, M., Falk, C. & German, J. (1994) Linkage disequilibrium between the FES, D15S127, and BLM loci in Ashkenazi Jews with Bloom syndrome. *Am J Hum Genet*, **55**, 453-460.
- Enenkel, C., Blobel, G. & Rexach, M. (1995) Identification of a yeast karyopherin heterodimer that targets import substrate to mammalian nuclear pore complexes. *J Biol Chem*, **270**, 16499-16502.
- Engel, L.W. (1993) The Human Genome Project. History, goals, and progress to date. *Arch Pathol Lab Med*, **117**, 459-465.
- Fearon, E.R., Cho, K.R., Nigro, J.M., Kern, S.E., Simons, J.W., Ruppert, J.M., Hamilton, S.R., Preisinger, A.C., Thomas, G. & Kinzler, K.W. (1990) Identification of a chromosome 18q gene that is altered in colorectal cancers. *Science*, **247**, 49-56.
- Fearon, E.R. & Vogelstein, B. (1990) A genetic model for colorectal tumorigenesis. *Cell*, **61**, 759-767.
- Feunteun, J. & Lenoir, G.M. (1996) BRCA1, a gene involved in inherited predisposition to breast and ovarian cancer. *Biochim Biophys Acta*, **1242**, 177-180.
- Fishel, R. & Kolodner, R.D. (1995) Identification of mismatch repair genes and their role in the development of cancer. *Curr Opin Genet Dev*, **5**, 382-395.
- Fishel, R., Lescoe, M.K., Rao, M.R., Copeland, N.G., Jenkins, N.A., Garber, J., Kane, M. & Kolodner, R. (1993) The human mutator gene homolog MSH2 and its association with hereditary nonpolyposis colon cancer [published erratum appears in Cell 1994 Apr 8;77(1):167]. *Cell*, **75**, 1027-1038.
- Flejter, W.L., Watkins, M., Abel, K.J., Chandrasekharappa, S.C., Weber, B.L., Collins, F.S. & Glover, T.W. (1993) Isolation and characterization of somatic cell hybrids with breakpoints spanning 17q22-->q24. *Cytogenet Cell Genet*, **64**, 222-223.

Floer, M. & Blobel, G. (1996) The nuclear transport factor karyopherin beta binds stoichiometrically to Ran-GTP and inhibits the Ran GTPase activating protein. *J Biol Chem*, **271**, 5313-5316.

Görlich, D., Prehn, S., Laskey, R.A. & Hartmann, E. (1994) Isolation of a protein that is essential for the first step of nuclear protein import. *Cell*, **79**, 767-778.

Görlich, D. & Laskey, R.A. (1995) Roles of importin in nuclear protein import. *Cold Spring Harb Symp Quant Biol*, **60:695-9**, 695-699.

Görlich, D., Vogel, F., Mills, A.D., Hartmann, E. & Laskey, R.A. (1995 a) Distinct functions for the two importin subunits in nuclear protein import. *Nature*, **377**, 246-248.

Görlich, D., Kostka, S., Kraft, R., Dingwall, C., Laskey, R.A., Hartmann, E. & Prehn, S. (1995 b) Two different subunits of importin cooperate to recognize nuclear localization signals and bind them to the nuclear envelope. *Curr Biol*, **5**, 383-392.

Görlich, D. & Mattaj, I.W. (1996) Nucleocytoplasmic transport. *Science*, **271**, 1513-1518.

Görlich, D., Pante, N., Kutay, U., Aebi, U. & Bischoff, F.R. (1996) Identification of different roles for RanGDP and RanGTP in nuclear protein import. *EMBO J*, **15**, 5584-5594.

Görlich, D. (1997) Nuclear protein import. *Curr Opin Cell Biol*, **9**, 412-419.

Görlich, D., Dabrowski, M., Bischoff, F.R., Kutay, U., Bork, P., Hartmann, E., Prehn, S. & Izaurralde, E. (1997) A novel class of RanGTP binding proteins. *J Cell Biol*, **138**, 65-80.

Görlich, D. (1998) Transport into and out of the cell nucleus. *EMBO J*, **17**, 2721-2727.

Groden, J., Thliveris, A., Samowitz, W., Carlson, M., Gelbert, L., Albertsen, H., Joslyn, G., Stevens, J., Spirio, L. & Robertson, M. (1991) Identification and characterization of the familial adenomatous polyposis coli gene. *Cell*, **66**, 589-600.

Hahn, S.A., Schutte, M., Hoque, A.T., Moskaluk, C.A., da Costa, L.T., Rozenblum, E., Weinstein, C.L., Fischer, A., Yeo, C.J., Hruban, R.H. & Kern, S.E. (1996) DPC4, a candidate tumor suppressor gene at human chromosome 18q21.1. [see comments]. *Science*, **271**, 350-353.

Hall, J.M., Lee, M.K., Newman, B., Morrow, J.E., Anderson, L.A., Huey, B. & King, M.C. (1990) Linkage of early-onset familial breast cancer to chromosome 17q21. *Science*, **250**, 1684-1689.

Hicks, G.R., Smith, H.M., Lobreaux, S. & Raikhel, N.V. (1996) Nuclear import in permeabilized protoplasts from higher plants has unique features. *Plant Cell*, **8**, 1337-1352.

Ichii, S., Horii, A., Nakatsuru, S., Furuyama, J., Utsunomiya, J. & Nakamura, Y. (1992) Inactivation of both APC alleles in an early stage of colon adenomas in a patient with familial adenomatous polyposis (FAP). *Hum Mol Genet*, **1**, 387-390.

Imamoto, N., Shimamoto, T., Takao, T., Tachibana, T., Kose, S., Matsubae, M., Sekimoto, T., Shimonishi, Y. & Yoneda, Y. (1995) In vivo evidence for involvement of a 58 kDa component of nuclear pore- targeting complex in nuclear protein import. *EMBO J*, **14**, 3617-3626.

Ioannou, P.A., Amemiya, C.T., Garnes, J., Kroisel, P.M., Shizuya, H., Chen, C., Batzer, M.A. & de Jong, P.J. (1994) A new bacteriophage P1-derived vector for the propagation of large human DNA fragments. *Nat Genet*, **6**, 84-89.

Ioannou, P.A. & deJong, P.J. (1996) Construction of bacterial artificial chromosome libraries using the modified P1 (PAC) system. *Curr Prot in Human Genetics*, (Abstract)

Ionov, Y., Peinado, M.A., Malkhosyan, S., Shibata, D. & Perucho, M. (1993) Ubiquitous somatic mutations in simple repeated sequences reveal a new mechanism for colonic carcinogenesis. *Nature*, **363**, 558-561.

Joslyn, G., Carlson, M., Thliveris, A., Albertsen, H., Gelbert, L., Samowitz, W., Groden, J., Stevens, J., Spirio, L. & Robertson, M. (1991) Identification of deletion mutations and three new genes at the familial polyposis locus. *Cell*, **66**, 601-613.

Karp, J.E. & Broder, S. (1995) Molecular foundations of cancer: new targets for intervention. *Nat Med*, **1**, 309-320.

Kinzler, K.W., Nilbert, M.C., Su, L.K., Vogelstein, B., Bryan, T.M., Levy, D.B., Smith, K.J., Preisinger, A.C., Hedge, P. & McKechnie, D. (1991 a) Identification of FAP locus genes from chromosome 5q21. *Science*, **253**, 661-665.

Kinzler, K.W., Nilbert, M.C., Vogelstein, B., Bryan, T.M., Levy, D.B., Smith, K.J., Preisinger, A.C., Hamilton, S.R., Hedge, P. & Markham, A. (1991 b) Identification of a gene located at chromosome 5q21 that is mutated in colorectal cancers [see comments]. *Science*, **251**, 1366-1370.

Knudson, A.G., Jr. (1987) Prince Takamatsu memorial lecture. Rare cancers: clues to genetic mechanisms. *Princess Takamatsu Symp*, **18:221-31**, 221-231.

Koepf, D.M., Wong, D.H., Corbett, A.H. & Silver, P.A. (1996) Dynamic localization of the nuclear import receptor and its interactions with transport factors. *J Cell Biol*, **133**, 1163-1176.

Köhler, M., Ansieau, S., Prehn, S., Leutz, A., Haller, H. & Hartmann, E. (1997) Cloning of two novel human importin-alpha subunits and analysis of the expression pattern of the importin-alpha protein family. *FEBS Lett*, **417**, 104-108.

Kunkel, T.A. (1993) Nucleotide repeats. Slippery DNA and diseases [news; comment]. *Nature*, **365**, 207-208.

Küssel, P. & Frasch, M. (1995 a) Yeast Srp1, a nuclear protein related to Drosophila and mouse pendulin, is required for normal migration, division, and integrity of nuclei during mitosis. *Mol Gen Genet*, **248**, 351-363.

Küssel, P. & Frasch, M. (1995 b) Pendulin, a Drosophila protein with cell cycle-dependent nuclear localization, is required for normal cell proliferation. *J Cell Biol*, **129**, 1491-1507.

Kutay, U., Bischoff, F.R., Kostka, S., Kraft, R. & Gorlich, D. (1997 a) Export of importin alpha from the nucleus is mediated by a specific nuclear transport factor [see comments]. *Cell*, **90**, 1061-1071.

Kutay, U., Izaurrealde, E., Bischoff, F.R., Mattaj, I.W. & Gorlich, D. (1997 b) Dominant-negative mutants of importin-beta block multiple pathways of import and export through the nuclear pore complex. *EMBO J*, **16**, 1153-1163.

Leach, F.S., Nicolaides, N.C., Papadopoulos, N., Liu, B., Jen, J., Parsons, R., Peltomaki, P., Sistonen, P., Aaltonen, L.A. & Nystrom-Lahti, M. (1993) Mutations of a mutS homolog in hereditary nonpolyposis colorectal cancer. *Cell*, **75**, 1215-1225.

Leggett, J.M., Thomas, H.M., Meredith, M.R., Humphreys, M.W., Morgan, W.G., Thomas, H. & King, I.P. (1994) Intergenomic translocations and the genomic composition of *Avena maroccana* Gdgr. revealed by FISH. *Chromosome Res*, **2**, 163-164.

Leppert, M., Dobbs, M., Scambler, P., O'Connell, P., Nakamura, Y., Stauffer, D., Woodward, S., Burt, R., Hughes, J. & Gardner, E. (1987) The gene for familial polyposis coli maps to the long arm of chromosome 5. *Science*, **238**, 1411-1413.

Levine, A.J. (1995) The genetic origins of neoplasia [editorial]. *JAMA*, **273**, 592

Lounsbury, K.M. & Macara, I.G. (1997) Ran-binding protein 1 (RanBP1) forms a ternary complex with Ran and karyopherin beta and reduces Ran GTPase-activating protein (RanGAP) inhibition by karyopherin beta. *J Biol Chem*, **272**, 551-555.

Lynch, H.T., Smyrk, T.C., Watson, P., Lanspa, S.J., Lynch, J.F., Lynch, P.M., Cavalieri, R.J. & Boland, C.R. (1993) Genetics, natural history, tumor spectrum, and pathology of hereditary nonpolyposis colorectal cancer: an updated review. *Gastroenterology*, **104**, 1535-1549.

MacPhee, D.G. (1995) Mismatch repair, somatic mutations, and the origins of cancer. *Cancer Res*, **55**, 5489-5492.

Makkerh, J.P.S., Dingwall, C. & Laskey, R.A. (1996) Comparative mutagenesis of nuclear localization signals reveals the importance of neutral and acidic amino acids. *Curr Biol*, **6**, 1025-1027.

Markowitz, S., Wang, J., Myeroff, L., Parsons, R., Sun, L., Lutterbaugh, J., Fan, R.S., Zborowska, E., Kinzler, K.W. & Vogelstein, B. (1995) Inactivation of the type II TGF-beta receptor in colon cancer cells with microsatellite instability [see comments]. *Science*, **268**, 1336-1338.

Maxam, A.M. & Gilbert, W. (1977) A new method for sequencing DNA. *Proc Natl Acad Sci U S A*, **74**, 560-564.

Melchior, F., Paschal, B., Evans, J. & Gerace, L. (1993) Inhibition of nuclear protein import by nonhydrolyzable analogues of GTP and identification of the small GTPase Ran/TC4 as an essential transport factor [published erratum appears in J Cell Biol 1994 Jan;124(1-2):217]. *J Cell Biol*, **123**, 1649-1659.

Miki, Y., Swensen, J., Shattuck-Eidens, D., Futreal, P.A., Harshman, K., Tavtigian, S., Liu, Q., Cochran, C., Bennett, L.M. & Ding, W. (1994) A strong candidate for the breast and ovarian cancer susceptibility gene BRCA1. *Science*, **266**, 66-71.

- Modrich, P. (1991) Mechanisms and biological effects of mismatch repair. *Annu Rev Genet*, **25:229-53**, 229-253.
- Modrich, P. (1994) Mismatch repair, genetic stability, and cancer. *Science*, **266**, 1959-1960.
- Mohandas, T., Heinzmann, C., Sparkes, R.S., Wasmuth, J., Edwards, P. & Lusis, A.J. (1986) Assignment of human 3-hydroxy-3-methylglutaryl coenzyme A reductase gene to q13-q23 region of chromosome 5. *Somat Cell Mol Genet*, **12**, 89-94.
- Moore, M.S. & Blobel, G. (1993) The GTP-binding protein Ran/TC4 is required for protein import into the nucleus. *Nature*, **365**, 661-663.
- Moore, M.S. & Blobel, G. (1994) Purification of a Ran-interacting protein that is required for protein import into the nucleus. *Proc Natl Acad Sci U S A*, **91**, 10212-10216.
- Moroianu, J. (1997) Molecular mechanisms of nuclear protein transport. *Crit Rev Eukaryot Gene Expr*, **7**, 61-72.
- Moroianu, J., Blobel, G. & Radu, A. (1996) The binding site of karyopherin alpha for karyopherin beta overlaps with a nuclear localization sequence. *Proc Natl Acad Sci U S A*, **93**, 6572-6576.
- Moroianu, J., Hijikata, M., Blobel, G. & Radu, A. (1995) Mammalian karyopherin alpha 1 beta and alpha 2 beta heterodimers: alpha 1 or alpha 2 subunit binds nuclear localization signal and beta subunit interacts with peptide repeat-containing nucleoporins. *Proc Natl Acad Sci U S A*, **92**, 6532-6536.
- Mullis, K., Faloona, F., Scharf, S., Saiki, R., Horn, G. & Erlich, H. (1986) Specific enzymatic amplification of DNA in vitro: the polymerase chain reaction. *Cold Spring Harb Symp Quant Biol*, **51 Pt 1:263-73**, 263-273.

Mullis, K.B. (1990) The unusual origin of the polymerase chain reaction. *Sci Am*, **262**, 56-61, 64-5.

Mullis, K.B. & Faloona, F.A. (1987) Specific synthesis of DNA in vitro via a polymerase-catalyzed chain reaction. *Methods Enzymol*, **155:335-50**, 335-350.

Nachury, M.V., Ryder, U.W., Lamond, A.I. & Weis, K. (1998) Cloning and characterization of hSRP1gamma, a tissue-specific nuclear transport factor. *Proc Natl Acad Sci U S A*, **95**, 582-587.

Nadler, S.G., Tritschler, D., Haffar, O.K., Blake, J., Bruce, A.G. & Cleaveland, J.S. (1997) Differential expression and sequence-specific interaction of karyopherin alpha with nuclear localization sequences. *J Biol Chem*, **272**, 4310-4315.

Neuhausen, S., Gilewski, T., Norton, L., Tran, T., McGuire, P., Swensen, J., Hampel, H., Borgen, P., Brown, K., Skolnick, M., Shattuck-Eidens, D., Jhanwar, S., Goldgar, D. & Offit, K. (1996 a) Recurrent BRCA2 6174delT mutations in Ashkenazi Jewish women affected by breast cancer. *Nat Genet*, **13**, 126-128.

Neuhausen, S.L., Mazoyer, S., Friedman, L., Stratton, M., Offit, K., Caligo, A., Tomlinson, G., Cannon-Albright, L., Bishop, T., Kelsell, D., Solomon, E., Weber, B., Couch, F., Struewing, J., Tonin, P., Durocher, F., Narod, S., Skolnick, M.H., Lenoir, G., Serova, O., Ponder, B., Stoppa-Lyonnet, D., Easton, D., King, M.C. & Goldgar, D.E. (1996 b) Haplotype and phenotype analysis of six recurrent BRCA1 mutations in 61 families: results of an international study. *Am J Hum Genet*, **58**, 271-280.

Newman, B., Austin, M.A., Lee, M. & King, M.C. (1988) Inheritance of human breast cancer: evidence for autosomal dominant transmission in high-risk families. *Proc Natl Acad Sci U S A*, **85**, 3044-3048.

Newmeyer, D.D. & Forbes, D.J. (1988) Nuclear import can be separated into distinct steps in vitro: nuclear pore binding and translocation. *Cell*, **52**, 641-653.

Nicolaides, N.C., Papadopoulos, N., Liu, B., Wei, Y.F., Carter, K.C., Ruben, S.M., Rosen, C.A., Haseltine, W.A., Fleischmann, R.D. & Fraser, C.M. (1994) Mutations of two PMS homologues in hereditary nonpolyposis colon cancer. *Nature*, **371**, 75-80.

Nishisho, I., Nakamura, Y., Miyoshi, Y., Miki, Y., Ando, H., Horii, A., Koyama, K., Utsunomiya, J., Baba, S. & Hedge, P. (1991) Mutations of chromosome 5q21 genes in FAP and colorectal cancer patients. *Science*, **253**, 665-669.

O'Neil, R.E. & Palese, P. (1995) NPI-1, the human homolog of SRP-1, interacts with influenza virus nucleoprotein. *Virology*, **206**, 116-125.

Ohtsubo, M., Okazaki, H. & Nishimoto, T. (1989) The RCC1 protein, a regulator for the onset of chromosome condensation locates in the nucleus and binds to DNA. *J Cell Biol*, **109**, 1389-1397.

Olson, M.V. (1993) The human genome project. *Proc Natl Acad Sci U S A*, **90**, 4338-4344.

Paine, P.L., Moore, L.C. & Horowitz, S.B. (1975) Nuclear envelope permeability. *Nature*, **254**, 109-114.

Palombo, F., Gallinari, P., Iaccarino, I., Lettieri, T., Hughes, M., D'Arrigo, A., Truong, O., Hsuan, J.J. & Jiricny, J. (1995) GTBP, a 160-kilodalton protein essential for mismatch-binding activity in human cells [see comments]. *Science*, **268**, 1912-1914.

Papadopoulos, N., Nicolaides, N.C., Wei, Y.F., Ruben, S.M., Carter, K.C., Rosen, C.A., Haseltine, W.A., Fleischmann, R.D., Fraser, C.M. & Adams, M.D. (1994) Mutation of a mutL homolog in hereditary colon cancer [see comments]. *Science*, **263**, 1625-1629.

Paschal, B.M., Delphin, C. & Gerace, L. (1996) Nucleotide-specific interaction of Ran/TC4 with nuclear transport factors NTF2 and p97. *Proc Natl Acad Sci U S A*, **93**, 7679-7683.

Paschal, B.M. & Gerace, L. (1995) Identification of NTF2, a cytosolic factor for nuclear import that interacts with nuclear pore complex protein p62. *J Cell Biol*, **129**, 925-937.

Pfeifer, M., Berg, S. & Reynolds, A.B. (1994) A repeating amino acid motif shared by proteins with diverse cellular roles [letter]. *Cell*, **76**, 789-791.

Passarge, E. (1994) Taschenatlas der Genetik, Thieme Verlag, Stuttgart.

Peinado, M.A., Malkhosyan, S., Velazquez, A. & Perucho, M. (1992) Isolation and characterization of allelic losses and gains in colorectal tumors by arbitrarily primed polymerase chain reaction. *Proc Natl Acad Sci U S A*, **89**, 10065-10069.

Phelan, C.M., Lancaster, J.M., Tonin, P., Gumbs, C., Cochran, C., Carter, R., Ghadirian, P., Perret, C., Moslehi, R., Dion, F., Faucher, M.C., Dole, K., Karimi, S., Foulkes, W., Lounis, H., Warner, E., Goss, P., Anderson, D., Larsson, C., Narod, S.A. & Furtreal, P.A. (1996) Mutation analysis of the BRCA2 gene in 49 site-specific breast cancer families [see comments] [published erratum appears in Nat Genet 1996 Jul;13(3):374]. *Nat Genet*, **13**, 120-122.

Plummer, S.J., Paris, M.J., Myles, J., Tubbs, R., Crowe, J. & Casey, G. (1997) Four regions of allelic imbalance on 17q12-qter associated with high-grade breast tumors. *Genes Chromosomes Cancer*, **20**, 354-362.

Powell, S.M., Zilz, N., Beazer-Barclay, Y., Bryan, T.M., Hamilton, S.R., Thibodeau, S.N., Vogelstein, B. & Kinzler, K.W. (1992) APC mutations occur early during colorectal tumorigenesis. *Nature*, **359**, 235-237.

Praml, C., Finke, L.H., Herfarth, C., Schlag, P., Schwab, M. & Ammer, L. (1995) Deletion mapping defines different regions in 1p34.2-pter that may harbor genetic information related to human colorectal cancer. *Oncogene*, **11**, 1357-1362.

- Radu, A., Blobel, G. & Moore, M.S. (1995) Identification of a protein complex that is required for nuclear protein import and mediates docking of import substrate to distinct nucleoporins. *Proc Natl Acad Sci U S A*, **92**, 1769-1773.
- Radu, A., Moore, M.S. & Blobel, G. (1995) The peptide repeat domain of nucleoporin Nup98 functions as a docking site in transport across the nuclear pore complex. *Cell*, **81**, 215-222.
- Rampino, N., Yamamoto, H., Ionov, Y., Li, Y., Sawai, H., Reed, J.C. & Perucho, M. (1997) Somatic frameshift mutations in the BAX gene in colon cancers of the microsatellite mutator phenotype. *Science*, **275**, 967-969.
- Reichelt, R., Holzenburg, A., Buhle, E.L., Jr., Jarnik, M., Engel, A. & Aeby, U. (1990) Correlation between structure and mass distribution of the nuclear pore complex and of distinct pore complex components. *J Cell Biol*, **110**, 883-894.
- Rexach, M. & Blobel, G. (1995) Protein import into nuclei: association and dissociation reactions involving transport substrate, transport factors, and nucleoporins. *Cell*, **83**, 683-692.
- Richards, S.A., Lounsbury, K.M. & Macara, I.G. (1995) The C terminus of the nuclear RAN/TC4 GTPase stabilizes the GDP-bound state and mediates interactions with RCC1, RAN-GAP, and HTF9A/RANBP1. *J Biol Chem*, **270**, 14405-14411.
- Richardson, R.T. & DeLong, M.R. (1991) Electrophysiological studies of the functions of the nucleus basalis in primates. *Adv Exp Med Biol*, **295:233-52**, 233-252.
- Riggleman, B., Wieschaus, E. & Schedl, P. (1989) Molecular analysis of the armadillo locus: uniformly distributed transcripts and a protein with novel internal repeats are associated with a Drosophila segment polarity gene. *Genes Dev*, **3**, 96-113.

Saiki, R.K., Scharf, S., Faloona, F., Mullis, K.B., Horn, G.T., Erlich, H.A. & Arnheim, N. (1985) Enzymatic amplification of beta-globin genomic sequences and restriction site analysis for diagnosis of sickle cell anemia. *Science*, **230**, 1350-1354.

Saiki, R.K., Gelfand, D.H., Stoffel, S., Scharf, S.J., Higuchi, R., Horn, G.T., Mullis, K.B. & Erlich, H.A. (1988) Primer-directed enzymatic amplification of DNA with a thermostable DNA polymerase. *Science*, **239**, 487-491.

Sanger, F., Nicklen, S. & Coulson, A.R. (1977) DNA sequencing with chain-terminating inhibitors. *Proc Natl Acad Sci U S A*, **74**, 5463-5467.

Scherneck, S. & Kölble, K. (1998) Mechanismen der Entstehung genetisch bedingter Krebsformen; in: Ganzen, D., Ruckpaul, K., Handbuch der Molekularen Medizin, Band 2: Tumorerkrankungen, Springer-Verlag, Berlin, Heidelberg, S. 3-26.

Schlessinger, D. (1990) Yeast artificial chromosomes: tools for mapping and analysis of complex genomes. *Trends Genet*, **6**, 248, 255-8.

Seki, T., Tada, S., Katada, T. & Enomoto, T. (1997) Cloning of a cDNA encoding a novel importin-alpha homologue, Qip1: discrimination of Qip1 and Rch1 from hSrp1 by their ability to interact with DNA helicase Q1/RecQL. *Biochem Biophys Res Commun*, **234**, 48-53.

Shizuya, H., Birren, B., Kim, U.J., Mancino, V., Slepak, T., Tachiiri, Y. & Simon, M. (1992) Cloning and stable maintenance of 300-kilobase-pair fragments of human DNA in Escherichia coli using an F-factor-based vector. *Proc Natl Acad Sci U S A*, **89**, 8794-8797.

Singer, M.F. (1982) SINES and LINEs: highly repeated short and long interspersed sequences in mammalian genomes. *Cell*, **28**, 433-434.

Sternberg, N.L. (1992) Cloning high molecular weight DNA fragments by the bacteriophage P1 system. *Trends Genet*, **8**, 11-16.

Strachan, T. & Read, A. P. (1996), Molekulare Humangenetik, Spektrum Akademischer Verlag GmbH, Heidelberg, Berlin, Oxford.

Suggs, S.V., Wallace, R.B., Hirose, T., Kawashima, E.H. & Itakura, K. (1981) Use of synthetic oligonucleotides as hybridization probes: isolation of cloned cDNA sequences for human beta 2-microglobulin. *Proc Natl Acad Sci U S A*, **78**, 6613-6617.

Szabo, C.I. & King, M.C. (1995) Inherited breast and ovarian cancer. *Hum Mol Genet*, **4 Spec No:1811-7**, 1811-1817.

Taggart, R.T., Mohandas, T.K., Shows, T.B. & Bell, G.I. (1985) Variable numbers of pepsinogen genes are located in the centromeric region of human chromosome 11 and determine the high-frequency electrophoretic polymorphism. *Proc Natl Acad Sci U S A*, **82**, 6240-6244.

Tavtigian, S.V., Simard, J., Rommens, J., Couch, F., Shattuck-Eidens, D., Neuhausen, S., Merajver, S., Thorlacius, S., Offit, K., Stoppa-Lyonnet, D., Belanger, C., Bell, R., Berry, S., Bogden, R., Chen, Q., Davis, T., Dumont, M., Frye, C., Hattier, T., Jammulapati, S., Janecki, T., Jiang, P., Kehrer, R., Leblanc, J.F. & Goldgar, D.E. (1996) The complete BRCA2 gene and mutations in chromosome 13q-linked kindreds [see comments]. *Nat Genet*, **12**, 333-337.

Thiagalingam, S., Lengauer, C., Leach, F.S., Schutte, M., Hahn, S.A., Overhauser, J., Willson, J.K., Markowitz, S., Hamilton, S.R., Kern, S.E., Kinzler, K.W. & Vogelstein, B. (1996) Evaluation of candidate tumour suppressor genes on chromosome 18 in colorectal cancers. *Nat Genet*, **13**, 343-346.

Thibodeau, S.N., Bren, G. & Schaid, D. (1993) Microsatellite instability in cancer of the proximal colon [see comments]. *Science*, **260**, 816-819.

Thorlacius, S., Olafsdottir, G., Tryggvadottir, L., Neuhausen, S., Jonasson, J.G., Tavtigian, S.V., Tulinius, H., Ogmundsdottir, H.M. & Eyfjord, J.E. (1996) A single BRCA2 mutation in male and female breast cancer families from Iceland with varied cancer phenotypes [see comments]. *Nat Genet*, **13**, 117-119.

Török, I., Strand, D., Schmitt, R., Tick, G., Torok, T., Kiss, I. & Mechler, B.M. (1995) The overgrown hematopoietic organs-31 tumor suppressor gene of *Drosophila* encodes an Importin-like protein accumulating in the nucleus at the onset of mitosis. *J Cell Biol*, **129**, 1473-1489.

Tsuji, L., Takumi, T., Imamoto, N. & Yoneda, Y. (1997) Identification of novel homologues of mouse importin alpha, the alpha subunit of the nuclear pore-targeting complex, and their tissue-specific expression. *FEBS Lett*, **416**, 30-34.

Varesco, L., Caligo, M.A., Simi, P., Black, D.M., Nardini, V., Casarino, L., Rocchi, M., Ferrara, G., Solomon, E. & Bevilacqua, G. (1992) The NM23 gene maps to human chromosome band 17q22 and shows a restriction fragment length polymorphism with BglII. *Genes Chromosomes Cancer*, **4**, 84-88.

Vogelstein, B., Fearon, E.R., Hamilton, S.R., Kern, S.E., Preisinger, A.C., Leppert, M., Nakamura, Y., White, R., Smits, A.M. & Bos, J.L. (1988) Genetic alterations during colorectal-tumor development. *N Engl J Med*, **319**, 525-532.

Vogelstein, B., Fearon, E.R., Kern, S.E., Hamilton, S.R., Preisinger, A.C., Nakamura, Y. & White, R. (1989) Allelotype of colorectal carcinomas. *Science*, **244**, 207-211.

Vogelstein, B. & Kinzler, K.W. (1993) The multistep nature of cancer. *Trends Genet*, **9**, 138-141.

Wagner, T., Tommerup, N., Wirth, J., Leffers, H., Zimmer, J., Back, E., Weissenbach, J. & Scherer, G. (1997) A somatic cell hybrid panel for distal 17q: GDIA1 maps to 17q25.3. *Cytogenet Cell Genet*, **76**, 172-175.

- Wang, P., Palese, P. & O'Neill, R.E. (1997) The NPI-1/NPI-3 (karyopherin alpha) binding site on the influenza a virus nucleoprotein NP is a nonconventional nuclear localization signal. *J Virol*, **71**, 1850-1856.
- Warburton, D., Gersen, S., Yu, M.T., Jackson, C., Handelin, B. & Housman, D. (1990) Monochromosomal rodent-human hybrids from microcell fusion of human lymphoblastoid cells containing an inserted dominant selectable marker. *Genomics*, **6**, 358-366.
- Weis, K., Mattaj, I.W. & Lamond, A.I. (1995) Identification of hSRP1 alpha as a functional receptor for nuclear localization sequences. *Science*, **268**, 1049-1053.
- Weis, K., Ryder, U. & Lamond, A.I. (1996) The conserved amino-terminal domain of hSRP1 alpha is essential for nuclear protein import. *EMBO J*, **15**, 1818-1825.
- Wilson, R.K., Chen, C., Avdalovic, N., Burns, J. & Hood, L. (1990) Development of an automated procedure for fluorescent DNA sequencing. *Genomics*, **6**, 626-634.
- Wooster, R., Bignell, G., Lancaster, J., Swift, S., Seal, S., Mangion, J., Collins, N., Gregory, S., Gumbs, C. & Micklem, G. (1995) Identification of the breast cancer susceptibility gene BRCA2 [see comments] [published erratum appears in Nature 1996 Feb 22; 379(6567):749]. *Nature*, **378**, 789-792.
- Wooster, R., Cleton-Jansen, A.M., Collins, N., Mangion, J., Cornelis, R.S., Cooper, C.S., Gusterson, B.A., Ponder, B.A., von Deimling, A. & Wiestler, O.D. (1994) Instability of short tandem repeats (microsatellites) in human cancers. *Nat Genet*, **6**, 152-156.
- Wooster, R., Neuhausen, S.L., Mangion, J., Quirk, Y., Ford, D., Collins, N., Nguyen, K., Seal, S., Tran, T. & Averill, D. (1994) Localization of a breast cancer susceptibility gene, BRCA2, to chromosome 13q12-13. *Science*, **265**, 2088-2090.

Xu, G.F., Lin, B., Tanaka, K., Dunn, D., Wood, D., Gesteland, R., White, R., Weiss, R. & Tamanoi, F. (1990) The catalytic domain of the neurofibromatosis type 1 gene product stimulates ras GTPase and complements ira mutants of *S. cerevisiae*. *Cell*, **63**, 835-841.

Xu, G.F., O'Connell, P., Viskochil, D., Cawthon, R., Robertson, M., Culver, M., Dunn, D., Stevens, J., Gesteland, R. & White, R. (1990) The neurofibromatosis type 1 gene encodes a protein related to GAP. *Cell*, **62**, 599-608.

Yano, R., Oakes, M., Yamaghishi, M., Dodd, J.A. & Nomura, M. (1992) Cloning and characterization of SRP1, a suppressor of temperature- sensitive RNA polymerase I mutations, in *Saccharomyces cerevisiae*. *Mol Cell Biol*, **12**, 5640-5651.

Yano, R., Oakes, M.L., Tabb, M.M. & Nomura, M. (1994) Yeast Srp1p has homology to armadillo/plakoglobin/beta-catenin and participates in apparently multiple nuclear functions including the maintenance of the nucleolar structure. *Proc Natl Acad Sci U S A*, **91**, 6880-6884.