

## 6 LITERATURVERZEICHNIS

- Abe,H., Takio,K., Titani,K., and Furuya,M. (1989). Amino-terminal amino acid sequences of pea phytochrome II fragments obtained by limited proteolysis. *Plant Cell Physiol.* *30*, 1089-1097.
- Adams,M.D., Celniker,S.E., Evans,C.A., Gocayne,J.D., and *et al.* (2000). The genome sequence of *Drosophila melanogaster*. *Science* *287*, 2185-2195.
- Ahlquist,P. (2002). RNA-Dependent RNA Polymerases, Viruses, and RNA Silencing. *Science* *296*, 1270-1273.
- Ahmad,M., Jarillo,J.A., Smirnova,O., and Cashmore,A.R. (1998). The CRY1 blue light photoreceptor of *Arabidopsis* interacts with phytochrome A in vitro. *Mol. Cell* *1*, 939-948.
- Albrecht,A.v. and Deng,X.-W. (1996). Light control of seedling development. *Annu. Rev. Plant Physiol. Plant Mol. Biol.* *47*, 215-243.
- Ansorge,W. and Pepperkok,R. (1988). Performance of an automated system for capillary microinjection into living cells. *J. Bioch. Bioph. Meth.* 283-292.
- Ashton,N.W., Champagne,C.E.M., Weiler,T., and Verkoczy,L.K. (2000). The bryophyte *Physcomitrella patens* replicates extrachromosomal transgenic elements. *New Phytol.* *146*, 391-402.
- Ashton,N.W. and Cove,D.J. (1977). The isolation and preliminary characterization of auxotrophe and analogue resistant mutants of the moss *Physcomitrella patens*. *Mol. Gen. Genet.* *154*, 87-95.
- Ausubel,F.M., Brent,R., Kingston,R.E., Moore,D.D., Seidman,J.G., and Struhl,K. (1988). *Current Protocols in Molecular Biology*. Jon Wiley & Sons, Inc.).
- Baldino,F., Chesselet,M.-F., and Lewis,M.E. (1989). High resolution in situ hybridization histochemistry. *Methods Enzymol.* *168*, 761-777.
- Batschauer,A., Gilmartin,P.M., Nagy,F., and Schäfer,E. (1994). The molecular biology of photoregulated genes. In *Photomorphogenesis in plants - 2nd Edition*, R.E.Kendrick and G.H.M.Kronenberg, eds. (Dortrecht: Kluwer Academiv Publishers, Netherlands), pp. 559-600.
- Baudin,A., Ozier-Kalogeropoulos,O. , Lacroute,F., and Cullin,C. (1993). A simple and efficient method for direct gene deletion in *Saccharomyces cerevisiae*. *Nucleic Acids Res.* *21*, 3329-3330.
- Beale,S.I. (1993). Biosynthesis of phycobilins. *Chem. Rev.* *93*, 785-802.
- Beetham,P.R., Kipp,P.B., Sawycky,X.L., Arntzen,C.J., and May,G.D. (1999). A tool for functional plant genomics: chimeric RNA/DNA oligonucleotides cause *in vivo* genespecific mutations. *Proc. Natl. Acad. Sci. USA* *96*, 8774-8778.
- Blattner,F.R., Plunkett,G.I., Bloch,C.A., Perna,N.T., Burland,V., and *et al.* (1997). The complete genome sequence of *Escherichia coli* K-12. *Science* *277*, 1453-1474.
- Boehringer Mannheim (1995). *The DIG System User's Guide for Filter Hybridization*.
- Borthwick,H.A., Hendricks,S.B., and Parker M W (1952a). The reaction controlling floral initiation. *Proc. Natl. Acad. Sci. USA* *38*, 929-934.
- Borthwick,H.A., Hendricks,S.B., Parker,M.W., Toole,E.H., and Toole,V.K. (1952b). A reversible photo-reaction controlling seed germination. *Proc. Natl. Acad. Sci. USA* *38*, 662-666.
- Bossen,M.E., Kendrick,R.E., and Vredenberg,W.J. (1990). The involvement of a G-protein in phytochrome-regulated Ca<sup>+</sup> dependent swelling of etiolated wheat protoplasts. *Physiol. Plant.* *80*, 55-62.
- Botto,J.F., Sanchez,R.A., and Casal,J.J. (1995). Role of phytochrome B in the induction of seed germination by light in *Arabidopsis thaliana*. *J. Plant Physiol.* *146*, 307-312.

- Bouché, N. and Bouchez, D. (2001). *Arabidopsis* gene knockout: phenotypes wanted. *Curr. Opin. Plant Biol.* 4, 111-117.
- Bowler, C., Neuhaus, G., Yamagata, H., and Chua, N.-H. (1994). Cyclic GMP and calcium mediate phytochrome phototransduction [published erratum appears in *Cell* 1994 Nov 18;79(4):743]. *Cell* 77, 73-81.
- Böse, G., Schwille, P., and Lamparter, T. (2003). The mobility of phytochrome within protonemal tip cells of the moss *Ceratodon purpureus*, monitored by fluorescence correlation spectroscopy. submitted.
- 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, 248-254.
- Briggs, W.R., Beck, C.F., Cashmore, A.R., Christie, J.M., Hughes, J., Jarillo, J.A., Kagawa, T., Kanegae, T., Liscum, E., Nagatani, A., and et al (2001). The phototropin family of photoreceptors. *Plant Cell* 13, 993-997.
- Briggs, W.R. and Olney, M.A. (2001). Photoreceptors in Plant Photomorphogenesis to Date. Five Phytochromes, Two Cryptochromes, One Phototropin, and One Superchrome<sup>1</sup>. *Plant Physiol.* 125, 85-88.
- Brockmann, J. and Schäfer, E. (1982). Analysis of Pfr destruction in *Amaranthus caudatus* L Evidence for two pools of phytochrome. *Photochem. Photobiol.* 35, 555-558.
- Brücker, G. (1997). Untersuchungen zum Phototropismus des Mooses *Ceratodon purpureus* Brid. mit Methoden der somatischen Hybridisierung und Mikroinjektion. Diplomarbeit am Fachbereich Biologie der Freien Universität Berlin.
- Brücker, G., Zeidler, M., Kohchi, T., Hartmann, E., and Lamparter, T. (2000). Microinjection of heme oxygenase genes rescues phytochrome-chromophore-deficient mutants of the moss *Ceratodon purpureus*. *Planta* 210, 529-535.
- Butler, W.L., Norris, K.H., Siegelman, H.W., and Hendricks, S.B. (1959). Detection, assay, and preliminary purification of the pigment controlling photoresponsive development of plants. *Proc. Natl. Acad. Sci. USA* 45, 1703-1708.
- Bünning, E. and Etzold, H. (1958). Über die Wirkung von polarisiertem Licht auf keimende Sporen von Pilzen, Moosen und Farnen. *Ber. Dt. Bot. Ges.* 71, 304-306.
- Caenorhabditis elegans sequencing consortium (1998). Genome sequence of the nematode *C. elegans*: a platform for investigating biology. *Science* 282, 2012-2019.
- Cashmore, A.R., Jarillo, J.A., Wu, Y.J., and Liu, D. (1999). Cryptochromes: blue light receptors for plants and animals. *Science* 284, 760-765.
- Chirgwin, J.M., Przybyla, A.E., MacDonald, R.J., and Rutter, W.J. (1979). Isolation of biologically active ribonucleic acid from sources enriched in ribonuclease. *Biochemistry* 18, 5294-5299.
- Choi, G., Yi, H., Lee, J., Kwon, Y.K., Soh, M.S., Shin, B., Luka, Z., Hahn, T.R., and Song, P.S. (1999). Phytochrome signalling is mediated through nucleoside diphosphate kinase 2. *Nature* 401, 610-613.
- Chory, J. and Wu, D.Y. (2001). Weaving the complex web of signal transduction. *Plant Physiol* 125, 77-80.
- Christie, J.M., Salomon, M., Nozue, K., Wada, M., and Briggs, W.R. (1999). LOV (light, oxygen, or voltage) domains of the blue-light photoreceptor phototropin (nph1): binding sites for the chromophore flavin mononucleotide. *Proc. Natl. Acad. Sci. USA* 96, 8779-8783.
- Clack, T., Mathews, S., and Sharrock, R.A. (1994). The phytochrome apoprotein family in *Arabidopsis* is encoded by five genes: the sequences and expression of PHYD and PHYE. *Plant Mol. Biol.* 25, 413-427.

- Clayton,R.A., White,O., Ketchum,K.A., and Venter,J.C. (1997). The first genome from the third domain of life. *Nature* 387, 459-462.
- Cleary,A.L. (1995). F-actin redistributions at the division site in living *Tradescantia* stomatal complexes as revealed by microinjection of rhodamine-phalloidin. *Protoplasma* 185, 152-165.
- Cleary,A.L., Gunning,B.E.S., Waseneys,G.O., and Hepler,P.K. (1992). Microtubule and F-actin dynamics at the division site in living *Tradescantia* stamen hair cells. *J. Cell Sci.* 103, 977-988.
- Cole-Strauss,A., Yoon,K., Xiang,Y., Byrne,B.C., Rice,M.C., Cryn,J., and Kmiec,E.B. (1996). Correction of the mutation responsible for sickle cell anemia by an RNA/DNA oligonucleotide. *Science* 273, 1389.
- Cole,W.J., Chapman,D.J., and Siegelman,H.W. (1967). The structure of phycocyanobilin. *J. Am. Chem. Soc.* 89, 3642-3645.
- Cornejo,J. and Beale,S.I. (1988). Algal heme oxygenase from *Cyanidium caldarium*. Partial purification and fractionation into three required protein components. *J. Biol. Chem.* 263, 11915-11921.
- Cornejo,J., Beale,S.I., Terry,M.J., and Lagarias,J.C. (1992). Phytochrome assembly. The structural and biological activity of 2(R),3(E)-phytychromobilin derived from phycobiliproteins. *J. Biol. Chem.* 267, 14790-14798.
- Cosgrove,D.J. (1994). Photomodulation of growth. In *Photomorphogenesis in plants - 2nd Edition*, R.E.Kendrick and G.H.M.Kronenberg, eds. (Dortrecht: Kluwer Academic Publishers, Netherlands), pp. 631-658.
- Cove,D.J. (1992). Regulation of development in the moss *Physcomitrella patens*. In *Development: The Molecular Genetic Approach*, V.Russo, S.Brody, and S.Ottolenghi, eds. (Heidelberg: Springer Verlag), pp. 179-193.
- Cove,D.J. (1993). Mutant analysis, a key tool for the study of metabolism and development. *Plant J.* 3, 303-308.
- Cove,D.J., Knight,C.D., and Lamparter,T. (1997). Mosses as model systems. *Trends in Plant Science* 2, 99-105.
- Cove,D.J., Quatrano,R.S., and Hartmann,E. (1996). The alignment of the axis of asymmetry in regenerating protoplasts of the moss *Ceratodon purpureus* is determined independently of axis polarity. *Development* 122, 371-379.
- Datsenko,K.A. and Wanner,B.L. (2000). One-step inactivation of chromosomal genes in *Escherichia coli* K-12 using PCR products. *Proc. Natl. Acad. Sci. USA* 97, 6640-6645.
- Davis,S.J., Bhoo,S.H., Durski,A.M., Walker,J.M., and Vierstra,R.D. (2001). The heme-oxygenase family required for phytochrome chromophore biosynthesis is necessary for proper photomorphogenesis in higher plants. *Plant Physiol* 126, 656-669.
- Davis,S.J., Kurepa,J., and Vierstra,R.D. (1999a). The *Arabidopsis thaliana* HY1 locus, required for phytochrome-chromophore biosynthesis, encodes a protein related to heme oxygenases. *Proc. Natl. Acad. Sci. USA* 96, 6541-6546.
- Davis,S.J., Vener,A.V., and Vierstra,R.D. (1999b). Bacteriophytochromes: phytochrome-like photoreceptors from nonphotosynthetic eubacteria. *Science* 286, 2517-2520.
- Deng,X.W. and Quail,P.H. (1999). Signalling in light-controlled development. *Semin. Cell Dev. Biol.* 10, 121-129.
- Devlin,P.F., Patel,S.R., and Whitelam,G.C. (1998). Phytochrome E Influences Internode Elongation and Flowering Time in *Arabidopsis*. *Plant Cell* 10, 1479-1488.

- Doetschmann,T., Gregg,R.G., Maeda,N., Hooper,M.L., Melton,D.W., Thompson,S., and Smithies,O. (1987). Targeted correction of a mutant HPRT gene in mouse embryonic stem cells. *Nature* 330, 576-578.
- Dower,W.J., Miller,J.F., and Ragsdale,C.W. (1988). High efficiency transformation of *E. coli* by high voltage electroporation. *Nucleic Acids Res.* 16, 6145.
- Elich,T.D., McDonagh,A.F., Palma,L.A., and Lagarias,J.C. (1989). Phytochrome chromophore biosynthesis. Treatment of tetrapyrrole- deficient *Avena* explants with natural and non-natural bilatrienes leads to formation of spectrally active holoproteins. *J. Biol. Chem.* 264, 183-189.
- Emanuelsson,O., Nielsen,H., and von Heije,G. (1999). ChloroP, a neural network-based method for predicting chloroplast transit peptides and their cleavage sites. *Protein Sci.* 8, 978-984.
- Esch,H. (1998). Die Rolle des Photorezeptors Phytochrom beim Phototropismus des Laubmooses *Ceratodon purpureus*. Isolierung und Charakterisierung aphototroper Mutanten. Dissertation am Fachbereich Biologie der Freien Universität Berlin.
- Esch,H., Hartmann,E., Cove,D., Wada,M., and Lamparter,T. (1999). Phytochrome-controlled phototropism of protonemata of the moss *Ceratodon purpureus*: physiology of the wild type and class 2 ptr-mutants. *Planta* 209, 290-298.
- Esch,H. and Lamparter,T. (1998). Light regulation of phytochrome content in wild-type and aphototropic mutants of the moss *Ceratodon purpureus*. *Photochem. Photobiol.* 67, 450-455.
- Etzold,H. (1965). Der Polarotropismus und Phototropismus der Chloronemen von *Dryopteris filix-mass* (L.) Schott. *Planta* 64, 254-280.
- Falchuk,K.H., Contin,J.M., Dziedzic,T.S., Feng,Z., French,T.C., Heffron,G.J., and Montorzi,M. (2002). A role for biliverdin IX $\alpha$  in dorsal axis development of *Xenopus laevis* embryos. *Proc. Natl. Acad. Sci. USA* 99, 251-256.
- Fankhauser,C. (2000). Phytochromes as light-modulated protein kinases. *Semin. Cell Dev. Biol.* 11, 467-473.
- Fankhauser,C. (2001). The phytochromes, a family of red/far-red absorbing photoreceptors. *J. Biol. Chem.* 276, 11453-11456.
- Fankhauser,C., Yeh,K.C., Lagarias,J.C., Zhang,H., Elich,T.D., and Chory,J. (1999). PKS1, a substrate phosphorylated by phytochrome that modulates light signaling in *Arabidopsis*. *Science* 284, 1539-1541.
- Firn,R.D. (1994). Phototropism. In *Photomorphogenesis in plants - 2nd Edition*, R.E.Kendrick and G.H.M.Kronenberg, eds. (Dordrecht: Kluwer Academic Publishers, Netherlands), pp. 659-681.
- Frankenberg,N., Mukougawa,K., Kohchi,T., and Lagarias,C. (2001). Functional Genomic Analysis of the HY2 Family of Ferredoxin-Dependent Bilin Reductases from Oxygenic Photosynthetic Organisms. *Plant Cell* 13, 965-978.
- Furuya,M. (1993). Phytochromes: their molecular species, gene families and functions. *Annu. Rev. Plant Physiol. Plant Mol. Biol.* 44, 617-645.
- Gassen,G. and Schimpf,G. (1999). *Gentechnische Methoden*. 2. Auflage. Spektrum Akademischer Verlag; Heidelberg, Berlin).
- Girke,T., Schmidt,H., Zahringer,U., Reski,R., and Heinz,E. (1998). Identification of a novel delta 6-acyl-group desaturase by targeted gene disruption in *Physcomitrella patens*. *Plant J.* 15, 39-48.
- Goff,S.A., Ricke,D., Lan,T.H., Presting,G., Wang,R., Dunn,M., and *et al.* (2002). A draft sequence of the rice genome (*Oryza sativa* L. ssp. japonica). *Science* 296, 92-100.

- Gorbsky,G.J., Sammak,P.J., and Borisy,G.G. (1988). Microtubule dynamics and chromosome motion visualized in living anaphase cells. *J. Cell Biol.* 106, 1185-1192.
- Guo,H., Mockler,T., Duong,H., and Lin,C. (2001). SUB1, an *Arabidopsis* Ca<sup>2+</sup>-Binding Protein Involved in Cryptochrome and Phytochrome Coaction. *Science* 291, 487-490.
- Halfter,U., Morris,P.C., and Willmitzer,L. (1992). Gene targeting in *Arabidopsis thaliana*. *Mol. Gen. Genet.* 231, 186-193.
- Halliday,K.J., Thomas,B., and Whitelam,G.C. (1997). Expression of heterologous phytochromes A, B or C in transgenic tobacco plants alters vegetative development and flowering time. *Plant J.* 12, 1079-1090.
- Hamaguchi,Y. and Kuriyama,R. (1982). *Exp. Cell Res.* 141, 450-454.
- Hanelt,S., Braun,B., Marx,S., and Schneider-Poetsch,H.A. (1992). Phytochrome evolution: a phylogenetic tree with the first complete sequence of phytochrome from a cryptogamic plant (*Selaginella martensii* spring). *Photochem. Photobiol.* 56, 751-758.
- Hartmann,E., Klingenberg,B., and Bauer,L. (1983). Phytochrome mediated phototropism in protonemata of the moss *Ceratodon purpureus* BRID. *Photochem. Photobiol.* 38, 599-603.
- Haupt,W. and Wagner,G. (1982). Chloroplast movement. In *Membranes and sensor ...*, Plenum press NY London Washington DC Boston (24.4.89)).
- Hisada,A., Hanzawa,H., Weller,J.L., Nagatani,A., Reid,J.B., and Furuya,M. (2000). Light-Induced Nuclear Translocation of Endogenous Pea Phytochrome A Visualized by Immunocytochemical Procedures. *Plant Cell* 12, 1063-1078.
- Hughes,J.E., Lamparter,T., and Mittmann,F. (1996). Cerpu;PHY0;2, a "normal" phytochrome in *Ceratodon* (Accession No. U56698) (PGR 96-067). *Plant Physiol.* 112, 446.
- Hughes,J.E., Lamparter,T., Mittmann,F., Hartmann,E., Gärtner,W., Wilde,A., and Börner,T. (1997). A prokaryotic phytochrome. *Nature* 386, 663.
- Imaizumi,T., Kadota,A., Hasebe,M., and Wada,M. (2002). Cryptochrome Light Signals Control Development to Suppress Auxin Sensitivity in the Moss *Physcomitrella patens*. *Plant Cell* 14, 386.
- Jabben,M. and Holmes,M.G. (1983). Phytochrome in light-grown plants. In *Encyclopedia of Plant Physiology*, W.Shropshire and H.Mohr, eds. (Berlin / Heidelberg / New York: Springer), pp. 704-722.
- Jasin,M., Moynaham,M.E., and Richardson,C. (1996). Targeted transgenesis. *Proc. Natl. Acad. Sci. USA* 93, 8804-8808.
- Jenkins,G.I. and Cove,D.J. (1983a). Phototropism and polarotropism of primary chloronemata of the moss *Physcomitrella patens*: responses of mutant strains. *Planta* 159, 432-438.
- Jenkins,G.I. and Cove,D.J. (1983b). Phototropism and polarotropism of primary chloronemata of the moss *Physcomitrella patens*: responses of the wild-type. *Planta* 158, 357-364.
- Jeon,J.S., Lee,S., Jung,K.H., Jun,S.H., Jeong,D.H., and *et al.* (2000). T-DNA insertional mutagenesis for functional genomics in rice. *Plant J.* 22, 561-570.
- Kadota,A., Sato,Y., and Wada,M. (2000). Intracellular chloroplast photorelocation in the moss *Physcomitrella patens* is mediated by phytochrome as well as by a blue-light receptor. *Planta* 210, 932-937.
- Kadota,A. and Wada,M. (1999). Red light-aphototropic (Rap) mutants lack red light-induced chloroplast relocation movement in the fern *Adiantum capillus veneris*. *Plant Cell Physiol.* 40, 238-247.

- Kadota,A., Wada,M., and Furuya,M. (1982). Phytochrome-mediated phototropism and different dichroic orientation of Pr and Pfr in protonemata of the fern *Asiantum capillus-veneris* L. Photochem. Photobiol. 35, 533-536.
- Kagawa,T., Lamparter,T., Hartmann,E., and Wada,M. (1997). Phytochrome-mediated branch formation in protonemata of the moss *Ceratodon purpureus*. J. Plant Res. 110, 363-370.
- Kaneko,T., Tanaka,A., Sato,S., Kotani,H., Sazuka,T., Miyajima,N., Sugiura,M., and Tabata,S. (1995). Sequence analysis of the genome of the unicellular cyanobacterium *Synechocystis* sp. strain PCC6803. I. Sequence features in the 1 Mb region from map positions 64% to 92% of the genome (supplement). DNA Res. 2, 191-198.
- Kasemir,H. (1983). Light control of chlorophyll accumulation in higher plants. In Encyclopedia of Plant Physiology, W.Shropshire and H.Mohr, eds. (Berlin / Heidelberg / New York: Springer), pp. 662-686.
- Kawai,H., Kanegae,T., Christensen,S., Kiyosue,T., Sato,Y., Imaizumi,T., Kadota,A., and Wada,M. (2003). Responses of ferns to red light are mediated by an unconventional photoreceptor. Nature 421, 287-290.
- Kempin,S.A., Liljegren,S.J., Block,L.M., Rounsley,S.D., Yanofsky,M.F., and Lam,E. (1997). Targeted disruption in *Arabidopsis*. Nature 389, 802-803.
- Kendrick,R.E. and Bossen,M.E. (1987). Photocontrol of ion fluxes and membrane properties in plants. In Phytochrom and Photoregulation in Plants, M.Furuya, ed. (Tokyo: Tokyo Academic), pp. 215-224.
- Kendrick,R.E. and Kronenberg,G.H.M. (1994). Photomorphogenesis in Plants. (Dortrecht: Kluwer Academic Publishers, Netherlands).
- Kern,V.D. and Sack,F.D. (1999). Irradiance-dependent regulation of gravitropism by red light in protonemata. Planta 209, 299-307.
- Kircher,S., Wellmer,F., Nick,P., Rugner,A., Schäfer,E., Harter,K., Terry,M.J., and Kendrick,R.E. (1999). Nuclear import of the parsley bZIP transcription factor CPRF2 is regulated by phytochrome photoreceptors. J. Cell Biol. 119, 143-152.
- Knight, C., Cove, D., Quatrano, R. S., and Cuming, A. The *Physcomitrella* EST programme (PEP). Annual International Meeting for Moss Research, 13. - 16.September 2002, Ambleside, UK. 2002. Ref Type: Conference Proceeding
- Kohchi,T., Mukougawa,K., Frankenberg,N., Masuda,M., Yokota,A., and Lagarias,J.C. (2001). The *Arabidopsis* HY2 Gene Encodes Phytochromobilin Synthase, a Ferredoxin-Dependent Biliverdin Reductase. Plant Cell 13, 425-436.
- Kolukisaoglu,H.U., Braun,B., Martin,W.F., and Schneider-Poetsch,H.A.W. (1993). Mosses do express conventional, distantly B-type-related phytochromes. Phytochrome of *Physcomitrella patens* (Hedw.). FEBS Lett. 334, 95-100.
- Koorneef,M., Rolff,E., and Spruit,C.J.P. (1980). Genetic control of light-inhibited hypocotyl elongation in *Arabidopsis thaliana* L. Heynh. Z Pflanzenphysiologie 100, 147-160.
- Kraml,M. (1994). Light direction and polarisation. In Photomorphogenesis in plants - 2nd Edition, R.E.Kendrick and G.H.M.Kronenberg, eds. (Dortrecht: Kluwer Academic Publishers, Netherlands), pp. 417-446.
- Kreis,T.E. and Birchmeier,W. (1982). Microinjection of fluorescently labeled proteins into living cells with emphasis on cytoskeletal proteins. Int. Rev. Cytol. 75, 209-214.
- Kufer,W. and Scheer,H. (1979). Chemical modification of biliprotein chromophores. Z. Naturforsch. [C]. 34, 776-781.

- Kunkel,T., Neuhaus,G., Batschauer,A., Chua,N.-H., and Schäfer,E. (1996). Functional analysis of yeast-derived phytochrome A and B phycocyanobilin adducts. *Plant J.* 10, 625-636.
- Kunkel,T., Tomizawa,K., Kern,R., Furuya,M., Chua,N.-H., and Schäfer,E. (1993). *In vitro* formation of a photoreversible adduct of phycocyanobilin and tobacco apophytochrome B. *Eur. J. Biochem.* 93, 587-593.
- Kunst,F., Ogasawara,N., Moszer,I., Albertini,A.M., Alloni,G., and *et al.* (1997). The complete genome sequence of the grampositive bacterium *Bacillus subtilis*. *Nature* 390, 249-256.
- Lagarias,D.M., Wu,S.-H., and Lagarias,J.C. (1995). Atypical phytochrome gene structure in the green alga *Mesotaelium caldariorum*. *Plant Mol. Biol.* 29, 1127-1142.
- Lamparter,T. and Brücker,G. (2003). Phytochrome in mosses. In 'New Frontiers in Bryology: Physiology, Molecular Biology & Applied Genomics'. A.Wood, M.Oliver, and D.J.Cove, eds. Kluwer Publishing).
- Lamparter,T., Brücker,G., Esch,H., Hughes,J., Meister,A., and Hartmann,E. (1998). Somatic hybridisation with aphototropic mutants of the moss *Ceratodon purpureus*: genome size, phytochrome photoreversibility, tip-cell phototropism and chlorophyll regulation. *J. Plant Physiol.* 153, 394-400.
- Lamparter,T., Esch,H., Cove,D., and Hartmann,E. (1997a). Phytochrome control of phototropism and chlorophyll accumulation in the apical cells of protonemal filaments of wildtype and an aphototropic mutant of the moss *Ceratodon purpureus*. *Plant Cell Physiol.* 38, 51-58.
- Lamparter,T., Esch,H., Cove,D., Hughes,J., and Hartmann,E. (1996). Aphototropic mutants of the moss *Ceratodon purpureus* with spectrally normal and with spectrally dysfunctional phytochrome. *Plant Cell Environment* 19, 560-568.
- Lamparter,T., Kagawa,T., Brücker,G., and Wada,M. (2003). Positive and negative tropic curvature induced by microbeam irradiation of protonemal tip cells of the moss *Ceratodon purpureus*. *Plant Biol.* *submitted*.
- Lamparter,T., Michael,N., Mittmann,F., and Esteban,B. (2002). Phytochrome from *Agrobacterium tumefaciens* has unusual spectral properties and reveals an N-terminal chromophore attachment site. *Proc. Natl. Acad. Sci. USA* 99, 11628-11633.
- Lamparter,T., Mittmann,F., Gärtner,W., Börner,T., Hartmann,E., and Hughes,J. (1997b). Characterization of recombinant phytochrome from the cyanobacterium *Synechocystis*. *Proc. Natl. Acad. Sci. USA* 94, 11792-11797.
- Lamparter,T., Podlowski,S., Mittmann,F., Hartmann,E., Schneider-Poetsch,H.A.W., and Hughes,J. (1995). Phytochrome from protonemal tissue of the moss *Ceratodon purpureus*. *J. Plant Physiol.* 147, 426-434.
- Lebel,E.G., Masson,J.E., Bogucki,A., and Paszkowski,J. (1993). Stress-induced intrachromosomal recombination in plant somatic cells. *Proc. Natl. Acad. Sci. USA* 90, 422-426.
- Lee,K.Y., Lund,P., Lowe,K., and Dunsmuir,P. (1990). Homologous recombination in plant cells after *Agrobacterium*-mediated transformation. *Plant Cell* 2, 415-425.
- Lessard,P., Decroocq,V., and Thomas,M. (1997). Isolation and Analysis of mRNA from Plant Cells: Cloning of cDNAs. In *Plant Molecular Biology: a Laboratory Manual*, M.S.Clark, ed. Springer-Verlag; Berlin, Heidelberg, New York), pp. 154-201.
- Liljegren,S.J. and Yanofski,M.F. (1998). Towards targeted transformation in plants. Response: targeting *Arabidopsis*. *Trends Plant Sci.* 3, 79-80.
- Maines,M.D. (1997). THE HEME OXYGENASE SYSTEM: A Regulator of Second Messenger Gases. *Annu. Rev. Pharmacol. Toxicol.* 37, 517-554.

- Malho,R., Read,N.D., Trewavas,A.J., and Pais,M.S. (1995). Calcium Channel Activity during Pollen Tube Growth and Reorientation. *Plant Cell* 7, 1173-1184.
- Mancinelli,A.L. (1982). The photoregulation of anthocyan synthesis. *Plant Physiol.* 640-660.
- Mancinelli,A. (1994). The physiology of phytochrome action. In: *Photomorphogenesis in Plants*, 2nd edition (eds: Kendrick RE, Kronenberg GHM), Kluwer Academic Publishers, Netherlands., pp. 211-269.
- Mandoli,D.F. and Briggs,W.R. (1981). Phytochrome control of two low-irradiance responses of etiolated oat seedlings. *Plant Physiol.* 63, 733-739.
- Marchuk,D., Drumm,M., Saulino,A., and Collins,F.S. (1991). Construction of T-vectors, a rapid and general system for direct cloning of unmodified PCR products. *Nucleic Acids Res.* 19, 1154.
- Martienssen,R.A. and Colot,V. (2001). DNA Methylation and Epigenetic Inheritance in Plants and Filamentous Fungi. *Science* 293, 1070-1074.
- Martinez-Garcia,J.F., Huq,E., and Quail,P.H. (2000). Direct targeting of light signals to a promoter element-bound transcription factor. *Science* 288, 859-863.
- McClintock,B. (1984). The significance of responses of the genome to challenge. *Science* 226, 792-801.
- Mengiste,T. and Paszkowski,J. (1999). Prospects for the Precise Engineering of Plant Genomes by Homologous Recombination. *Biol. Chem.* 380, 749-758.
- Miao,Z.-H. and Lam,E. (1995). Targetted disruption of the TGA3 locus in *Arabidopsis thaliana*. *Plant J.* 7, 359-365.
- Millar,A.J., McGrath,R.B., and Chua,N.-H. (1994). Phytochrome phototransduction pathways. *Ann. Rev. Genet.* 28, 325-349.
- Miller,D.D., Callaham,D.A., Gross,D.J., and Hepler,P.K. (1992). Free Ca<sup>2+</sup> gradient in growing pollen tubes of *Lillium*. *J. Cell Sci.* 101, 7-12.
- Minaschek,G., Bereiter-Hahn,J., and Bertholdt,G. (1989). Quantitation of the volume of liquid injected into cells by means of pressure. *Exp. Cell Res.* 434-442.
- Mittmann,F. (1997). Molekularbiologische Untersuchungen zum Phytochromsystem in *Cryptogamae*. Diplomarbeit am Fachbereich Chemie der Freien Universität Berlin.
- Mittmann,F. (2003). Molekularbiologische Untersuchungen zum Phytochromsystem der Moose *Physcomitrella patens* und *Ceratodon purpureus*. Dissertation am Fachbereich Biologie, Chemie, Pharmazie der Freien Universität Berlin.
- Muramoto,T., Kohchi,T., Yokota,A., Hwang,I., and Goodman,H.M. (1999). The *Arabidopsis* Photo-morphogenic Mutant *hyl* Is Deficient in Phytochrome Chromophore Biosynthesis as a Result of a Mutation in a Plastid Heme Oxygenase. *Plant Cell* 11, 335-348.
- Muramoto,T., Tsurui,N., Terry,M.J., Yokota,A., and Kohchi,T. (2002). Expression and biochemical properties of a ferredoxin-dependent heme oxygenase required for phytochrome chromophore synthesis. *Plant Physiol* 130, 1958-1966.
- Nagy,F. and Schäfer,E. (2000). Nuclear and cytosolic events of light-induced, phytochrome-regulated signaling in higher plants. *EMBO J.* 19, 157-163.
- Nebel,B.J. (1969). Responses of moss protonemata to red and far-red polarized light: evidence for disc-shaped phytochrome photoreceptors. *Planta* 87, 170-179.
- Neff,M.M., Fankhauser,C., and Chory,J. (2000). Light: an indicator of time and place. *Genes Dev.* 14, 257-271.



- Neuhaus, G., Bowler, C., Hiratsuka, K., Yamagata, H., and Chua, N.-H. (1997). Phytochrome-regulated repression of gene expression requires calcium and cGMP. *EMBO J.* 16, 2554-2564.
- Neuhaus, G., Bowler, C., Kern, R., and Chua, N.H. (1993). Calcium/calmodulin-dependent and -independent phytochrome signal transduction pathways. *Cell* 73, 937-952.
- Ni, M., Tepperman, J.M., and Quail, P.H. (1998). PIF3, a phytochrome-interacting factor necessary for normal photoinduced signal transduction, is a novel basic helix-loop-helix protein. *Cell* 95, 657-667.
- Nozue, K., Kanegae, T., Imaizumi, T., Fukuda, S., Okamoto, H., Yeh, K.C., Lagarias, J.C., and Wada, M. (1998). A phytochrome from the fern *Adiantum* with features of the putative photoreceptor NPH1. *Proc. Natl. Acad. Sci. USA* 95, 15826-15830.
- Offringa, R., de Groot, M.J.A., Haagsman, H.J., Does, M.P., van den Elzen, P.J.M., and Hooykaas, P.J.J. (1990). Extrachromosomal homologous recombination and gene targeting in plant cells after *Agrobacterium*-mediated transformation. *EMBO J.* 9, 3077-3084.
- Okamoto, H., Hirano, Y., Abe, H., Tomizawa, K., Furuya, M., and Wada, M. (1993). The deduced amino acid sequence of phytochrome from *Adiantum* included consensus motifs present in phytochrome-b from seed plants. *Plant Cell Physiol.* 34: 8, 1329-1334.
- Okamoto, H., Matsui, M., and Deng, X.-W. (2001). Overexpression of the Heterotrimeric G-Protein  $\alpha$ -Subunit Enhances Phytochrome-Mediated Inhibition of Hypocotyl Elongation in *Arabidopsis*. *Plant Cell* 13, 1639-1651.
- Ortiz de Montellano, P.R. (2000). The mechanism of heme oxygenase. *Curr. Opin. Chem. Biol.* 4, 221-227.
- Ortiz de Montellano, P.R. and Wilks, A. (2000). Heme Oxygenase: Structure and Mechanism. In "Iron Porphyrins", *Adv. Inorg. Chem.* 51, 359-407.
- Paques, F. and Haber, J.E. (1999). Multiple pathways of recombination induced by double-strand breaks in *Saccharomyces cerevisiae*. *Microbiol. Rev.* 63, 349-404.
- Parinov, S. and Sundaresan, V. (2000). Functional genomics in *Arabidopsis*: large-scale insertional mutagenesis complements the genome sequencing project. *Curr. Opin. Biotechnol.* 11, 157-161.
- Parks, B.M. and Quail, P.H. (1991). Phytochrome-deficient *hy1* and *hy2* long hypocotyl mutants of *Arabidopsis* are defective in phytochrome chromophore biosynthesis. *Plant Cell* 3, 1177-1186.
- Parks, B.M. and Spalding, E.P. (1999). Sequential and coordinated action of phytochromes A and B during *Arabidopsis* stem growth revealed by kinetic analysis. *Proc. Natl. Acad. Sci. USA* 96, 14142-14146.
- Pasentsis, K., Paulo, N., Algarra, P., Dittrich, P., and Thümmler, F. (1998). Characterization and expression of the phytochrome gene family in the moss *Ceratodon purpureus*. *Plant J.* 13, 51-61.
- Paszowski, J., Baur, M., Bogucki, A., and Potrykus, I. (1988). Gene targeting in plants. *EMBO J.* 7, 4021-4026.
- Pepperkok, R., Schneider, C., Philipson, L., and Ansorge, W. (1988). Single cell assay with an automated capillary microinjection system. *Exp. Cell Res.* 178, 369-376.
- Pierson, E.S., Miller, D.D., Callahan, D.A., Shipley, A.M., Rivers, B.A., Cresti, M., and Hepler, P.K. (1994). Pollen tube growth is coupled to the extracellular calcium ion flux and the intracellular calcium gradient: effect of BAPTA-type buffers and hypertonic media. *Plant Cell* 6, 1815-1828.
- Platt, J.L. and Nath, K.A. (1998). Heme oxygenase: Protective gene or Trojan horse. *Nat. Med.* 4, 1363-1365.

- Pratt,L.H. (1995). Phytochromes: differential properties, expression patterns and molecular evolution. *Photochem. Photobiol.* *61*, 10-21.
- Pringsheim,E.G. and Pringsheim,O. (1935). Physiologische Studien an Moosen. 3. Die Züchtung von Laubmoosprotonemen im Dunkeln. *Jahrb. Wiss. Bot.* *82*, 312-332.
- Puchta,H. (1998). Towards targeted transformation in plants. *Trends Plant Sci.* *3*, 77-78.
- Puchta,H. (2002). Gene replacement by homologous recombination in plants. *Plant Mol. Biol.* *48*, 173-182.
- Puchta,H., Dujon,B., and Hohn,B. (1993). Homologous recombination in plant cells is enhanced by in vivo induction of double strand breaks into DNA by a site-specific endonuclease. *Nucleic. Acids. Res.* *21*, 5034-5040.
- Puchta,H., Dujon,B., and Hohn,B. (1996). Two different but related mechanisms are used in plants for the repair of genomic doublestrand breaks by homologous recombination. *Proc. Natl. Acad. Sci. USA* *93*, 5055-5060.
- Puchta,H. and Hohn,B. (1991). A transient assay in plant cells reveals a positive correlation between extrachromosomal recombination rates and length of homologous overlap. *Nucleic Acids Res.* *19*, 2693-2700.
- Puchta,H., Swoboda,P., and Hohn,B. (1995). Induction of intrachromosomal homologous recombination in whole plants. *Plant J.* *7*, 203-210.
- Puissant,C. and Houdebine,L.M. (1990). An improvement of the single-step method of RNA isolation by acid guanidinium-thiocyanat-phenol-chloroform extraction. *BioTechniques* *8*, 148-149.
- Quail,P.H. (1994). Phytochrome genes and their expression. In *Photomorphogenesis in Plants - 2nd Edition*, R.E.Kendrick and G.H.M.Kronenberg, eds. (Dordrecht: Kluwer Academic Publishers, Netherlands), pp. 71-104.
- Quail,P.H. (1998). The phytochrome family: dissection of functional roles and signalling pathways among family members. *Philos. Trans. R. Soc. Lond. B. Biol. Sci.* *353*, 1399-1403.
- Quail,P.H. (2000). Phytochrome interacting factors. *Semin. Cell Dev. Biol.* *11*, 457-466.
- Quail,P.H. (2002). Phytochrome Photosensory Signalling Networks. *Nature Reviews* *3*, 85-93.
- Reiss,B., Klemm,M., Kosak,H., and Schell,J. (1996). RecA protein stimulates homologous recombination in plants. *Proc. Natl. Acad. Sci. USA* *93*, 3094-3098.
- Reiss,B., Schubert,I., Köpchen,K., Wendeler,E., Schell,J., and Puchta,H. (2000). RecA stimulates sister chromatid exchange and the fidelity of double-strand break repair, but not gene targeting, in plants transformed by *Agrobacterium*. *Proc. Natl. Acad. Sci. USA* *97*, 3358-3363.
- Reski,R. (1998a). Development, genetics and molecular biology of mosses. *Bot. Acta* *111*, 1-15.
- Reski,R. (1998b). *Physcomitrella* and *Arabidopsis*: the David and Goliath of reverse genetics. *Trends Plant Sci.* *3*, 209-210.
- Richaud,C. and Zabolon,G. (1997). The heme oxygenase gene (pbsA) in the red alga *Rhodella violacea* is discontinuous and transcriptionally activated during iron limitation. *Proc. Natl. Acad. Sci. USA* *94*, 11736-11741.
- Rios,G., Lossow,A., Hertel,B., Breuer,F., Schaefer,S., Broich,M., and *et al.* (2002). Rapid identification of *Arabidopsis* insertion mutants by non-radioactive detection of T-DNA tagged genes. *Plant J.* *32*, 243-253.
- Roberts,D.M., Lukas,T.J., and Watterson,D.M. (1986). Structure, function and mechanism of action of calmodulin. *Crit. Rev. Plant Sci* *4*, 311-339.

- Rogers, S.O. and Bendich, A.J. (1985). Extraction of DNA from milligram amounts of fresh, herbarium and mummified plant tissues. *Plant Mol. Biol.* 5, 69-76.
- Rüdiger, W., Thümmler, F., and Springer-Verlag Berlin Heidelberg. (1991). Phytochrome in lower plants. In *Phytochrome properties ...*, pp. 57-70.
- Sage, L.C. (1992). *Pigment of the Imagination - A History of Phytochrome Research*. Academic Press).
- Sakamoto, K. and Briggs, W.R. (2002). Cellular and Subcellular Localization of Phototropin 1. *Plant Cell* 14, 1723-1735.
- Sakamoto, K. and Nagatani, A. (1996). Nuclear localization activity of phytochrome B. *Plant J.* 10, 859-868.
- Sambrook, J., Fritsch, E.F., and Maniatis, T. (1989). *Molecular Cloning. A Laboratory Manual*. 2nd edition. Cold Spring Harbor Laboratory Press).
- Sambrook, J. and Russell, D.W. (2001). *Molecular Cloning. A Laboratory Manual*. 3rd edition. Cold Spring Harbor Laboratory Press).
- Sanger, F., Nicklen, S., and Coulsen, A.R. (1977). DNA sequencing with chain-terminating inhibitors. *Proc. Natl. Acad. Sci. USA* 74, 5463-5467.
- Sanger, J.M., Mittal, B., Pochapin, M.B., and Sanger, J.W. (1987). Stress fiber and cleavage furrow formation in living cells microinjected with fluorescently labeled alpha-actinin. *Cell Motil. Cytoskeleton* 7, 209-220.
- Sawahel, W., Onde, S., Knight, C., and Cove, D. (1992). Transfer of foreign DNA into *Physcomitrella patens* protonemal tissue by using the gene gun. *Plant Mol. Biol. Reporter* 10, 314-315.
- Schaefer, D.G. (2002). A NEW MOSS GENETICS: Targeted Mutagenesis in *Physcomitrella patens*. *Annu. Rev. Plant Biol.* 53, 477-501.
- Schaefer, D.G. and Zryd, J.-P. (1997). Efficient gene targeting in the moss *Physcomitrella patens*. *Plant J.* 11, 1195-1206.
- Schena, M. and Yamamoto, K.R. (1988). Mammalian glucocorticoid receptor derivatives enhance transcription in yeast. *Science* 241, 965.
- Scheuerlein, R.W. and Haas, C.J. (1995). Phytochromgesteuerte Farnsporenkeimung. *BIUZ* 25, 178-184.
- Schild, A. (1981). *Untersuchungen zur Sporenkeimung und Protonemaentwicklung bei dem Laubmoos Physcomitrella patens*. Dissertation, Universität Mainz, Germany.
- Schipper, O., Schaefer, D., Reski, R., and Fleming, A. (2002). Expansins in the bryophyte *Physcomitrella patens*. *Plant Mol. Biol.* 50, 802.
- Schneider-Poetsch, H.A.W. (1992). Signal transduction by phytochrome: phytochromes have a module related to the transmitter modules of bacterial sensor proteins. *Photochem. Photobiol.* 56, 839-846.
- Schnorf, M., Neuhaus-Url, G., Galli, A., Iida, S., Potrykus, I., and Neuhaus, G. (1991). An improved approach for transformation of plant cells by microinjection: molecular and genetic analysis. *Transgenic. Res.* 1, 23-30.
- Schnorf, M., Potrykus, I., and Neuhaus, G. (1994). Routine system for characterization of microcapillaries by bubble pressure measurement. *Exp. Cell Res.* 210, 260-267.
- Shalev, G., Sitrit, Y., Avivi-Ragolski, N., Lichtenstein, C., and Levy, A.A. (1999). Stimulation of homologous recombination in plants by expression of the bacterial resolvase RuvC. *Proc. Natl. Acad. Sci. USA* 96, 7398-7402.

- Shanklin J., Jabben M., and Vierstra, R.D. (1987). Red light-induced formation of ubiquitin-phytochrome conjugates. *Proc. Natl. Acad. Sci. USA* *84*, 359-363.
- Sharma, R., Lopez-Juez, E., Nagatani, A., and Furuya, M. (1993). Identification of photo-inactive phytochrome A in etiolated seedlings and photo-active phytochrome B in green leaves of the *aurea* mutant of tomato. *Plant J.* *4*, 1035-1042.
- Sharrock, R.A. and Quail, P.H. (1989). Novel phytochrome sequences in *Arabidopsis thaliana*: structure, evolution, and differential expression of a plant regulatory photoreceptor family. *Genes Dev.* *3*, 1745-1757.
- Sheen, J., Hwang, S., Niwa, Y., Kobayashi, H., and Galbraith, D.W. (1995). Green-fluorescent protein as a new vital marker in plant cells. *Plant J.* *8*, 777-784.
- Shinomura, T., Nagatani, A., Hanzawa, H., Kubota, M., Watanabe, M., and Furuya, M. (1996). Action spectra for phytochrome A- and B-specific photoinduction of seed germination in *Arabidopsis thaliana*. *Proc. Natl. Acad. Sci. USA* *93*, 8129-8133.
- Simms *et al.* (1993). RNA Isolation with TRIzol® Reagent. *Focus* *15*, 99-102.
- Smith, H. (1995). Physiological and ecological function within the phytochrome family. *Ann. Rev. Plant Physiol. Plant Mol. Biol.* *46*, 289-315.
- Smith, H. (2000). Phytochromes and light signal perception by plants -- an emerging synthesis. *Nature* *407*, 585-591.
- Sorger, P.K. and Pelham, H.R.B. (1988). Yeast heat shock factor is an essential DNA-binding protein that exhibits temperature-dependent phosphorylation. *Cell* *54*, 855-864.
- Southern, E.M. (1975). Detection of Specific Sequences Among DNA Fragments by Gel Electrophoresis. *J. Mol. Biol.* *98*, 517.
- Spector, T. (1978). Refinement of the coomassie blue for protein quantitation. *Anal. Biochem.* *86*, 142-146.
- Springer, P.S. (2000). Gene traps: tools for plant development and genomics. *Plant Cell* *12*, 1007-1020.
- Stocker, R., Yamamoto, Y., McDonagh, A.F., Glazer, A.N., and Ames, B.N. (1987). *Science* *235*, 1043-1046.
- Stolz, B. and Bereiter-Hahn, J. (1987). *Cell Calcium* *8*, 103-121.
- Strepp, R., Scholz, S., Kruse, S., Speth, V., and Reski, R. (1998). Plant nuclear gene knockout reveals a role in plastid division for the homolog of the bacterial cell division protein FtsZ, an ancestral tubulin. *Proc. Natl. Acad. Sci. U. S. A* *95*, 4368-4373.
- Swoboda, P., Gal, S., Hohn, B., and Puchta, H. (1994). Intrachromosomal homologous recombination in whole plants. *EMBO J.* *13*, 484-489.
- Szabados, L., Kovács, I., Oberschall, A., Ábrahám, E., Kerekes, I., Zsigmond, L., and *et al.* (2002). Distribution of 1000 sequenced T-DNA tags in the *Arabidopsis* genome. *Plant J.* *32*, 233-242.
- Tenhunen, R., Marver, H.S., and Schmid, R. (1968). The enzymatic conversion of heme to bilirubin by microsomal heme oxygenase. *Proc. Natl. Acad. Sci. USA* *61*, 748-755.
- Tepperman, J.M., Zhu, T., Chang, H.-S., Wang, X., and Quail, P.H. (2001). Multiple transcription-factor genes are early targets of phytochrome A signalling. *Proc. Natl. Acad. Sci. USA* *98*, 9437-9442.
- Terada, R., Urawa, H., Inagaki, Y., Tsugane, K., and Iida, S. (2002). Efficient gene targeting by homologous recombination in rice. *Nat. Biotechnol.* *20*, 1030-1034.
- Terry, M.J. (1997). Phytochrome chromophore-deficient mutants. *Plant Cell Environment* *20*, 740-745.

- Terry, M.J. and Kendrick, R.E. (1996). The *aurea* and *yellow-green-2* mutants of tomato are deficient in phytochrome chromophore synthesis. *J. Biol. Chem.* *271*, 21681-21686.
- Terry, M.J. and Kendrick, R.E. (1999). Titel? *Plant Physiol.* *119*, 152.
- Terry, M.J., Linley, P.J., and Kohchi, T. (2002). Making light of it: the role of plant haem oxygenases in phytochrome chromophore synthesis. *Biochem. Soc. Trans.* *30*, 609.
- Terry, M.J., McDowell, M.T., and Lagarias, J.C. (1995). (3Z)- and (3E)-phytochromobilin are intermediates in the biosynthesis of the phytochrome chromophore. *J. Biol. Chem.* *270*, 11111-11118.
- Terry, M.J., Wahleithner, J.A., and Lagarias, J.C. (1993). Biosynthesis of the plant photoreceptor phytochrome. *Arch. Biochem. Biophys.* *306*, 1-15.
- The *Arabidopsis* Genome Initiative (2000). Analysis of the genome sequence of the flowering plant *Arabidopsis thaliana*. *Nature* *408*, 796-815.
- Thomas, H. and Stoddart, L. (1980). Leaf senescence. *Annu. Rev. Plant Physiol.* *31*, 83-111.
- Thomas, K.R. and Capecchi, M.R. (2003). Site-directed mutagenesis by gene targeting in mouse embryonic stem cells. *Cell* *51*, 503-512.
- Thümmler, F., Dufner, M., Kreisler, P., and Dittrich, P. (1992). Molecular cloning of a novel phytochrome gene of the moss *Ceratodon purpureus* which encodes a putative light-regulated protein kinase. *Plant Mol. Biol.* *20*, 1003-1017.
- Thykjaer, T., Finnemann, J., Schauser, L., Christensen, L., Poulsen, C., and Stougaard, J. (1997). Gene targeting approaches using positive-negative selection and large flanking regions. *Plant Mol. Biol.* *35*, 523-530.
- Tinland, B., Hohn, B., and Puchta, H. (1994). *Agrobacterium tumefaciens* transfers single stranded T-DNA into the plant cell nucleus. *Proc. Natl. Acad. Sci. USA* *91*, 8000-8004.
- Tovar, J. and Lichtenstein, C. (1992). Somatic and meiotic chromosomal recombination between inverted duplications in transgenic tobacco plants. *Plant Cell* *4*, 319-332.
- Troxler, R.F., Brown, A.S., and Brown, S.B. (1979). Bile pigment synthesis in plants. Mechanism of 18O incorporation into phycocyanobilin in the unicellular rhodophyte *Cyanidium caldarium*. *J. Biol. Chem.* *254*, 3411-3418.
- Valanne, N. (1966). The germination of moss spores and their control by light. *Ann. Bot. Fenn.* *3*, 1-40.
- Vile, G.F., Basu-Modak, S., Waltner, C., and Tyrell, R.M. (1994). Heme oxygenase 1 mediates an adaptive response to oxidative stress in human skin fibroblasts. *Proc. Natl. Acad. Sci. USA* *91*, 2607-2610.
- Vince-Prue, D. (1983). Photomorphogenesis and Flowering. In *Encyclopedia of Plant Physiology*, W. Shropshire and H. Mohr, eds. (Berlin / Heidelberg / New York: Springer), pp. 457-490.
- Wada, M. and Sugai, M. (1994). Photobiology of ferns. In *Photomorphogenesis in plants - 2nd Edition*, R.E. Kendrick and G.H.M. Kronenberg, eds. (Dordrecht: Kluwer Academic Publishers, Netherlands), pp. 783-803.
- Walbot, V. (1992). Strategies for mutagenesis and gene cloning using transposon tagging and T-DNA insertional mutagenesis. *Annu. Rev. Plant Physiol. Plant Mol. Biol.* *43*, 49-82.
- Walker, L.M. and Sack, F.D. (1990). Amyloplasts as possible statoliths in gravitropic protonemata of the moss *Ceratodon purpureus*. *Planta* *181*, 71.
- Wang, Z.Y., Kenigsbuch, D., Sun, L., Harel, E., Ong, M.S., and Tobin, E.M. (1997). A Myb-related transcription factor is involved in the phytochrome regulation of an *Arabidopsis* Lhcb gene. *Plant Cell* *9*, 491-507.

- Wang,Z.Y. and Tobin,E.M. (1998). Constitutive expression of the CIRCADIAN CLOCK ASSOCIATED 1 (CCA1) gene disrupts circadian rhythms and suppresses its own expression. *Cell* 93, 1207-1217.
- Wassenegger,M. (2000). RNA-directed DNA methylation. *Plant Mol. Biol.* 43, 203-220.
- Weber,M., Möller,K., Welzeck,M., and Schorr,J. (1995). Effect of lipopolysaccharide on transformation efficiency in eucaryotic cells. *BioTechniques* 19, 930-940.
- Weigel,D., Ahn,J.H., Blazquez,M.A., Borevitz,J.O., Christensen,S.K., and *et al.* (2000). Activation tagging in *Arabidopsis*. *Plant Physiol.* 122, 1003-1013.
- Weisenseel,M.H. and Ruppert,H.K. (1977). Phytochrome and Calcium Ions are involved in light-induced membrane depolarization in *Nitella*. *Planta* 137, 225-229.
- Weller,J.L., Terry,M.J., Rameau,C., Reid,J.B., and Kendrick,R.E. (1996). The phytochrome-deficient *pcd1* mutant of pea is unable to convert heme to biliverdin IX-alpha. *Plant Cell* 8, 55-67.
- Whitelam,G.C. and Devlin,P.F. (1997). Roles of different phytochromes in *Arabidopsis* photomorphogenesis. *Plant Cell Environment* 20, 752-758.
- Wilks,A. and Ortiz de Montellano,P.R. (1993). Rat liver heme oxygenase. High level expression of a truncated soluble form and nature of the meso-hydroxylating species. *J. Biol. Chem.* 268, 22357-22362.
- Yamaguchi,R., Nakamura,M., Mochizuki,N., Kay,S.A., and Nagatani,A. (1999). Light-dependent translocation of a phytochrome B-GFP fusion protein to the nucleus in transgenic *Arabidopsis*. *J. Cell Biol.* 145, 437-445.
- Yeh,K.C. and Lagarias,J.C. (1998). Eukaryotic phytochromes: Light-regulated serine/threonine protein kinases with histidine kinase ancestry. *Proc. Natl. Acad. Sci. USA* 95, 13976-13981.
- Yeh,K.C., Wu,S.H., Murphy,J.T., and Lagarias,J.C. (1997). A cyanobacterial phytochrome two-component light sensory system. *Science* 277, 1505-1508.
- Yoon,K., Cole-Strauss,A., and Kmiec,E.B. (1996). Targeted gene correction of episomal DNA in mammalian cells mediated by a chimeric RNA.DNA oligonucleotide. *Proc. Natl. Acad. Sci. USA* 93, 2071-2076.
- Young,J.C. and Sack,F.D. (1992). Time-lapse analysis of gravitropism in *Ceratodon protonemata*. *Am. J. Bot.* 79, 1358.
- Yu,J., Hu,S., Wang,J., Wong,G.K., Li,S., Deng,Y., and *et al.* (2002). A draft sequence of the rice genome (*Oryza sativa* L. ssp. *indica*). *Science* 296, 79-92.
- Zeidler,M. (1995). Induzierbare Gen-Expression im Moos *Ceratodon purpureus*. Diplomarbeit am Fachbereich Biologie der Freien Universität Berlin.
- Zeidler,M. (1998). Das Phytochrom CP2 des Mooses *Ceratodon purpureus*: Expression und Charakterisierung. Dissertation am Fachbereich Biologie der Freien Universität Berlin.
- Zeidler,M., Lamparter,T., Hughes,J., Hartmann,E., Remberg,A., Braslavsky,S., Schaffner,K., and Gartner,W. (1998). Recombinant phytochrome of the moss *Ceratodon purpureus*: heterologous expression and kinetic analysis of Pr->Pfr conversion. *Photochem. Photobiol.* 68, 857-863.
- Zhang,D., Wadsworth,P., and Hepler,P.K. (1990). Microtubule dynamics in living dividing plant cells: confocal imaging of microinjected fluorescent brain tubulin. *Proc. Natl. Acad. Sci. USA* 87, 8820-8824.
- Zhang,D., Wadsworth,P., and Hepler,P.K. (1993). Dynamics of microfilaments are similar, but distinct from microtubules during cytoskeleton in living, dividing plant cells. *Cell Motil. Cytoskeleton* 24, 151-155.

- Zhang,W., McElroy,D., and Wu,R. (1991). Analysis of rice Act1 5' region activity in transgenic rice plants. *Plant Cell* 3, 1155-1165.
- Zhu,T., Peterson,D.J., Tagliani,L., St.Clair,G., Baszynski,C., and Bowen,B. (1999). Targeted manipulation of maize genes *in vivo* using chimeric RNA/DNA oligonucleotides. *Proc. Natl. Acad. Sci. USA* 96, 8768-8773.
- Zhu,Y., Tepperman,J.M., Fairchild,C.D., and Quail,P.H. (2000). Phytochrome B binds with greater apparent affinity than phytochrome A to the basic helix-loop-helix factor PIF3 in a reaction requiring the PAS domain of PIF3. *Proc. Natl. Acad. Sci. USA* 97, 13419-13424.
- Zwaka,T.P. and Thomson,J.A. (2003). Homologous recombination in human embryonic stem cells. *Nat. Biotechnol.* 21, 319-321.